AMERICAN JOURNAL

OF

OPHTHALMOLOGY

THIRD SERIES FOUNDED BY EDWARD JACKSON

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VOLUME 31, 1948

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664 North Michigan Avenue, Chicago 11, Illinois

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Plate 1. Fat emboli are shown in the retinal vessels by the use of Sudan-IV stain. Milo H. Fritz and Michael J. Hogan ..... facing page 527

Plate 2—Figure 1. (A) Large extremely vascular type of pterygium. (B) This shows the head of the pterygium transplanted beneath the bulbar conjunctiva below. (C) Thin, relatively avascular type of pterygium. (D) This eye had been operated on some months before this picture was taken. It shows vascularity and thickening of the bulbar conjunctiva. No X-ray therapy was given. (E) This eye shows a slight amount of injection following surgery and X-ray therapy. Henry L. Hilgartner, R. T. Wilson, and J. D. Wilson ..... facing page 667

Plate 3—Figure 1. Case 1. Drawings of quadrants of iris. Right, the unaffected eye. Left, the affected eye. Shaler Richardson ..... facing page 1223

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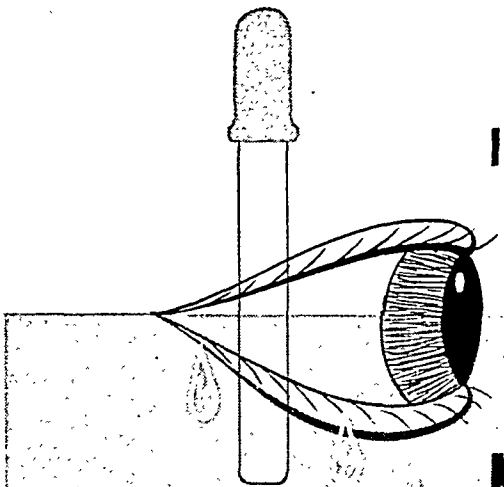
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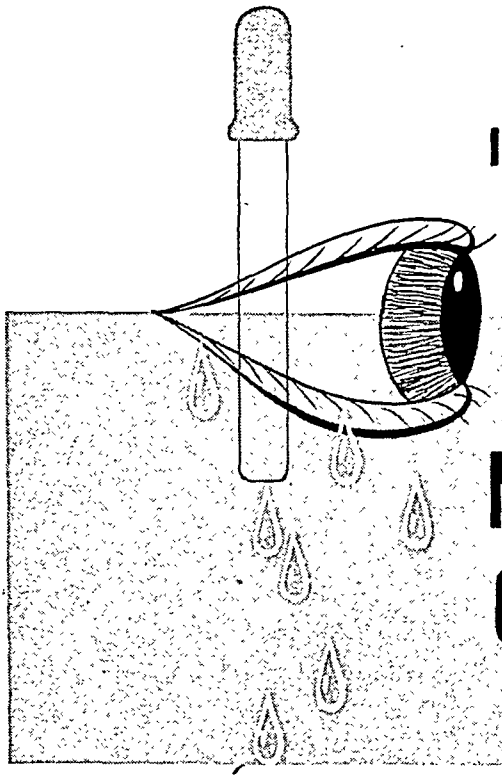
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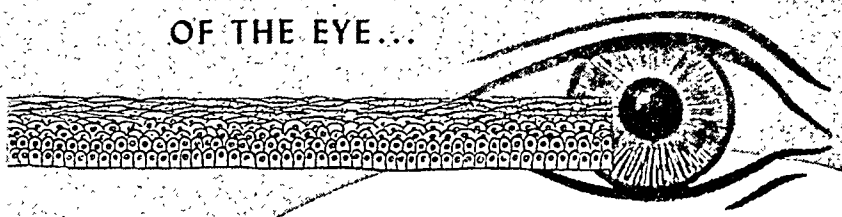
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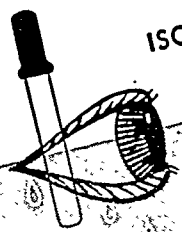
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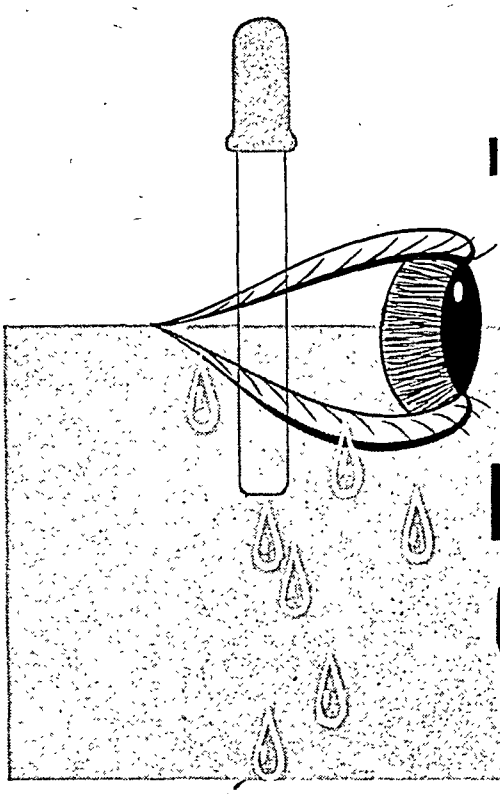
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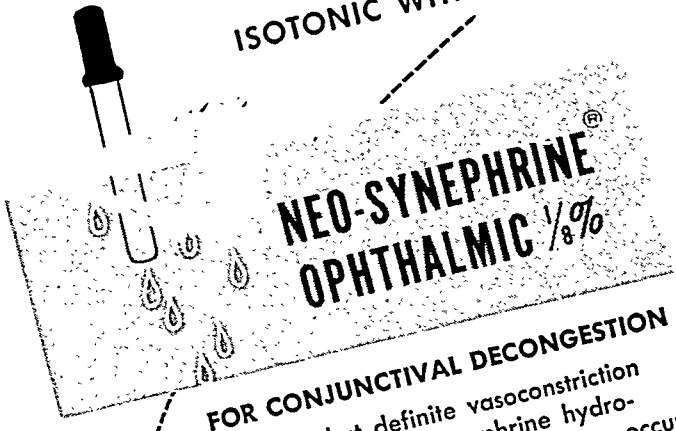
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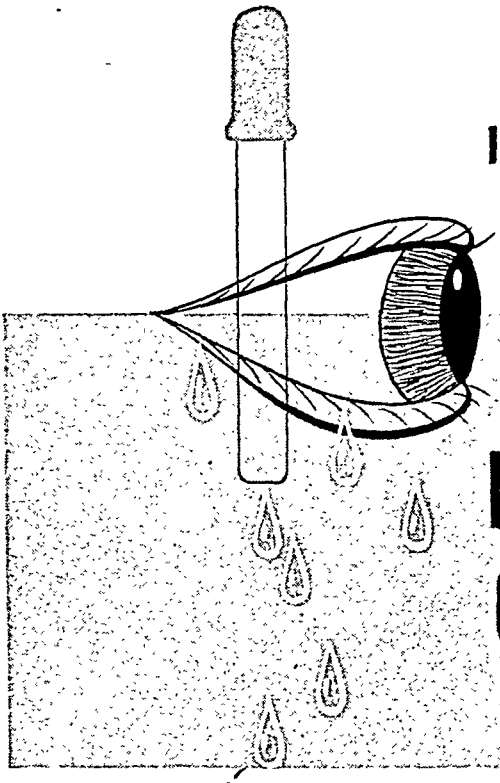
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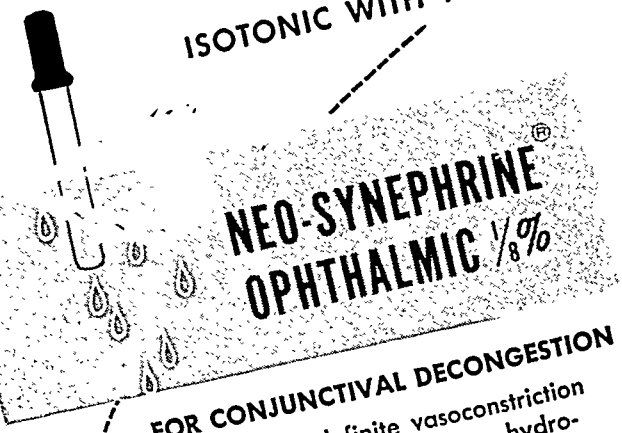
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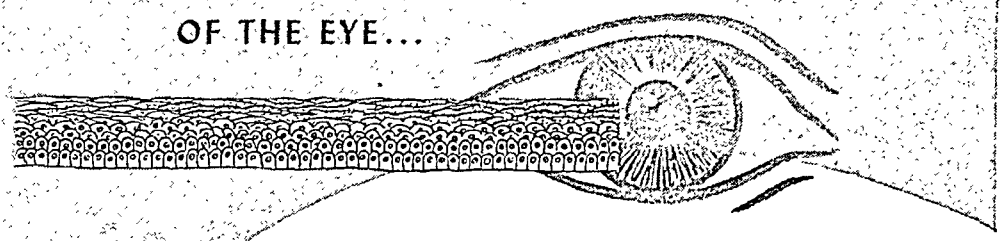
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AMERICAN JOURNAL OF OPHTHALMOLOGY

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THE BLOOD SUPPLY OF THE OPTIC NERVE AND ITS CLINICAL SIGNIFICANCE

THE SECOND FRANCIS I. PROCTOR LECTURE*

DERRICK VAIL, M.D.
Chicago, Illinois

The finer details of the blood supply of the optic nerve are not adequately covered in the textbooks or even in the reference books of ophthalmology. The larger vessels and the general anatomic relationships are discussed to be sure, but there is scant mention of their important terminals or loops. Since it is these latter that have ultimately to do with the nutrition of the optic-nerve tissue, they warrant more study in order to obtain the information we need in the interpretation of clinical findings. Schwalbe in 1887, Kuhnt in 1879, Leber in 1903, and Magitot in 1908, concerned themselves with the problem and by injection experiments demonstrated many factors that were confirmed by later observers. These in turn have added and refined our information so that a reasonably clear picture develops. It is the purpose of this paper to review the anatomy of the optic nerve and its blood supply and to touch on a few of the lesions with which ophthalmologists are concerned.

GROSS ANATOMY OF OPTIC NERVE AND CHIASM

It is necessary for a better understanding to consider briefly the gross anatomy of the optic nerve and chiasm. Schaeffer and deSchweinitz, in classic articles, have shown that there is a considerable variation in the anatomic relationship between the optic chiasm and the diaphragma sella, the sella turcica, the circle of Willis, the internal carotid arteries, the cavernous sinus, and the third ventricle. The length of the intracranial portion of the optic nerves have also been shown to vary considerably and, in association, the intracranial portion of the ophthalmic artery likewise shows varying lengths in different specimens. However, in spite of all of these variations in approximately 75 percent of individuals, the relationship of the optic chiasm to the adjacent structures is reasonably constant. The variations must be borne in mind for they may explain anomalous and puzzling clinical findings; for example, bizarre field defects in pituitary disease or bizarre pressure effects on the chiasm from calcified or aneurysmic lesions in the adjacent vessels of the circle of Willis.

According to Wolff, "the optic nerve, ensheathed in pia, runs as a flattened band from the antero-lateral angle of the somewhat quadrilateral chiasm forwards and outwards to the optic foramen. About half way along this course it receives a covering of arachnoid.

"Becoming more oval and acquiring a dural covering it traverses this foramen or canal and enters the orbit. As a rounded cord, it now runs forwards and slightly outwards and downwards in a somewhat sinuous manner (to allow for ocular move-

* Presented before the University of California Medical School, September 18, 1947.

ments) and is attached to the back of the eyeball, just above and at a 3-mm. internal to its posterior pole.

"It total length is 5 cm.; the intracranial portion being about 1 cm., the intracanalicular portion 6 mm., the intraorbital 3 cm., and the intraocular 0.7 mm.

RELATIONS

"(a) Intracranial portion. The nerve lies at first on the diaphragma sellae, which covers the pituitary body, then on the anterior portion of the cavernous sinus. Above it is the anterior perforated substance, the medial root of the olfactory tract, and the anterior cerebral artery, which crosses it from without inwards. The internal carotid artery is at first below, then lateral. The ophthalmic artery usually comes off the internal carotid under the middle of the optic nerve, but since its course here is antero-posterior, and that of the nerve outwards as well as forwards, it may appear at the inner border of the nerve before it eventually passes laterally. At any rate, in this first portion of its course it is nearer the inner border than the outer. The nearer the origin of the artery is to the optic foramen, the nearer the inner side of the nerve is placed, and vice versa.

"(b) Canalicular portion. The nerve is surrounded by its membranes, dura arachnoid and pia, but it should be carefully noted that above, these are firmly united to each other, to the periosteum and to the nerve. This forms a point of fixation of the nerve, which otherwise might easily be pushed backwards and forwards in and out of the cranium and thus liable to injury (Schwalbe). This fixation of the nerve also accounts for the fact that, in the optic canal, the cranial subarachnoid space only communicates with that around the optic nerve below.

"The ophthalmic artery crosses below the nerve in the dural sheath to the lateral side. It leaves the dura at or near the anterior end of the canal.

"Medially, the optic nerve is in relationship with the sphenoidal air sinus or a posterior ethmoidal air cell, from which it may be separated by a thin plate of bone only. Sometimes the sphenoidal sinus or posterior air cell may invade the roots of the lesser wing of the sphenoid, or even the wing itself. The nerve is then surrounded by air cells."

Onodi, in 1910, presented a monograph on the subject of "The Optic Nerve and the Accessory Sinuses of the Nose." In it he showed a number of beautiful and instructive specimens in which the optic nerve either lay bare in the sphenoid sinus, or in the posterior ethmoidal cells, or in very close proximity to these structures, separated therefrom, often by a very thin, bony wall. His work is perhaps forgotten for the most part, but bears careful study. The influence of sphenoiditis or inflammation of the posterior ethmoidal cells upon the optic nerve in the production of retrobulbar optic neuritis is pretty well discounted today. Undoubtedly, however, certain cases of this disease can only be thus explained.

Herzog, carrying this work further, showed that where the nerve is separated from the sinuses by a bony wall there is great variation in the thickness and substance of this wall. Some of the specimens showed a heavy thick bone with few lacunae; others were thin and cancellous with lacunae that connected directly with the mucous membrane of the sinuses on the one hand and the dura of the optic nerve on the other.

To continue with Wolff's description of the optic nerve:

"(c) Orbital portion. At the optic foramen the nerve is surrounded by the origin of the ocular muscles, that of the superior and internal recti being closely adherent to the sheath. It is this connection which gives rise to the pain so characteristic of retrobulbar neuritis.

"Between it and the origin of the external rectus are the two divisions of the III nerve,

the naso-ciliary, the sympathetic, the VI nerve and sometimes the ophthalmic vein or veins. Farther forwards the muscles are separated from the nerve by orbital fat.

"The naso-ciliary, the ophthalmic artery and the superior ophthalmic vein cross the nerve superiorly from without inwards. The ciliary ganglion lies to the outer side of the nerve between it and the external rectus. The long and short ciliary nerves and arteries gradually surround the nerve as it passes to the back of the eyeball."

Circulation of spinal fluid to optic nerve

The central retinal artery, which comes off the ophthalmic near the optic foramen, runs forward in or outside of the dural sheath of the nerve. The artery will be discussed later in more detail. Before doing so, it is necessary to look into the relation of the basal cisterns of the brain and investigate the circulation of the spinal fluid to the optic nerve in all of its parts.

According to Locke and Haffziger, the cisterna basalis and the cisterna magna cerebellomedullaris are to be considered as the main pathway of the cerebrospinal fluid. The smaller spaces are channels leading from the main stream. The basal cistern is made up of pars pontis, pars interpeduncularis, and pars chiasmatis. The pars chiasmatis is the portion of the cisterna basalis located farthest forward. It extends forward a short distance and posteriorly to fill in the space between the diverging limbs of the chiasm. The pars chiasmatis also extends about the chiasm, and infundibulum, as well as continuing along the optic nerves toward the globes. It may partially envelop the pituitary body. It is the deepest portion of the cisterna basalis, an important point relating to gravity and its bearing on inflammatory stasis, as well as from a therapeutic point of view.

The superior surface of the sphenoidal sinus is marked by a groove in which lies the chiasm and origin of the optic nerves. Often very thin, it corresponds topographically with the cisterna chiasmatis. Still thinner is the bony lamella making up the roof of the posterior ethmoidal cells. It is perforated by multiple openings, assuring numerous communications between the nasal fossae and the anterior meningeal spaces.

Cerebrospinal fluid is contained not in the subarachnoid space probably, but between two layers of the arachnoid, one of which is adherent to the dura and the other to the pia. It is the various enlargements of the space between the two layers of the arachnoid that form the different cisterns. Adhesions between these two layers are responsible for the collection and stasis of cerebrospinal fluid and lead the formation of subarachnoid cysts and inflammatory bands of tissue (Vail). This condition is known as adhesive arachnoiditis and occurs any place in the central nervous system.

Weed and others have shown that cerebrospinal fluid penetrates into the most minute structure of the spinal cord and brain along the perivascular spaces. So that wherever vessels go, they are surrounded by collarettes of spinal fluid. This probably applies to the chiasm and optic nerve and one can readily see that cerebrospinal fluid may accompany the septal network of capillaries in the optic nerve particularly.

However, Behr believes that there is a separation between the intervaginal space and the perivascular connective tissue of the central vessels where they enter the optic nerve and that this separation is a complete one. Thus the lacunar system of the axial-nerve part is separated from the intravaginal space. There is no possibility that cerebrospinal fluid could enter the axial-nerve part or the perivascular spaces of the intraneural vessels. Thus free fluid in the nerve tissue itself moves absolutely separately from the free fluid in the septal tissue. Hemorrhages and edema are able to spread along the septa in the nerve stem, but they do not enter the nerve parenchyma as

long as physiologic borders (pial) remain intact.

Mortensen and Sullivan have shown by means of ingenious experiments that spinal fluid passes both into the venous channels and into the cervical lymph nodes, as originally demonstrated by Key and Retzius, in 1876. Thorium dioxide, injected into the subarachnoid space of animals, passes rather readily into both the superficial and deep lymph nodes, which are visible by X ray. Batson confirmed the work of Mortensen and Sullivan, tracing the passage of the opaque mass from the subarachnoid space along the olfactory nerves to the nasal mucosa and then by way of lymph vessels along the pharynx to the upper deep cervical nodes. LeGros Clark (cited by Batson) has demonstrated that a flow in the reverse direction is possible. It has long been known that a free vascular connection exists between the nasal mucosa and the intracranial contents.

Therefore, it appears entirely probable that the protection to nerve structure by bone is only of structural significance, and bone presents no barrier to hematogenous or lymphatogenous infections, toxins, or influences.

Magitot (1908), by injection experiments, was led to believe that the intracranial and intracanalicular portions of the optic nerve have a separate blood supply from that of the intraorbital portion. The orbital portion of the nerve is supplied by branches of the ophthalmic artery, while the intracranial and intracanalicular portions are supplied by meningeal twigs arising from branches of the internal carotid, anterior cerebral, and anterior communicating arteries. Thus while the central retinal artery, which is derived from the ophthalmic, sends small nutrient vessels from the center of the nerve to the periphery, on the other hand the nutrient vessels of the canalicular and intracranial portions of the nerve are from the periphery to the center. These nutrient twigs are end-arteries. This explains the ease, if Magitot is correct in his premise, with which the papillomacular bundle, very delicate and highly differentiated, can be affected by endogenous toxins or infections. The basal cisterns thus become a common meeting ground between nerve parenchyma and blood, on the one hand, and the nasal sinuses, lymphatic systems of the sinuses, and the skull, on the other.

Vascular supply of the optic nerve

Arterial

Our understanding of the vascular nutrition of the optic nerve, although still somewhat confused, has been greatly clarified by the experimental work of Beauvieux and Ristitch (1924) and particularly of Eugene Wolff (1939) and Behr (1935). These authors have shown some discrepancies in their findings, but not enough to interfere with a reasonable interpretation.

The intracranial portion of the optic nerve is supplied chiefly by minute branches, inferiorly, from the internal carotid, sometimes the ophthalmic; superiorly, from the anterior cerebral and anterior communicating arteries. That there can exist much variation in individual cases, is evident from the work of Schaeffer and deSchweinitz. These minute vessels penetrate the pia, pass into the nerve tissue, and form the septal network of the nerve. In doing so the pial sheath is invaginated and forms the connective-tissue covering of the septal capillaries. The fibrous tubes making up the septa are not absolutely closed, according to Behr, but show spaces or small openings communicating with other bundles. The septa are separated from the nerve bundles by glial fibers. Metabolism is regulated principally or exclusively by the bordering glial membranes and the fibers connecting them. Nutriment and metabolites coming from the vessels pass first the perivascular cerebrospinal space, then through the connective-tissue covering. Fluid is collected in this mesodermal connective tissue, and what is

needed from this fluid for the nutrition of the ectodermal nervous tissue passes through the bordering glial membrane. Behr makes the point that, by this collection of free-tissue lymph fluid, a uniform uninterrupted nutrition of the nerve is maintained without quantitative imbalance.

The septa (blood vessels) of the intracranial part can be clearly differentiated between the peripheral and axial portions. In the latter, in which the papillomacular bundle is situated, the septa are thinner and more scarce (the "end-arteries" of Magitot) than in other places, and the individual optic-nerve bundles thus are larger. The nutrition of the papillomacular bundle is therefore less abundant in the intracranial part of the optic nerve than elsewhere. This anatomic finding is probably sufficient to explain the vulnerability of the papillomacular bundle.

The intracanalicular portion of the optic nerve, approximately 6 mm. long, is supplied by pial vessels arising from the internal carotid, and anastomoses with septal vessels from the orbital and intracranial portions of the nerve. Here the septal network is relatively poor. Behr also points out that in the optic canal, there are strong bridges between the optic nerve and the bone, formed by radial connections between pial sheath and dura-periosteum. These bridges are dangerous in skull fractures, injuring the nerve more often than direct injury by bone splinters.

The orbital portion is supplied by two groups of vessels derived from the ophthalmic artery. (a) Those that pierce the dura behind the entrance of the central vessels, and (b) those that anteriorly join the pial network at the site of the entry of the central vessels. Occasionally, there is found a recurrent branch of the central vessel (Wolff, Igersheimer, Abbie) which may extend backward as far as the optic foramen. Apparently, this is a rare finding.

The upper and lateral portions of the periphery of the nerve is supplied by minute branches from the ophthalmic artery, which freely anastomose with each other; with the posterior ciliary arteries at the circle of Zinn; and with the recurrent or collateral arteries that arise from the central artery as it enters the dural sheath. These latter supply chiefly the inferior periphery of the nerve.

As they pierce the dura from different directions, they traverse the subarachnoid space either at right angles or obliquely and, shrouded in meningeal tissue, form the septa.

The axial or central part of the nerve is supplied by branches from the central collateral artery (Wolff) and occasionally, as mentioned before, by a posterior axial branch from the central artery, fine branches of which anastomose with the pial network of vessels.

According to Wolff "the central artery of the retina, about 0.28 mm. in diameter, comes off the ophthalmic artery close to the optic foramen, usually in company with one or other branches, most commonly the medial ciliary artery. It runs a wavy course forward to some 10 to 15 mm. behind the globe. From this position on the under aspect of the nerve until it passes into the retina, the artery makes five bends. The first bend is found where the artery turns upwards at the right and angles, or nearly so, to pierce the dura and arachnoid, from both of which membranes it receives a covering. Having reached the subarachnoid space clothed by the above membranes, it bends forwards and also to one or the other side. After a very short course, for the artery is always cut here transversely in sections, it again bends upwards at nearly a right angle, passes through or rather invaginates the pia to reach the center of the nerve. The entering vessel is clothed by the whole thickness of the pia, and at first some arachnoid trabeculae as well, and thus takes with it the contained (pial) vessels. The fourth bend is formed where the artery passes forward in the center of the nerve. The fifth bend

is made by the terminal branches as they leave the parent vessel at the nerve head to pass into the retina.

"At about the point where the central artery pierces the dura it gives off one or more branches, which diminishes its diameter by about one third. Some of these immediately enter the pia, dividing into branches which go forwards, backwards, and circularly, and joining the pial network, send branches into the nerve. Others pass into the nerve with the central artery, running parallel with it. Although extremely well described by Kuhnt in 1879, these vessels have often been forgotten in subsequent works, and this has led to a great deal of confusion." (To emphasize the fact that they do exist Wolff suggests the name of central collateral arteries.)

"One of these vessels, larger than the rest, can be traced to the lamina cribrosa. These collateral vessels send branches into the nerve and hence get narrower as they pass anteriorly. At the point where the central artery bends forwards at the center of the nerve a branch of the collateral vessels, not of the central artery itself (Magitot) passes backwards, towards the optic foramen.

"While the collateral arteries get finer as they are traced forwards, the central artery remains the same size from its point of penetration to its bifurcation. This is due to the fact that in this portion of its course the central artery gives off no branches, or at least none of any consequence, hence in its intraneural course, takes no part in the nutrition of the nerve (Kuhnt, Behr)."

Origin of central artery

Beauvieux and Ristitch found eight variations in the origin of the central artery.

1. It springs from a trunk common to the long internal ciliary artery on its superior surface (1 in 20).

2. It arises from a trunk common to the external ciliary artery, turns around the external edge of the nerve to penetrate its superior surface (2 in 20).

3. Same as above, except the vessel penetrates the inferior surface (3 in 20).

4. It arises from a trunk that is common to external and internal long ciliary arteries and reaches the inferior surface of the nerve (1 in 20).

5. It arises from a trunk common to the long internal ciliary artery on the external or lateral edge of the nerve. It then turns around the latter and disappears in its inferior surface (5 in 20).

6. It arises from a trunk common to the short posterior ciliary artery, turns around the nerve and enters into its inferior surface (1 in 20).

7. It arises directly from the ophthalmic, external margin, after the lacrimal artery and penetrates into the nerve, sometimes in its superior surface (1 in 20) and, sometimes in its inferior surface (5 in 20).

8. It appears as the first branch of the ophthalmic and enters the nerve in its inferior surface (1 in 20).

These authors are at variance with Wolff in the conclusion that no communication exists between the central arteries and the vessels of the pia of other origin, which contribute to the vascularization of the orbital portion of the nerve, nor do they believe that there is any communication of the central artery branches and those coming from the anterior cerebrals.

The injections by Beauvieux and Ristitch of the central artery alone, have shown that the region of the lamina cribrosa is supplied by twigs from the arterial circle of Zinn (short posterior ciliary arteries). The circle of Zinn together with twigs from the central artery, supply the papilla of the optic nerve. Branches are also sent to the retina, even the fully developed cilioretinal artery. There are apparently no anastomoses between the hyaloid and sclerochoroidal systems.

Central retinal vein

The central retinal vein has numerous anastomoses with the capillaries near the papilla, the lamina cribrosa, and the choroidal system. Beauvieux and Ristitch showed that coloring matter injected into the central artery can be seen to fill the peripapillary choroidal veins, then into the vortex veins, and also into the scleral veins which contribute to form the short posterior ciliary veins. The central vein leaves the optic nerve either obliquely or parallel and then at right angles, usually proximal to the entry of the artery. From thence it becomes the venous network in the orbital fat which empties in the cavernous sinus, the superior ophthalmic vein, the inferior ophthalmic vein, or several combinations. The central vein contributes also to the plexus surrounding the optic nerve and ophthalmic artery.

According to Cone and MacMillan, the posterior central vein of the optic nerve (Kuhnt) is found in the center of the optic nerve during its course through the optic canal. It arises by confluence from numerous venules which collect blood from the orbital portion of the nerve, and it is accompanied by a strand of connective tissue which is the continuation of the pia. It leaves the stem on its lower aspect where the ophthalmic artery is found in the dural sheath. The vein then proceeds around the external margin of the nerve and empties into the cavernous sinus (Greef 1900). The finding is constant and its lumen is nearly the same size as the anterior central vein. Greef says that, according to Berlin, injury of the vessel is responsible for the hemorrhage present at times in fracture of the optic canal.

The posterior central vein of Kuhnt seems to have been neglected and almost forgotten. It may play an important role not only in injury to the nerve in the optic foramen but, by sudden compression in spontaneous subarachnoid hemorrhage, it may lead to profound and remote results in the retina.

Elschnig (1893) was the first to show that a rich anastomoses existed between the arteries arising from the external carotid and the ophthalmic artery. He conducted experiments on a cadaver and showed that after the occlusion of the internal carotid artery intracranially, water and water soluble dyes injected into the common carotid artery would, by retrograde flow appear in the distal segment of the ophthalmic artery. Walsh and King verified this important observation in a series of ingenious experiments and conclusively showed that a large collateral circulation exists between the external carotid artery and the ophthalmic artery of the same side and that there is sufficient cross circulation so that the ophthalmic artery of the opposite side may be filled from the external carotid artery.

Clinical significance

A good understanding of the nutrition of the optic nerve helps us to interpret the clinical manifestations encountered when the nutrition is interfered with. There are, of course, many gaps in our knowledge and many errors of interpretation.

The demyelinating diseases, of which multiple sclerosis is the most common, are poorly understood. There is some glimmer of hope in the recent studies of Putnam and his co-workers. These investigators bring strong evidence to bear upon the premise that thrombosis of venules are essential links in the chain of causation of multiple sclerosis and encephalomyelitides. The premise is based upon the following evidence: (1) Experimental. (2) Human cases—similar lesions in human material following thrombosis of veins of certain size or compression of a pial vein by a tumor. (3) Thrombi, usually in venules and veins, have been observed in a large proportion of cases of acute encephalomyelitis and

in the more acute lesions of multiple sclerosis by various authors over the past half century. (4) Exogenous factors—infection, pregnancy, trauma, and chilling increases the coagulability of the blood to produce thrombophlebitis. These factors correspond closely with those that appear to precipitate the onset or exacerbations of multiple sclerosis. (5) The clothing mechanism of the blood is abnormally labile in cases of multiple sclerosis. Obstructive changes (Rucker) have been observed in the retinal vessels, some of which might be interpreted as thrombotic. Abnormalities can be observed in the capillaries of the nail bed in a majority of cases.

Sheinker studied 20 cases of multiple sclerosis. In all cases the early stage of plaque formation showed positive correlation between the lesion and vascular changes that are probably thrombotic.

There is also some evidence that a tendency to thrombosis may in some measure be allergic and Foster-Kennedy has described cases of acute retrobulbar optic neuritis which were definitely allergic. Putnam and his co-workers treated 43 patients, who had multiple sclerosis, with dicouramin. The results are promising. The dramatic response to blood letting or draining of the sinuses, especially the sphenoid, that is seen in some cases of retrobulbar optic neuritis suggests that the circulation in the optic nerve has a lot to do with the condition. It is also logical to assume from the description of this circulation that has been given, that the intracranial portion of the optic nerve is the primary locus of the disease. Rønne has described a number of cases of acute retrobulbar optic neuritis where the lesion was located in the chiasm; and careful field studies by other observers including myself have supported his findings.

Similar arguments can be directed toward the pathogenesis of other forms of neuritis and the toxic amblyopias. That is to say, a suppression of function of the papillomacular bundle, more commonly in the intracranial portion, due to interference with its blood supply.

The papilledema that is seen on rare occasions in cases where only a focal infection can be found is presumably on a thrombotic basis. The removal of the focus and the establishment of collateral circulation results in improvement (Frost).

Verhoeff and Simpson report a remarkable case of tubercle in the central vein associated with periphlebitis retinalis in the other eye. Other tubercles were found in the vaginal space, in the arachnoid, pia, and in the episcleral tissue, 1.8 mm. outside of the subvaginal space. Their patient had a hemorrhagic glaucoma, the cause of which was not determined until histologic examination. The Mantoux test was negative.

Goldstein and Wexler described a case of bilateral atrophy of the optic nerve due to periarteritis nodosa. Histologic examination showed an affected postciliary artery entering the dura of the optic nerve and proceeding into the region of the lamina and anterior segment of the nerve. The optic disc contained many inflammatory round cells and glial tissue. The infiltration extended behind the lamina and the nerve fibers were atrophic. In Von Herrenschwand's case the periarterial nodes occurred particularly when the ciliary artery altered its direction, such as at its entrance into the sclera, its course through the lamina cribrosa, and on its course from the sclera toward the ciliary body.

The optic atrophy of tabes undoubtedly is associated with a nutritional disturbance of the nerve fibers due to the syphilitic involvement of the blood vessels, as Moore and Woods have so ably argued. Its relationship to syphilitic arachnoiditis has not yet, however, been entirely disapproved. It is entirely possible that the pial network of vessels of the optic nerve, especially in its intracranial portion, may be the first site of the lesion, thus explaining the peripheral

contraction of fields of vision in tabes. Stargardt found, in 10 cases of syphilitic optic atrophy, earliest change in the chiasm and intracranial portion of the optic nerve. There was evidence of inflammation in the pial investment and some gliosis of the superficial parts of the nerves. He noted that the myelin sheaths became degenerated before the axis cylinders. Behr, in discussing the careful study of nine cases of optic atrophy due to syphilis, noted that the primary change was an inflammatory process in the connective-tissue system of the intracranial portion of the nerve and of the blood vessels in relation to this. The myelin sheaths were affected before the axis cylinders. Greenfield and Epstein corroborated Stargardt's observations fully and remarked that the superficial fibers in the optic nerve were first affected, that the myelin was more affected than the nerve fibers, and finally that inflammatory changes in the meninges were much more evident in the intracranial than in the intraorbital portion of the optic nerves.

Gradle (1917), in discussing glaucomatous cupping and atrophy of the optic nerve in cases where the intraocular pressure was never elevated, regarded it as a special disease that began as an optic neuritis with formation of the cavernous changes in the optic nerve described by Schnabel. Loewenstein described vascular changes (thrombosis) in the optic nerve which led to cavernous degeneration, calcified drusen, and sclerotic plaques. He and Garrow also described further examples of this condition which they termed spongy degeneration and cavitation of the optic nerve. Knapp, Elwyn, and others believed that their cases showing the clinical picture of glaucoma without ocular hypertension were secondary to compression by calcified carotid arteries upon the optic nerve. Recently Rintelen, in a classic article on the arteriosclerotic atrophy of the optic nerves, described the histologic findings in 6 out of 35 cases. The atrophic conditions in the nerve were localized chiefly in the anterior third of the nerve, in the part that contains the central vessels. He also found in one case an area that he called "red malacia." Arteriosclerosis of the central artery has little effect on the nerve. The damage is due to the sclerosis of the small nutrient vessels. Subsequent to this local malnutrition, cicatriced areas occur with disappearance of the nerve fibers and secondary glial proliferation. He believed that the arteriosclerotic malacia of the optic nerve is of much more importance than the calcification of the carotid arteries. He distinguishes three forms of arteriosclerotic atrophy of the optic nerve: (1) A benign, slowly progressive, diffuse atrophy, especially limited to the periphery of the nerve. This occurs in the aged and is clinically marked by a moderately cupped and pale optic disc. (2) A malignant, rapidly progressing atrophy which often shows exacerbations, occurring mostly in young patients with arteriosclerosis or hypertension. This form is caused by the malacious areas in the anterior part of the nerve and may have the clinical aspect of a glaucoma without ocular hypertension. (3) A clinically less important atrophy of the optic nerve caused by a direct compression of the nerve by calcified carotid arteries.

It is entirely probable that vascular disease of the nerve as previously described may account for the progress of cupping, atrophy, and field changes that frequently continue after the ocular hypertension has been quite controlled in true glaucoma, especially in the aged.

Drusen bodies in the papilla are hyalin formations. They are formed locally and not directly from surrounding tissue. The first anatomic signs of drusen formations are found in the smallest vessels in front of the lamina cribrosa. Before hyalin is present, the walls of these vessels become thickened. Drusen bodies are found else-

where in the optic nerve and may, by pressure or interference with the nutrient vessels, disturb the function of the nerve fibers. Tuberose sclerosis is closely allied to this process.

The retinal and preretinal hemorrhages found in cases of subarachnoid hemorrhage have created much speculation as to their origin and mode of production. The evidence is pretty conclusive that there is no direct extension of blood through the optic disc from the distended hemorrhagic vaginal sheath. Ballantyne, whose recent studies have thrown further light upon this condition, believes that, while it may be a physical possibility for blood to pass through the optic foramen, it does so only in exceptional cases. He as well as Bucklers and Greear and others think that the sudden rise of intracranial pressure produces a venous stasis which in turn leads to hemorrhages throughout the orbital and ocular structures. Hemorrhage occurs in the subdural and subarachnoid spaces, and the blood in the latter situation, by putting pressure and tension on the central retinal vein, accounts for the retinal and vitreous hemorrhages.

It must be considered also that the pressure upon the posterior part of the globe by the distended subarachnoid space compresses the veins that so freely anastomose around the optic nerve at its insertion into the globe. The role of the posterior central vein of the optic nerve in the production of these retinal hemorrhages has not been studied, so far as is known.

It has been pointed out that there is a rich anastomoses between the arteries arising from the external carotid and the ophthalmic arteries. This explains the number of cases of retained vision where the ophthalmic artery intracranially has been obliterated surgically in the treatment of vascular aneurysms of the circle of Willis (Dandy, Adson).

The cases of blindness and optic atrophy occurring rather infrequently in head injuries require some comment. There is no question but that there is complete degeneration of the axis cylinders both above and below the lesion in severe cases. Most all authors agree that the primary site of injury to the optic nerve lies in the intracanalicular portion and sometimes in the intracranial portion of the nerve, owing to their immobility, and this position of the lesion corresponds with the appearance of pallor of the disc from 14 to 21 days after the injury. The damage to the nerve may be the result of (a) subvaginal hemorrhage within the optic foramen, with pressure on or tearing of the nutrient vessels of the optic nerve, (b) intraneural hemorrhage, (c) fracture, with perhaps tearing of the nervous tissue, (4) later by callus formation within the optic foramen, following a fracture through the anterior clinoid (Turner, Lillie and Adson, Rodger). The role of the posterior central vein in this condition has been mentioned (Berlin), and it must take an active part in the associated hemorrhages from the nutrient and septal hemorrhages that undoubtedly occur at the time of the injury.

These clinical conditions are but a few of the important lesions affecting the optic nerve that a knowledge of the minute details of the nutrition of the optic nerve helps to interpret. Further studies are necessary and it is hoped that this paper will serve as a stimulus to those studies, particularly experimental ones.

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A STUDY OF THE ANGLE OF BIFURCATION OF RETINAL VESSELS*

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It is often stated that in sclerosis of the retinal vessels the arterial branches diverge from the stem vessel at an acute angle. Lurje[1] mentions that in sclerotic states in which hypertension is present the arteries are usually straight and branch acutely.

Friedenwald[2] (using the evidence presented by Hertel and by Coats that the neural portion of the central artery shows more sclerotic changes than the retinal portions) states that the straightness of the retinal arteries and their tendency to branch at acute angles must be due to longitudinal shrinkage in the central vessel behind the disc, which draws the branches of the first and second order onto the disc.

To add credence to this hypothesis, he examined the fundi of two groups of elderly arteriosclerotic patients—one group in whom the retinal arteries were straight and narrow and one group in whom they were straight and tortuous—counting the number of major branches which crossed the disc margin. The group in whom the retinal arteries were straight and narrow showed an average of 5 to 6 major branches crossing the disc margin while the group in whom the retinal arteries were straight and tortuous showed an average of slightly better than four. This appears to be the only evidence in the literature to substantiate this oft-quoted statement.

Friedenwald, however, believes that, in the condition which he designates arteriolar sclerosis, the angle of bifurcation is more obtuse. In his Doyne Memorial Lecture he stated: "The larger retinal arteries in early cases (of arteriolar sclerosis) are full and tortuous and often show a widening of their reflex band associated with a coppery appearance of blood column. . . . In late stages of this condition the larger arteries also show marked lesions, such as beading, increased visibility of their walls, and even diffuse constriction of caliber. A point of distinction between these cases in their late stages and those of the group next to be described (arteriosclerosis with hypertension) is that the larger arteries in arteriolar sclerosis usually remain tortuous and branch at right angles even when they have become greatly narrowed, while in the next group they are generally quite straight and branch at acute angles." However, no evidence is presented to support this concept.

PLAN OF STUDY

In order to assemble some specific data on this subject, a plan of study was drawn up. The angles were measured from photographs of normal and arteriosclerotic fundi

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for comparison. Bedell's *Atlas of Fundus Photographs*,[5] was used since it was thought that the results would be less prejudiced than if studies on a selected series of pictures were made. Those photographs were selected in which the branches of the retinal artery were most clearly in focus. Because of the lack of detail in these reproductions, it was found impossible to measure accurately the angle by direct application of a protractor. Therefore, each photograph was enlarged by means of a reflection projector on a screen of white paper. The arterial pattern was traced on this paper. In addition to enlarging the photographs from 3.5 cm. to 23 cm., this procedure proved advantageous in that it transferred the photograph to white paper where trigonometric calculations could more readily be made.

Calculation of angles

In calculating the angles at the first, second, and third bifurcations of the central arteries, straight lines were drawn from the junction of the branches and stem, following the centers of the vessels. In this way tortuosity of the two arterial limbs distal to the bifurcation did little to influence the fairly accurate construction of the angle. Each line was extended to exactly 5 cm.; the ends were joined by another line, creating an isosceles triangle. A perpendicular was dropped from the vertex of the angle to this line which necessarily bisected the angle.

Using elementary trigonometry, either half of the bisected angle was readily calculated; that figure, multiplied by two, revealed the size of the angle in question. In this way, 70 angles of normal fundi and 23 angles of arteriosclerotic fundi were measured. Contrary to expectations, the averages showed a normal average angle of 70 degrees and an arteriosclerotic average angle of 82 degrees.*

In other words, in this small series, and by the methods employed, the arteriosclerotic vessels showed a more obtuse angle than did the normal vessel angles. This result was quite contrary to the generally accepted statements found in the literature already referred to with the possible exception of that made by Friedenwald. Individual variation in the size of the angles in different fundi was found to be very great in both normal and arteriosclerotic fundi, ranging from a low of 37 degrees to a high of 106 degrees in normal fundi, and from a low of 45 degrees to a high of 108 degrees in arteriosclerotic fundi.

Comments

Interesting is the fact that in those few cases where several bifurcations were measured from the same fundus, individual variations were not nearly so marked. Of 18 normal fundi in which several angles were measured in each, in 9 the angles differed by less than 10 degrees and in 15 by less than 20 degrees; of the 6 arteriosclerotic fundi so measured, in 2 the angles differed by less than 10 degrees and in 5 by less than 20 degrees.

Although every precaution was taken to standardize the technique there were many instances in which the construction lines following the long axis through the center of the vessels offered a number of choices; thus, others repeating the study might arrive at somewhat different averages. However, since this error occurs equally in measuring both normal and arteriosclerotic fundi, it seems reasonable to assume that others might find a similar ratio between the two

* The standard deviation of the measurements for the bifurcation angles of 70 normal retinal arteries is 14.2; for the 23 angles of bifurcation of sclerotic arteries the standard deviation is 14.5. The standard errors are, therefore, 1.7 and 3.0, respectively. For normal arteries the angle of bifurcation may be given as 69.8 degrees $\pm$1.7 degrees; for the sclerotic arteries, 81.5 degrees $\pm$3.0 degrees. The standard error of the difference is 3.5, and the ratio of the difference of the means to the standard error of the difference is 3.3, indicating a significant difference between the two groups.

groups of fundi. In several cases, the outline of the retinal vessels was difficult to visualize; perhaps in this way error might have been introduced.

Discussion

As mentioned earlier in this paper, Friedenwald stated that longitudinal shrinkage of the central artery behind the disc was responsible for the acute angles reputedly found in retinal arteriosclerosis. It seems equally convenient to explain the more obtuse angles found in this series by the converse condition; namely, a longitudinal stretching of the central artery.

Thoma[3] believed that the first change in arteriosclerosis was a loss of the normal elasticity and contractability in the walls of the arteries; consequently the arteries become lengthened. Since no increase occurs in the size of the eye, the elongated arteries must adapt themselves to the environment by becoming tortuous.

Duke-Elder[4] also believes that the elongation of the arteries causes an increased degree of tortuosity but ascribes the elongation to the hypertrophic thickening of the vessel walls. He states that if the thickness of the walls is increased, the length of the vessel must also increase, for it appears unlikely that the additional tissue would be deposited in the vessel wall in one plane only.

Perhaps this arterial lengthening, which is thought to be the cause of tortuosity, is the cause of the more obtuse angles that this short series of measurements seems to indicate are present in arteriosclerosis. In order to determine whether this longitudinal stretching does occur, an attempt was made to measure the length of the central artery, on the fundus photographs, from its point of emergence from the disc to its first bifurcation. However, because most of the vessels in the disc area were out of focus and therefore poorly defined, no accurate measurements could be made.

One might more reasonably postulate a shrinkage of the retina itself with retraction toward the nervehead. This would tend to widen the angle of the relatively stiff vessel tree as the branches would be flexed away from the more resistant trunk vessel. Moreover, the branches are anchored to the retina by their capillaries; whereas, we know that there is a capillary free zone about the arterial trunks. Retraction toward the periphery would not be expected because we know that the retinal periphery in arteriosclerotic subjects shows degeneration, cyst formation, and other signs of atrophy and thinning.

It is evident that while the results are quite contrary to the generally accepted statements, they appear to be in accord with Friedenwald's observations on arteriolar sclerosis. However, since Bedell deals only with arteriosclerotic fundi in his *Atlas,* we are able only to report on this condition. Whether perhaps a few or many of Bedell's cases are in reality cases of arteriolar sclerosis as defined by Friedenwald is an open question; certainly one cannot tell from the brief descriptions or from the photographs. We are able, therefore, only to say that in this study of arteriosclerotic fundi, as selected by Bedell, it was found that the arterial branches came off more obtusely than did the arterial branches of normal fundi of a larger series.

The fact that in normal fundi the angles vary from 37 to 106 degrees, and in arteriosclerotic fundi from 45 to 108 degrees precludes the possibility of using the size of the angle of bifurcation as an aid in diagnosis. However, if serial funduscopic photographs were taken of individual cases over a period of years, perhaps then the measurement of the angle of bifurcation by the method described in this study might prove a reliable index of the progress of sclerosis.

Summary

Using Bedell's funduscopic photos the angle of bifurcation of 70 normal retinal

arteries and of 23 arteriosclerotic retinal arteries was measured. The average angle in the normal fundi was found to be 70 degrees and in the arteriosclerotic fundi 82 degrees; this appears to be quite contrary to the generally accepted statements found in the literature. A brief discussion of the possible mechanisms responsible for the more obtuse angles in arteriosclerosis is presented.

Acknowledgement is made to Dr. John N. Evans for his encouragement and guidance in the preparation of this paper.

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ON THE MECHANISM OF PRODUCTION OF MASSIVE PRERETINAL HEMORRHAGE FOLLOWING RUPTURE OF A CONGENITAL MEDIAL-DEFECT INTRACRANIAL ANEURYSM*

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Two possible explanations have been offered for the preretinal hemorrhages commonly associated with ruptured congenital medial-defect aneurysms of the cerebral arteries. In one of these, the older, it is postulated that blood passes by direct extension from the subarachnoid space along the optic nerve through the lamina cribosa to infiltrate the retina[1, 2] (fig. 1). In the other, a more recent and generally accepted explanation, extravasated blood is thought to pass along the perineural or intervaginal space of the optic nerve and to constrict the central vein of the retina as it leaves the nerve, [3, 19-21] thus producing marked engorgement and eventually rupture of the preretinal veins (fig. 2). We have recently had the opportunity to make a detailed study of a case of preretinal hemorrhage of the type in question. In reviewing the anatomy of the eye especially with reference to the vascular arrangement, we have been impressed by certain venous relationships which appear to serve as an entirely satisfactory and quite probable basis for a third possible explanation of the intraocular hemorrhage (fig. 3).

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Case report

History. The patient, a 38-year-old white housewife, was in good health until the early morning of the day of death, at which time she complained of sudden, severe pain in the frontal region of the head. This was followed by vomiting and convulsions. She was hospitalized 2½ hours after onset of the pain. There was no history of trauma or of similiar episodes. Her mother was said to have died of a "stroke" two years previously.

Examination. The patient was semiconscious, uncoöperative, and responded

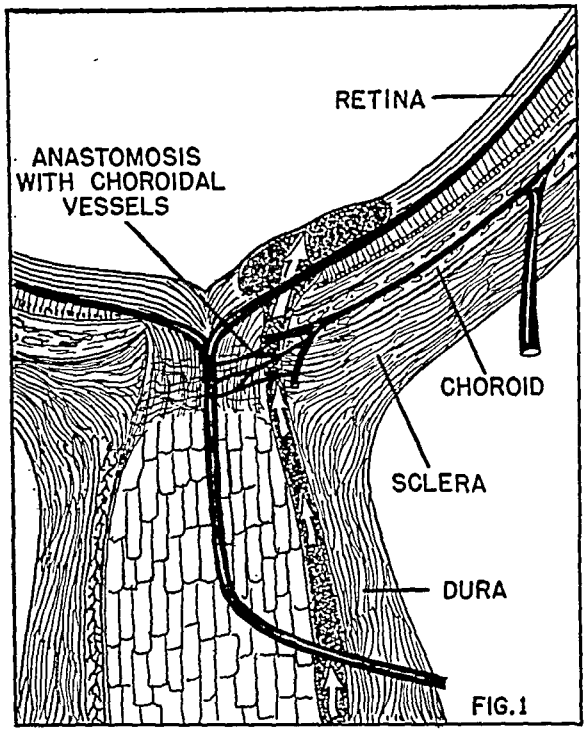


Fig. 1 (Miller and Cuttino). Diagram of mechanism of production of preretinal hemorrhage, as postulated by Symonds. According to this hypothesis, blood in the intervaginal space was thought to be of sufficient pressure to traverse the lamina cribrosa and appear in the retina.

poorly to questions. Blood pressure was 125/80 mm. Hg, pulse 60, respirations 24 per minute, and temperature 36.6°C. The skin was cold and clammy. She moved her right arm about aimlessly, but did not move her left arm. Repeated extensor spasms followed episodes of hyperventilation.

Eye Findings. A slow lateral nystagmus of the right eye was present. The right pupil was larger than the left, and both were fixed. There was a fixed left lateral gaze. Funduscopic examination showed marked protrusion of the right optic disc with a large flame-shaped hemorrhage virtually obliterating the temporal half of the right fundus. The left eye was normal. Right facial paralysis and ptosis of the right eyelid were questionable. The reflexes on the left side of the body were slightly reduced with a positive Hoffman's sign on the right.

Laboratory findings. The pertinent laboratory findings were as follows: Hgb. 8.3 gm.; W.B.C., 31,450, R.B.C., 3,480,000; platelets, normal; spinal fluid grossly bloody, contained 1,300,000 R.B.C. and 120 W.B.C. The initial cerebrospinal-fluid pressure was 570 mm. and the final pressure, 230 mm. of water.

Course of disease. Shortly after admission an extreme extensor rigidity similiar to that of the decerebrate animal followed one of the convulsions. The pupillary reflex returned, and reëxamination revealed that bilateral Hoffman and Babinski signs, ankle clonus, and equal but hyperactive reflexes had developed. Blood pressure was now 170/110 mm. Hg. The patient grew progressively weaker and became comatose. Secretions collected in the upper respiratory tract, requiring frequent aspiration. The pulse rose to 152 per minute and the temperature to 39°C. Terminally the respiration movements became slow and deep. The patient died 12 hours after onset of the severe frontal headache.

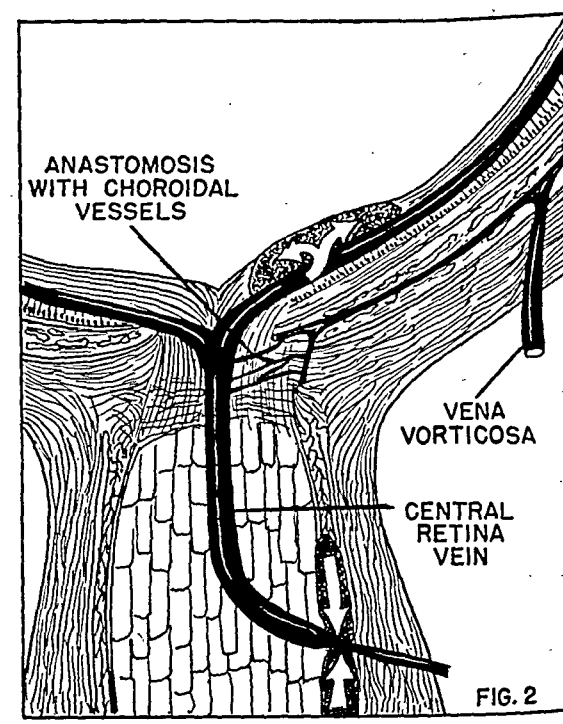


Fig. 2 (Miller and Cuttino). Diagram of mechanism of production of preretinal hemorrhage, proposed by Paton and Holmes. Here the hemorrhage results from stasis produced by compression of the central retinal vein as it leaves the optic nerve.

Autopsy findings. When the cranial cavity was opened at autopsy, the dura was under increased tension. Attached to its right under surface was a meningioma, 8 mm. in diameter. Over the convexity of the brain was a diffuse subarachnoid hemorrhage. The inferior surface of the brain likewise was covered by hemorrhage; this was especially prominent in the vicinity of the right internal carotid artery and on the inferior surface

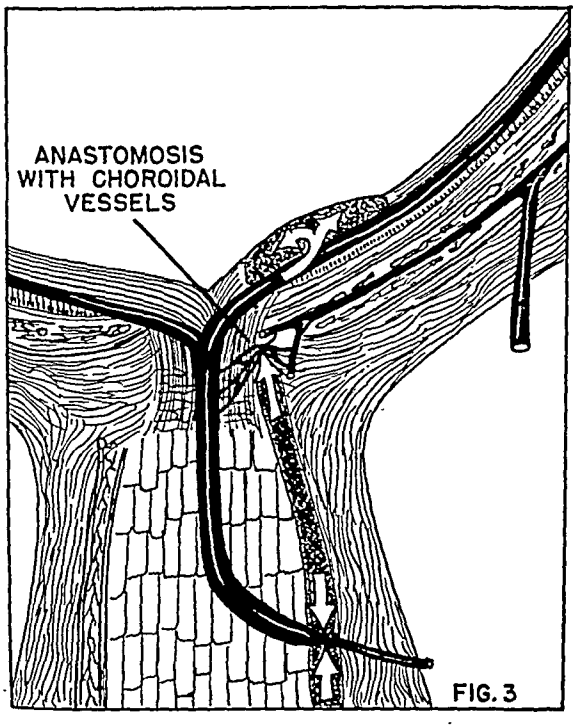


Fig. 3 (Miller and Cuttino). Diagram of the mechanism of production of preretinal hemorrhage, as outlined in Figure 2, but with the modification of compression of the choroidal anastomosis, as suggested in the text.

of the right frontal lobe. The right internal carotid artery was dilated throughout its intracranial course. At the common site of origin of the anterior cerebral, middle cerebral, and posterior communicating arteries was a saccular aneurysm, 1 cm. in diameter, with an anterolaterally situated rupture in its thin wall. Corneal sections of the brain revealed a 2-cm. deep penetration of the temporal lobe, directly opposite the aneurysm, by hemorrhage.

Nervous-system dissection. The cranial



Fig. 4 (Miller and Cuttino). Right eye on section showing preretinal hemorrhage and hemorrhage about the optic nerve. The hemorrhage about the optic nerve is not continuous with the hemorrhage of the retina.

nerves were not remarkable except for the right optic nerve. This was surrounded by blood as it entered the optic foramen. There was also clearly defined hemorrhage in the central portion of the nerve. As demon-



Fig. 5 (Miller and Cuttino). Right eye showing preretinal hemorrhage confined within the retina and the relationship of the intervaginal hemorrhage to the lamina cribrosa. Hematoxylin and eosin (×17).

strated by serial cross sections at 2-cm. intervals, the latter was confined to the intracranial segment of the nerve. Throughout its orbital course the nerve was surrounded by blood, which lay in the intervaginal space. Hemisection of the right eye showed hemorrhage in the nasal half of the retina, which did not connect with that in the intervaginal space of the nerve (fig. 4). The left eye showed nothing unusual. Further dissection of the central nervous system was noncontributory.

The somatic organs showed an early pneumonia, left ovarian cyst, and right ventricular dilatation.

Microscopic findings. In microscopic preparations the aneurysm was found to be a fibrous connective-tissue sac whose thin walls contained neither muscle nor elastic tissue. Interrupted serial sections of the optic nerve and eye were prepared. The hemorrhage in the center of the optic nerve was thus shown to be small and confined to the intracranial segment of the nerve. The hemorrhage in the subarachnoid and subdural spaces was traced uninterruptedly throughout the course of the nerve to an abrupt termination at the lamina cribrosa (fig. 5). There was no connection between the hemorrhage in the intervaginal space of the optic nerve and that in the retina. The central retinal artery and vein were not constricted as they left the optic nerve, nor were they dilated in their intraneural course. The optic nerve was edematous. Sections of the eye showed moderate papilledema and numerous dilated preretinal veins. The intraocular blood noted grossly was confined by the internal limiting membrane to the retina; there was no extension into the vitreous chamber (fig. 6). One of the dilated preretinal veins located in the nerve fiber and ganglionic cell layers and in juxtaposition to the hemorrhage was clearly ruptured at a point where its wall had become necrotic (figs. 6 and 7). The vessel was obviously the origin of the preretinal hemorrhage. The central artery and vein were

somewhat dilated in the region of the optic disc. No dilatation of the choroidal vessels was observed.

Other microscopic sections confirmed the findings of pneumonia and the left cystic ovary.

Anatomic diagnosis. The following anatomic diagnosis summarizes the findings in the case: Ruptured congenital medial-defect aneurysm of the right internal carotid artery at its termination; massive subarachnoid hemorrhage, with hemorrhage in the optic nerve at its point of entry into the intraorbital space of the right eye; hemorrhage along the course of the right optic nerve in the subarachnoid and subdural spaces; rupture of a preretinal vein with associated preretinal hemorrhage in the right eye; right ventricular dilatation of the heart; anemia; hemorrhage, acute congestion, and early pneumonia of both lungs; left ovarian cyst; recent corpus luteum; abdominal adhesions; meningioma.

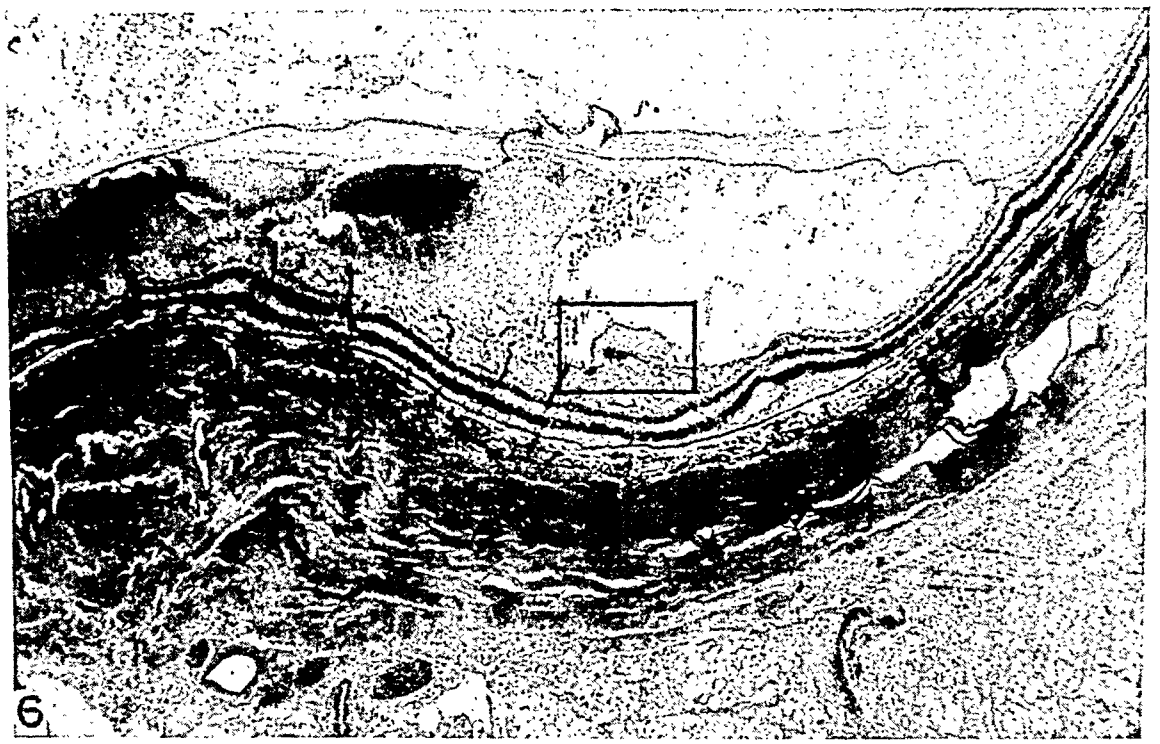


Fig. 6 (Miller and Cuttino). Preretinal hemorrhage at the site of rupture of the preretinal vein. The confinement of this hemorrhage by the internal limiting membrane of the retina is well shown. Hematoxylin and eosin (×35).

The dynamics of preretinal hemorrhage

To acquire a satisfactory understanding of the possible mechanisms responsible for preretinal hemorrhages a detailed knowledge of the vascular supply of the eyeball and optic nerve is essential. The ophthalmic artery, in supplying the eyeball, has two components; namely, the central artery of the retina, which supplies part of the optic nerve and all of the retina, and the ciliary artery, which supplies the remainder of the eyeball.[4, 5] Shortly after its entry into the proximal part of the optic nerve the central artery of the retina gives off a recurrent branch. In its intraneural course it supplies branches to the choroid at the level of the lamina cribrosa. These branches enter numerous capillary plexuses, through which they eventually anastomose with branches of the anterior ciliary artery in the region of the ciliary process. The central artery then continues to the optic disc, where it divides

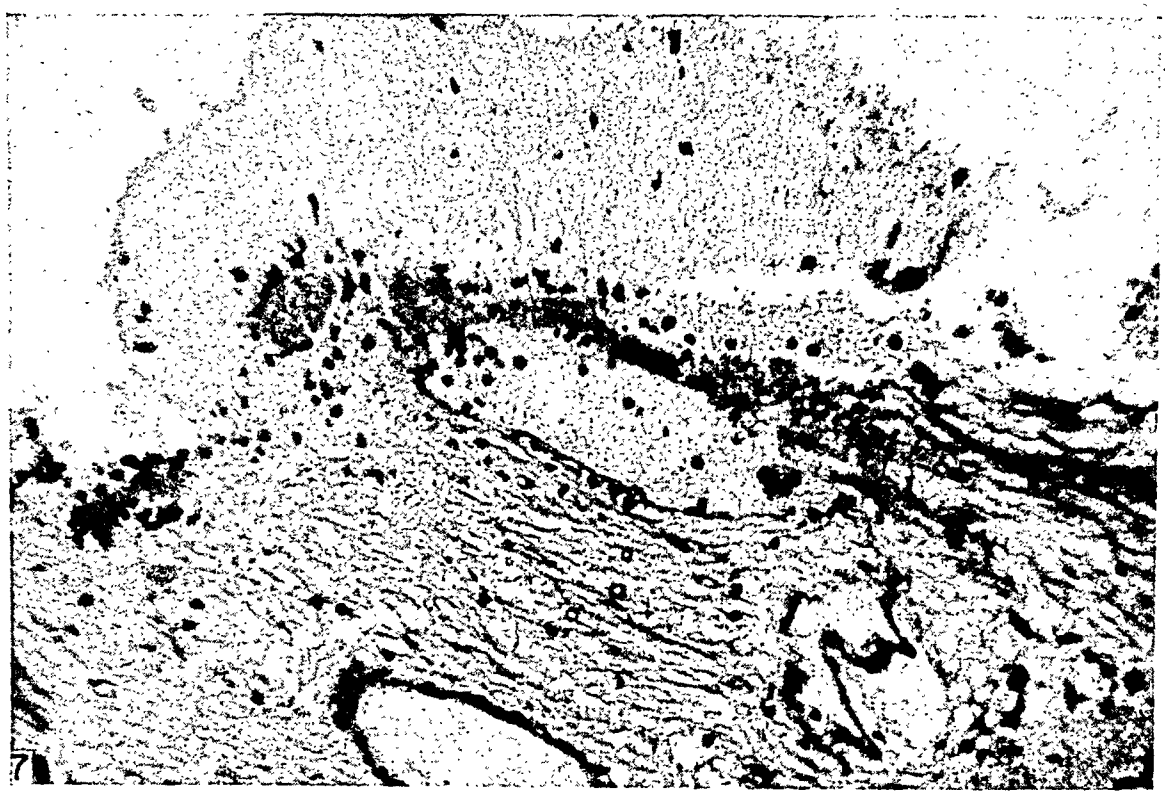


Fig. 7 (Miller and Cuttino). High-power view of the ruptured preretinal vein, as shown in bracketed zone of Figure 6. Half of this vessel wall shows necrosis and is the origin of the hemorrhage. Hematoxylin and eosin (×250).

into two branches, directed upward and downward, respectively. Each of these two primary branches divides into nasal and temporal secondary branches. Divisions of the latter follow a dichotomous pattern.[26] The vascular network into which the central artery ultimately breaks up in the retina has no connection with any other artery in the eyeball.[5, 26] Thus, it is generally agreed that the terminal branches of the central artery are end-arteries, analogous to the subpial arteries of the brain. These terminal branches lie against the inner layers of the retina; namely, the plexiform and ganglion-cell layers, from which position they extend outward to the inner nuclear layer.[27] The outer layers of the retina are nourished by the transudation of fluid from the choroid vessels.[5, 26]

The venous drainage of the retina parallels the arterial supply; there are no anastomotic connections of the veins in the retina with either those of the choroid and sclera or those of the ciliary body. These retinal veins all drain into the central vein at the optic disc. The latter, as it passes through the lamina cribrosa, has a limited anastomosis with the choroidal veins;[5, 26] except for this anastomosis, the central vein is considered an end-vein. The central artery and vein lie parallel and adjacent to each other in the center of the optic nerve for a distance of 5 to 20 mm. behind the eyeball.[8, 9] At this point the vein usually takes a position at right angles to the artery and reaches the periphery of the nerve nearer the eyeball than the point of entry of the artery into the nerve. Most commonly it runs for a variable distance in the subarachnoid space before transversing the intervaginal space and piercing the dura. The central artery, on the other hand, leaves the dura, crosses the intervaginal and subarachnoid spaces immediately and enters the nerve. Upon reaching the center of the nerve, it turns anteriorly, forming a 90° angle, and

takes its position adjacent to the vein. The central vein, thus, usually has a longer course in the subarachnoid space of the nerve than has the artery. The vein then proceeds proximally into the orbit to drain most commonly into the cavernous sinus.[5, 10] However, on at least one side anastomosis with the ophthalmic veins is present, thus making it possible for blood to drain either into the angular and facial veins or downward through the inferior orbital fissure into the pterygoid plexus.

The theories advanced to explain preretinal hemorrhages, like those utilized in the pathogenesis of papilledema, depend heavily upon the demonstration of the free communication between the subarachnoid and subdural spaces of the cranial cavity and the corresponding intervaginal or perineural spaces of the optic nerve through the optic foramen.[11] This anatomic relationship has been proved to exist by injection experiments in which various dyes were used[16, 28] and by study of the distribution of blood following spontaneous subarachnoid hemorrhage due to ruptured intracranial aneurysms;[1-3, 13-14, 19, 21,29] the extravasated blood has been traced from the cerebral subarachnoid space as far forward as the lamina cribrosa.

The earliest description of intraocular hemorrhage associated with spontaneous subarachnoid hemorrhage was contributed by Litten in 1881.[12] Symonds[1, 2] quoted a case, reported by Hale-White in 1895, in which the intracranial subarachnoid hemorrhage, extending into the intervaginal space of the optic nerve, had torn its way forward under the retina in both eyes. Symonds himself felt that there was sufficient pressure in the optic-nerve sheaths to force the passage of blood through the lamina cribrosa (fig. 1). Doubler and Marlow[13] described a similar case. Paton[14] thought that in a small percentage of cases retinal hemorrhages were due to direct leakage of blood from the optic nerve sheath through the lymphatic space at the site of the lamina cribrosa and along the central vessels into the optic disc and retinal tissues. He based his opinion on his failure to demonstrate dilated retinal vessels on ophthalmoscopic examination. In none of the more recent reports has continuity of the intervaginal hemorrhage with either the substance of the optic nerve or the retina been demonstrated.

Among the theoretical explanations proposed for papilledema, those based upon venous obstruction are of chief interest in conjunction with the pathogenesis of preretinal hemorrhages. Before the demonstration of the collateral circulation of the central vein in the orbit with the facial veins and the pterygoid plexus, it was thought that stasis of the ophthalmic vein resulting from obstruction of the cavernous sinus by thrombosis or compression from without was the cause of papilledema.[6, 11] Swift, however, has reconsidered this possibility recently in his discussion of anomalous and poorly developed anastomoses of the transverse sinus[15] and doubts this explanation.

According to Greear,[3] Uhthoff, in 1901, was the first to question the observation of direct hemorrhage from the intervaginal space of the optic nerve into the retina. Cushing and Bordley[16] were able to produce papilledema, as well as swelling of the intervaginal space, experimentally in dogs either by introducing fluid under tension into the intracranial subdural space or by simple digital compression exerted against dura exposed by a trephine opening. Their production of venous congestion by constriction of neck veins in the absence of fluid under tension in the perineural space failed to result in papilledema. Wolff and Davies[17] could not substantiate these results and pointed out that in dogs the central vessels do not cross the intervaginal space.

Paton and Holmes[7] in their study of the pathogenesis of papilledema concluded that it resulted from increased intravenous pressure which developed following compression of the intervaginal portion of the central vein. This compression was due to trans-

mitted increased intracranial pressure. In association with the increased pressure within the sheath of the optic nerve there was obstruction of the lymph drainage from the optic disc. Fry's[8, 9] studies on the anatomy of the central vessels supported their interpretation, as did the observation of Wallfoors (quoted by Lauber[18]), who demonstrated the continuity of the intracranial and intervaginal spaces by ligating the optic nerve proximal to the exit of the central retinal vein and thus preventing the development of papilledema when the intracranial pressure was increased.

Riddoch and Goulden[19] in interpreting their cases of intracranial aneurysm suggested that preretinal hemorrhages, as well as papilledema, could be explained on the basis of compression of the central retinal vein by the hemorrhage in the intervaginal space (fig. 2). The result of this compression was, according to these observers, an increase in the intraocular venous pressure, venous dilatation, and eventual rupture of the preretinal veins. They cited as variable factors the suddenness of rupture of the aneurysm, the distance of the aneurysm from the optic nerve, and the presence or absence of arachnoidal adhesions in the cisterna basalis. These variations tend to alter the degree of intervaginal tension and thus influence the production of preretinal hemorrhage. MacDonald[20] pointed out that the dura about the optic nerve in the orbit is the only portion of dura unsupported by a bony wall and therefore readily distensible. Drews and Minckler[21] affirmed the part played by increased pressure within the intervaginal space and suggested double angulation and axial elongation of the central retinal vein in its intervaginal course resulting from distension of the optic dura as additional factors responsible for the rise in central retinal venous pressure.

As a corollary, Igersheimer[22] has noted the absence of papilledema in a case with coëxistent glaucoma and intracranial neoplasm, the inference being that, in preexisting increased intraocular pressure, papilledema does not develop with increased intracranial pressure. Conversely, marked papilledema and retinal extravasation may develop under conditions of normal intracranial pressure when there is decreased intraocular tension.

Recently Ballantyne[23] has described hemorrhages occurring not only in the intervaginal space, but also in the optic nerve, the dural sheath, Tenon's capsule, the optic chiasm, the pial sheath in the sclera near the porus opticus, and in the orbital fat and muscle. He thought that the sudden rise in intracranial pressure at the moment of rupture of an intracranial aneurysm was followed by excessive venous stasis resulting from compression of the dural sinuses. Rupture of the distended veins in these scattered areas was, he thought, the result of "loci minori resistentiae." Because of the lack of continuity of the hemorrhages, he was not satisfied with the suggestion that the preretinal hemorrhage results from venous pressure due to simple extension of blood from the cerebral subarachnoid space into that of the optic nerve. It is the general consensus at the present time,[6, 11] however, that preretinal hemorrhages associated with extravasation of blood into the intervaginal space of the optic nerve, as well as those associated with papilledema, can be explained on the basis of obstruction of the central retinal vein as it passes through the intervaginal spaces of the nerve.

In our own case, described above, rupture of a congenital medial defect aneurysm of the right internal carotid artery has been demonstrated. Its histologic features are in accord with those described by Forbus.[30] Its location was such that blood could be traced into the subarachnoid space, through the optic foramen, and continuously along the intervaginal space of the optic nerve, terminating abruptly at the lamina cribrosa. In the eye an independent hemorrhage was found associated with a ruptured preretinal vein just beneath the internal

limiting membrane in the retina. Our interpretation of these findings is in general agreement with the consensus of opinion regarding the mechanism of production of preretinal hemorrhages; that is, that the hemorrhage is due to increased venous pressure. We think, however, that the *choroidal anastomosis* of the central vein at the lamina cribrosa, as well as the vein at its point of emergence from the nerve into the intervaginal space, is obstructed. Following rupture of the aneurysm the blood, under a high pressure simulating the systemic arterial pressure, is transmitted directly against the lamina cribrosa. The tissues of the lamina cribrosa are then compressed upon the *anastomosis* of the central retinal vein with the choroidal veins. The resulting sudden obstruction of the vein at its point of emergence from the nerve *and its choroidal anastomosis* is followed by rapid elevation of the preretinal intravenous pressure and rupture of a preretinal vein (fig. 3).

In support of this interpretation it should be recalled that the retina is supplied by end vessels and that their first anastomotic connections are with the choroidal vessels at the lamina cribrosa. Assuming the prevalent theory of obstruction of the central vein at its exit from the nerve to be correct, the result in that case would be a gradual compensatory distention of the choroidal anastomosis, and there would be no rupture of the distended preretinal veins. On the other hand, if the obstruction of the central vein occurred at its point of emergence from the nerve *and also at the choroidal anastomoses,* as suggested in our case, there would be no avenue of return for venous blood from the retina. The result would be an abruptly and markedly increased preretinal intravenous tension and almost immediate rupture of one or more preretinal veins. It might be added that the failure to demonstrate blood histologically in the intervaginal space would not be contrary to this view because pressure could be transmitted through spinal fluid trapped in perineural spaces.

Our interpretation is analogous to a theory postulated by Manz,[24] who thought that swelling of the optic disc results from compression of the lamina cribrosa by an increased cerebrospinal fluid pressure in the intervaginal space. It has further been shown in animals that ligation of the optic nerve distal to the exit of the central vessels from the nerve results in papilledema and swelling of the nerve distal to the point of ligation.[6] These findings were absent when the ligation was made proximal to the exit of the central vessels. They were particularly pronounced, however, when the ligation included only the vein. No mention is made of the simultaneous occurrence of preretinal hemorrhage in the experiments.

Summary

1. An instance of preretinal hemorrhage following massive subarachnoid hemorrhage from the rupture of a medial defect aneurysm of the internal carotid artery has been studied with particular reference to the pathogenesis of the ocular lesion.

2. Prevalent theories relating to the mechanism of production of preretinal hemorrhage accompanying subarachnoid hemorrhage have been reviewed and a modification proposed.

3. It is suggested that preretinal hemorrhages accompanying subarachnoid hemorrhage from ruptured medial defect aneurysms of the superficial cerebral arteries are the result of sudden increase in preretinal intravenous pressure which arises from compression of the choroidal anastomosis of the central vein of the retina at the level of the lamina cribrosa, together with compression of the central vein at its intervaginal portion, by extension of the subarachnoid hemorrhage into the intervaginal space about the optic nerve.

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THE SIGNIFICANCE OF THE BASE PRESSURE IN PRIMARY GLAUCOMA*

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The intraocular pressure varies throughout the day and from day to day in the normal as well as in the glaucomatous eye. Apparent variations may be due to the readings of two different tonometers, to a difference in the manner in which two individuals take the pressure readings, to changing muscle tension around the eyeball, to differences in the position of the tonometer foot plate on the cornea, and to the length of time the instrument rests on the cornea before the reading is made. Real variations may depend on whether or not miotics have been used, frequency of their use, and differences in strength, and the time elapsed since last used prior to the pressure readings. In glaucomatous eyes, variations in pressure no doubt depend on the current emotional state of the patient and the size of the pupil. Most important of all, however, are the real variations contingent on the glaucomatous state.

PEAK AND BASE PRESSURES

In glaucomatous eyes, the height to which the pressure rises is referred to in this paper as the "peak pressure" and the depth to which the pressure descends as the "base pressure." These terms represent merely the upper and lower limits of the excursions of the pressure taken from time to time. Any sustained elevation of the base pressure indicates permanent damage to the filtration angle. The difference between the base pressure and the peak pressure represents the transitory, functional factor in the glaucomatous state. The more advanced the glaucoma the more nearly the base pressure approaches the peak pressure, so that in absolute glaucoma they tend to merge.

The peak and base pressures are in a way comparable to the systolic and diastolic blood pressures. In both instances the lower pressure represents a rest period. A high diastolic pressure means less rest for the heart, and a sustained elevated base pressure means continuous damage to the eye with more rapidly developing field changes. A glaucomatous eye with a normal base pressure may for years show no field changes and no cupping of the disc but these changes may appear and progress rapidly when the base pressure is elevated. A further analogy to the heart can be made: in absolute glaucoma the base pressure tends to approach the peak pressure, and in a decompensated heart, the diastolic pressure approaches the systolic pressure.

STUDY PRESSURE TREND

For the purpose of this study the tension curves kept as a routine procedure in the office have been employed. This means that the intervals between pressure readings varied in length from a day to three or more months. Because of real and apparent variations already mentioned, frequent readings over a short period are not desirable. A long-range perspective, giving the general trend, is necessary. It is not so valuable to know that the pressure is 30 mm. Hg one week and 25 mm. Hg the next week as it is to know whether or not the reading of 25 mm. Hg is a sustained low or mean low, and whether or not it has risen to a mean 25 mm. Hg from a mean 15 mm. Hg. It is of more interest to compare the base pressure now with what it was a few months ago or even one year ago than to compare the current pressure with that of one week

* Read at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947.

ago or even one month ago. Perhaps a more accurate comparison can be made between pressures taken at the same time of day. This is usually done, for patients generally pay visits to the office at about the same time. For our purposes, however, these small diurnal variations as well as the variations consequent to the changing emotional state, physical condition, treatment with miotics, and time elapsed since last medication can be disregarded in the long-range, over-all estimate of the pressure trend.

Classification of primary glaucoma

Fundamentally, I think the classification of primary glaucoma into shallow-angle and deep-angle glaucoma is sound.

A. Shallow-angle type

Shallow-angle or iris-block glaucoma is caused by some transitory dynamic factor back of the iris which pushes the root of the iris forward, blocking the angle. If this functional dynamic factor subsides or abates, the angle opens and the pressure returns to normal. If this blocking occurs often enough and over sufficiently protracted periods, the angle fails to open adequately because peripheral synechias form and the pressure is constantly elevated; that is, the base pressure has risen above normal. The functional episodes continue, so that the peak pressure soars, but in the interludes the pressure never returns to normal. Therefore, the height to which the base pressure rises represents the degree of permanent, irrevocable damage done the angle.

A common belief is that the functional factor is in the ciliary body in the nature of a vascular crisis. This produces edema of the ciliary body and processes which in turn push the iris root forward. There is not much histologic evidence to support this. In eyes approaching the absolute glaucomatous state when the base pressure nears the peak pressure, there may be evidence of increased vitreous pressure. This is frequently demonstrated on the operating table. If such eyes are palpated with an instrument such as a spatula, they will be quite hard even with the anterior chamber open. It seems possible, therefore, that transitory rises in vitreous pressure push the iris-lens diaphragm forward and block the angle.

B. Deep-angle type

The primary glaucoma, characterized by an angle which is of normal depth or deeper than normal, is thought to be due to trabecular obstruction. Not a great deal is known about the exact nature of the obstruction. Microscopic sections indicate that in some instances a cuticular product is laid down by the endothelium lining the interstices of the trabeculae, and in others there is a sclerosis of the trabeculae. The important point here for our discussion is that the changes leading to the glaucoma are commonly believed to be organic with no functional element. Were this true, the intraocular pressure should rise gradually with only small excursions due to variable factors not inherent in the glaucomatous state as previously discussed. Judging from a study of tension curves on this type of glaucoma, one can see that there may be excursions of pressure but never to the point of acute deep-angle glaucoma. This apparent variable functional element in this type of glaucoma is not readily explainable. It is true in general, however, that this type of glaucoma does show a more or less steady rise in the pressure, and that the apparent functional factor indicated by the excursion of pressure is an inconspicuous feature. Therefore, in this type of glaucoma we do not have the same occasion to speak of peak and base pressure as we do in the shallow-angle type. The pressure at any given time tends to represent the permanent organic damage to the angle.

In all glaucomas, primary as well as secondary, peripheral synechias eventually form. There is no exception to this, regardless of the causes of the glaucoma. Granting this, there is no escape from the fact that

prolonged increased intraocular pressure per se promotes the formation of peripheral synechias. Thus a vicious circle is formed by which "x," the unknown quantity initiating the glaucoma, causes an increase in the pressure which in turn promotes peripheral synechias which in turn produce increased pressure. This vicious circle, if continued, eventually causes complete annular peripheral synechia whereby the peak and base pressures merge and absolute glaucoma is reached.

Type of operation indicated

In determining the type of operation indicated, particularly in shallow-angle glaucoma where the functional feature is prominent, how high the pressure goes (peak) is not so important as how low it is capable of going (base). The higher the base pressure, the greater the drainage load the operation must carry. Sometimes it is impossible without several observations to determine the base pressure and therefore the operation indicated. For instance, if the intraocular pressure is found to be 35 mm. Hg even with miotics, it is important to know if this is peak, base, or average. If this is base pressure, then an operation capable of carrying a greater drainage load must be done than if the base pressure were 25 mm. Hg. Patients with glaucoma are too often sent to a consultant with instructions not to use miotic drops for 12 or more hours prior to the visit. If an opinion must be based on one visit, I should prefer to have the patient come with drops used routinely, since this gives a better idea of the base pressure. A pressure of 45 mm. Hg without drops is not as informative as a pressure of 20 mm. Hg with drops.

The difference between an acute glaucoma and an acute exacerbation of a chronic glaucoma is that in the former the base pressure is normal and in the latter it is elevated. This may be a difficult differential diagnosis to make but it is exceedingly important in determining the type of operation indicated.

A general working rule I employ for chronic primary glaucoma is:

A. Shallow-angle glaucoma

1. Low or normal base pressure—iridencleisis operation.
2. Rising base pressure to high normal, or up to approximately 30 mm. Hg—iridencleisis with sclerectomy or Lagrange type of operation.
3. Base pressure over 30 mm. Hg—trephining operation.

B. Deep-angle glaucoma

1. Base pressure of 30 to 35 mm. Hg—iridencleisis or cyclodialysis operation.
2. Base pressure of 35 to 40 mm. Hg—iridencleisis with sclerectomy or cyclodialysis operation.
3. Base pressure of over 40 mm. Hg—trephining operation.

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READING DIFFICULTY (DYSLEXIA) FROM THE OPHTHALMIC POINT OF VIEW*

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Reading difficulty, or dyslexia, is the result of the dysfunction of the various factors that are concerned in learning. Although the most prominent characteristic of dyslexia is an inability to read, the components of the problem are so diverse that any remedial program must be based on a thorough investigation of each individual reading failure. Not until the facts disclosed by the individual investigation are completely correlated and analyzed should any attempt either at diagnosis or prognosis be made.

Too often in the past, research studies in this field have been made to prove some preconceived idea that eventually influenced the research worker to interpret his findings and mold them into prejudiced patterns. The approach in previous investigations has depended largely on the particular field—psychology, education, ophthalmology, and so forth—in which the investigator was interested. An ophthalmic research worker would, for example, select a group of poor readers and attempt to correlate the ocular defects with the reading difficulties.

It is the purpose of this paper to present certain broad aspects of the problem of dyslexia, to outline the influence of certain physical factors involved in reading difficulties, to present some of the psychophysiologic elements, and to discuss the ocular findings in 133 cases of dyslexia under treatment.

BROAD ASPECTS OF DYSLEXIA

Patients with reading difficulty should not be neglected for fear that the difficulty might defy diagnosis and correction. Based on our results, it can be said that in otherwise normal children, dyslexia can be helped almost without exception. Although some patients, because of abnormal mental ability, do not show the expected improvement, most patients make gains that are both rapid and permanent. The most outstanding improvements in our experience have been a two years' gain in reading skill in two months; a five years' gain in 10 months; and a six years' gain in one year.

Since it would be unreasonable to expect a single individual, no matter how expert in his own field, to investigate and analyze reading failure on a sufficiently broad basis, it has been found necessary to coördinate the work among a group of experts. A staff capable of carrying on this work should include a skilled educational psychologist; teachers having special aptitude, interest, and experience in remedial instruction; a psychologist versed in psychometry and proficient in the art of interviewing and advising; a psychiatrist who understands the emotional development of the child as well as child-parent relationships; an internist; an otolaryngologist; an ophthalmologist; a social worker; and a voice teacher. This staff of experts must be willing to work together and to listen to each other's opinions.

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* From the Department of Ophthalmology, Northwestern University Medical School, and the Dyslexia Memorial Institute. Read before the Chicago Ophthalmological Society, March 17, 1947.

The author wishes to acknowledge the untiring work of the following present and former members of the staff of the Dyslexia Memorial Institute: Dr. Daniel P. MacMillan, Dr. James H. Appleman, Prof. Alfred Schmieding, Dr. Albert H. Andrews, Dr. Frederick Hiller, Dr. George Shambaugh, Dr. Frank Wojniak, Dr. Truman O. Anderson, Dr. Clara Burri, Violet Lannert, Marguerite Ullmann, Marjorie Hunter, Dorothy Taraba, and the members of the Dyslexia Guild.

Before a course of treatment is prescribed, the patient's environment, physical status, emotional reactions, learning achievements, and work habits should be completely investigated. After each member of the staff has examined the patient, a conference should be held to report the findings and to establish the remedial program. It is advisable, even necessary, to consult with the patient's parents, siblings, and teachers in order to make recommendations and the reasons for them. Consulting with all persons concerned makes for better understanding. The patient, himself, should be given a clear explanation of the follow-up procedures.

Such a complex program can be facilitated if a central location can be provided to carry out the entire schedule. If a child should need not only medical care, including that of the eyes and ears, but also psychologic, educational, and psychiatric guidance, and voice training as well, the time consumed and the expenses incurred in getting treatments at different locations would make the prognosis less satisfactory.

Physical factors influencing dyslexia

Since vision is so dependent upon sufficient and proper lighting, one must determine what qualities and intensities of light are desirable for different reading situations. Much information is available concerning the optimum requirements for proper physical factors, which are controllable and necessary for comfortable reading.

Patterson and Tinker,[1, 2] and Luckiesch and Moss[3, 4] have investigated and reported extensively much valuable detail and information on the hygiene of reading. It has been estimated that the critical level for reading was between 3 and 4 foot-candles, but, as a margin of safety, reading should not be done with less than 5 foot-candles of light. School rooms should not have less than 10 foot-candles, and sight-saving classes should have 20 to 25 foot-candles. The critical level of light intensity for reading newspapers should be 7 foot-candles, but for a margin of safety, an intensity of 15 to 20 foot-candles is recommended. The critical level was defined as the intensity beyond which no improvement in reading performance occurred as the illumination intensity increased.

Maximum readability occurs when optimal physical conditions are supplied, with the printed material set in 10- to 12-point black type on a 2-point lead, in line lengths of 3 to 3½ inches, on white paper without gloss finish. Under these conditions, the light should not be less than 10 foot-candles. This light intensity should be increased even to 50 foot-candles for prolonged tasks of reading difficult material or for proofreading. Glares should be avoided at all times.

Pyscho-physiologic aspects

As a rule, the more intelligent a person is and the more perceptual experiences he has encountered, the more quickly he learns from abstractions and symbols. Since printed letters and words are abstract symbols, it is necessary to have visual perceptual experiences in order to understand their meanings when arranged in phrases and sentences.

If we accept the customary concept that reading is a simple reaction to visual stimuli, we would have to conclude that the visual process is the dominate factor in dyslexia. However, in order to analyze and interpret reading achievements and failures, it is necessary to consider the central perceptual and conceptual processes as well as the entire peripheral ocular mechanism in all its complexity.

There are many individuals with normal or superior intelligence who, although they are unable to understand printed signs and symbols, are able to learn through oral instruction.

Such a complex achievement as reading involves many variables, and it would be unreasonable to assume that any function can be altered from normal development

without influencing the entire psychophysiologic mechanism. The degree to which normal or abnormal functions influence the process as a whole depends upon the ability of the person to adjust himself to the psychophysiologic needs or contingencies or stimuli that are present at any particular time. The degree of this homeostatic[5] stability and adaptation depends on the relative degree of normality of all the diverse functions that are involved in the reading processes.

According to conservative estimates, about 15 percent of the school population has some degree of dyslexia. This varies considerably with the standard of the school and the opportunities of the home. The social-economic status of the family seems to have no significant influence on the development of dyslexia. In the series of cases presented in this study, the average age of the patient was 12 years and 2 months. Boys having reading difficulties outnumbered girls, 4 to 1. The average intelligence quotient in the patients herein studied was 107.6, with the highest, full-scale I.Q. at 147.

Reading readiness in general is a further consideration. The child's readiness for reading requires broad interests. He must have a certain degree of emotional and social maturity, a normal expectancy in language development, and a sufficient number of perceptual and informational experiences.

Wilson[6] found that letter-perception abilities are more closely related to beginning reading progress than any of the other abilities studied. Since so much depends upon accurate visual perception, it is essential to determine at what age a child's eyes are sufficiently mature for him to learn to read. It is no more reasonable to assume that every child will have fully matured visual development when he enters school at the age of six years than to say that all children are equally developed in other maturational processes. Park and Burri[7] have shown that a larger percentage of children at the prereading age and in the first and second grades have more incompletely matured visual mechanisms than children in the next higher grades.

If this slow development of "eye readiness" should persist, it would become a definite deterrent to reading readiness and eventually, because the criticisms of teachers and parents would arouse anxiety in the child, it might lead to nervousness, irritability, resentments, and behavior problems. Under these circumstances, it is advisable to postpone, or at least to modify the entire reading program until such immature maturational processes have been corrected.

Ocular study of dyslexia

Many reports have been made and many conclusions reached relative to the etiologic importance of ophthalmic findings in reading difficulties, some with finality, others with less certainty.

The following data were catalogued after an analysis was made of the ophthalmic factors in this study of 133 cases of dyslexia. The results and conclusions are presented with the preface that all data should be interpreted as being only a part of the complex problem and that the whole makeup of the child must be considered.

Visual examination

In this series, 75 percent of the patients had normal vision; 20 percent had subnormal vision in both eyes; and 5 percent had subnormal vision in one eye only. At the initial examination an additional 8 percent seemed to have subnormal vision, but these examinees attained normal vision easily at a subsequent examination. Perhaps, their lack of interest and attention in any task concerned with reading was carried over to the examination.

Only 19 percent showed sufficient ametropia to require refraction. There were twice as many hyperopic as myopic cases. Glasses were removed from six of our pa-

tients, five of whom were wearing spectacles because they had been prescribed empirically as an aid in reading. Three of these patients had a high degree of exophoria which was aggravated by the convex lenses. An inaccurate refraction influences reading adversely and is worse than ametropia itself, for the patient then has to compensate for an artificial ametropia.

The incidence of subnormal vision cannot be ignored as a factor in dyslexia but it is relatively rare. No doubt, to attain clear vision, ametropia with its accompanying excessive demand upon the ocular neuromuscular mechanism results in fatigue and would be a very definite factor in some cases. For as Dearborn[8] mentions, the fatigue would thus lessen the incentive to learn, causing avoidance or neglect of reading.

Oculomotor functions

Ninety-three percent of the cases in this series had normal motility during fixations into the various fields of action of the extraocular muscles both monocularly and binocularly.

Since fusion ability was present in practically all cases of dyslexia (97 percent), fusion per se is not a dominating influence. It is the ability to maintain fusion without undue effort and fatigue which determines the proper oculomotor function. Although fusion and stereopsis are acquired oculocerebral processes, 22 percent of our cases showed extremely weak stereopsis or none at all. Of these, only 4 percent were due to tropias. The remaining 18 percent learned stereopsis properly after training. The question naturally arises whether or not weak stereopsis is another manifestation of the dyslexia enigma.

Ocular dominance

The number of investigations dealing with the controversial question of dominance, handedness, eyedness, have been considerably smaller during the last 5 years than the preceding 10 years. Although the results are still somewhat conflicting, the evidence points to the conclusion that handedness is not significantly related to reading ability but that mixed eye-hand dominance is probably present in some cases of reading disability.

In checking for ocular dominance, 80 percent of our cases showed no preference; 8 percent had a tendency to alternate; 2 percent had a tendency to alternate but recovered quickly; 3 percent showed a tendency to suppress one eye; and 7 percent suppressed one eye completely. By using the stereoscope with dissimilar cards that stimulate fusion only slightly, the probability of introducing an extraneous factor in determining the dominance is eliminated. For, as soon as an extraneous act such as pointing and sighting is used, one eye or the other, through expediency, will be chosen as the dominant one, even though both eyes are maintaining fixation and fusion of the image of the object observed. Apparently not more than 13 percent of dyslexia cases show any tendency to fixate alternately or to suppress one image, unless this suppression is due to a strabismus.

Incidence of phorias

Phorias have more significance, for 55 percent of the patients were orthophoric. The remaining 45 percent were heterophoric, and half of them were exophoric for near (reading distance). This condition with its potential of temporary diplopia can be a definite hindrance to the proper functioning of the eyes, causing a predisposition to fatigue and eventual lack of interest in reading or doing other tasks close at hand. The Maddox rod and red light were used to measure phorias. The various types of phorias present and their relative incidences were:

Orthophoria, 55 percent; esophoria for distance and near, 5 percent; esophoria for distance only, 2 percent; esophoria for near, 4 percent; exophoria for distance and near, 4 percent; exophoria for distance only,

2 percent; exophoria for near, 22 percent; esophoria for distance and exophoria for near, 2 percent; hyperphoria, 4 percent; tropia, 4 percent. From 4 degrees esophoria to 4 degrees exophoria was considered as orthophoria; less than 2 degrees was normal for hyperphoria.

Measurement of ductions

During the measurements of ductions, care was taken with each individual to obtain accurate reports as to the point at which the image separated and diplopia appeared and the point of recovery—where the two images fused again. In scoring for ductions, the standards were quite flexible. A variation from the established normal of approximately 10 percent was allowed as "normal." The phorometer was used to make these measurements which are analyzed in Table 1.

TABLE 1

An analysis of ductions

	Diplopia Considered Normal	Recovery from Diplopia Considered Normal	Percentage of Entire Series (133 Cases)		
			Lower Ability	"Normal"	More than Normal Ability
			Percent	Percent	Percent
Distance					
Adduction	18*		17	66	17
Adduction		10*	28	55	17
Abduction	8†		20	74	6
Abduction		5†	25	70	5
Near					
Adduction	24*		15	60	25
Adduction		13*	22	61	17
Abduction	14†		10	63	27
Abduction		6†	15	57	28

* Prism base out.
† Prism base in.

Even with a relatively low prism strength considered as normal in measuring the diplopia and recovery points, it is evident that weak fusion amplitude is definitely associated with dyslexia, especially weak recovery ability from diplopia. With a low duction reserve in the presence of convergence insufficiency or accompanying accommodative or convergence spasm, there is a tendency toward undue fatigue that prevents the eyes from efficiently making the fusional responses and adjustments so necessary in getting and maintaining single and clear binocular vision. If this is not accomplished efficiently, there is a constant tendency for the two images to fail to remain on the fovea and, as a result, there is blurring of the images or even potential temporary diplopia. An unusual amount of nervous energy is required to adjust the foveal positions constantly in order to achieve and keep a single image. This may be evidenced by some general physical and emotional disturbance and can happen even though the vision may be normal or may have been improved to normal by refraction. Thus, in studying the correlation of the eyes to dyslexia the entire peripheral ocular mechanism must be considered.

Orthoptic treatments were recommended in 69 (52 percent) of our cases showing abnormal ductions or marked muscular imbalances. Eleven of these were orthophoric, 5 had tropias (3 of which were of such magnitude it was impossible to measure their ductions), and the remainder were heterophoric.

Observations were made by motion pictures* of the eyes while reading. This included rate of reading, average fixations calculated per 100 words, span of recognition, number of regressions per 100 words, saccadic movements, whether rhythmic or arrhythmic, whether eyes are synchronized, and so forth. The results are indicated in Table 2.

TABLE 2

ANALYSIS OF OCULAR MOVEMENTS IN READING

Grade level used to photograph eye movements	1	2	3	4	5 to 7	High School and College
Reading ability from psychologic report (average)	2.12	2.8	2.8	4.1	5.9	10.3
Rate per minute						
Norms*	55	90	115	168	200	310
Dyslexia	83	66	97	95	161	250
Fixations per 100 words						
Norms*	190	150	137	115	100	70
Dyslexia	164	181	162	181	119	96
Regressions per 100 words						
Norms*	40	32	30	25	17	13
Dyslexia	19	43	29	35	23	12
Span of recognition Norms	.52	.66	.73	.87	1.0	1.4
Span of recognition Dyslexia	.61	.55	.61	.55	.84	1.0

* Taylor, E. A.: Controlled Reading. The University of Chicago Press, 1937.

There were several patients for whom no reading graphs were made for they lacked the ability to read even first-grade material.

The excellent showing made by the group that was photographed while reading first-grade material is attributed to the circumstance that even though their average reading ability was on the 2.12 grade level, they refused to try any reading on that level. In the over-all picture of the peripheral ocular function while reading on the other grade levels, the dyslexia cases are inferior to the "norms."

Exercises were given to 15 percent of our cases to stimulate rhythmic saccadic movements, to increase the span of recognition, to overcome regressions, and to regulate the ocular speed in reading.

It would be erroneous to take the peripheral ocular mechanism habits as the standard and the visual acuity as the determinant of cerebral action or of perceptual processes. It is also inconclusive to take mental processes as the sole factor influencing the modus operandi of peripheral ocular performance. Since the roles are probably interchangeable, it would be difficult to determine which acts as the originator and which as the compensator. All available faculties plus the desire to achieve the universal concept are probably integrated in the processes of learning.

* Four types of eyes—emmetropic, hyperopic, myopic, and aphakic—were also photographed.[9] Conditions under which these patients read were identical, except for their refractive corrections. The results showed that the excursion of the eyes in reading a line was influenced by the power of lenses used in myopia and aphakia. The excursions of emmetropic eyes and hyperopic eyes (with +11D. to +13D. lenses) averaged 6.5 to 7 mm. The excursions of aphakic eyes reading under similar conditions (with +13D. lenses) were increased even to 10.5 or 11 mm. The myopic eyes moved approximately 5 to 5.5 mm. This occurs in individuals who have had no difficulty in reading and helps explain the marked difficulty which some aphakic patients have in adjusting to lenses, especially while reading.

Conclusions and Summary

1. Dyslexia is an entity.

2. The incidence of dyslexia is sufficiently high to require attention.

3. The correction of this condition can be best attained after a complete examination and appraisal of the child and his problem from every viewpoint, including physical, emotional, and pedagogic.

4. A somewhat detailed analysis is made of the ophthalmic findings that were coincidental with other symptoms in a series of 133 cases of dyslexia.

5. Ametropia must be considered as a factor in some cases of dyslexia.

6. Refraction should correct the ametropia but the empirical prescribing of glasses to help a child overcome reading disabilities is not advisable.

7. Abnormal motility is rare in dyslexia cases—probably as rare as in an unselected group.

8. Fusion is present in practically all cases, so fusion per se seems not to be a dominant factor.

9. The incidence of the lack of stereopsis is rather high.

10. Phorias are significant, especially exophoria for reading distance.

11. Weak ductions, slow recovery ability after diplopia, heterophoria, convergence insufficiency or accommodative or convergence spasm are associated with half of our cases.

12. Orthoptic treatments were recommended in 52 percent of our cases.

13. Exercises were given in 15 percent of our series to stimulate rhythmic saccadic movements, to increase span of recognition, to overcome regressions, and to regulate the ocular speed in reading.

14. It is erroneous to take the peripheral ocular mechanisms as determinants of perceptual and conceptual processes.

15. Conversely, it is illogical to take the cerebral processes as determinants of the ocular functions.

16. The roles of originators and compensators are probably interchangeable when an abnormality is present. Otherwise, there is perfect homeostasis between these sensory and motor functions.

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THE SIGNIFICANCE OF THE INTRACUTANEOUS TEST FOR HYPERSENSITIVITY TO UVEAL PIGMENT*

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The intracutaneous test for hypersensitivity to uveal pigment is the direct outgrowth of Elschnig's old anaphylactic theory of sympathetic ophthalmia.[1] The test was first used clinically by one of us (A. C. W.) in 1921.[2] At first it was read on a clinical basis, based on erythema and induration at the end of 30 minutes, 24 hours, and 48 hours. In 1934 Friedenwald studied the histologic changes accompanying a positive test.[3] He showed that two weeks after the injection of the pigment into the skin of a hypersensitive individual, there occurred in the skin a remarkable and typical histologic picture, characterized by phagocytosis of the injected pigment, infiltration of the dermis with lymphocytes, giant cells, and epithelioid cells, the latter usually occurring in nodules. The picture in the skin was startlingly similar to the picture of sympathetic ophthalmia in the eye.

Since the publication of Friedenwald's paper, chief reliance has been placed on the histologic reading of the excised skin. This test has been used extensively in the Wilmer Institute since 1934. It is the purpose of this report to summarize our experiences with this test, to discuss its occurrence in various ocular conditions, and to attempt an evaluation of its significance, its diagnostic and its prognostic import.

TECHNIQUE

A. PREPARATION OF PIGMENT

The uveal pigment is prepared from fresh beef eyes obtained from the slaughter house. Under sterile precautions, the eyes are clipped clean of the surrounding orbital tissue. They are then dipped for a few seconds in boiling water and further cleansed. The corneas are then removed, a sagittal section made in the eye, the vitreous, lens, and retina removed. The uveal tract is then dissected out intact and clipped free at the optic nerve. The uveal tracts of all the eyes thus dissected are ground up in a sterile mortar with glass, sand, and salt solution. The pigment is thus extracted from the uveas and the pigment-containing solution poured off and fresh salt solution added until the supernatant fluid becomes pigment free. The pigment-containing salt solution is then diluted so the end dilution is 5 cc. of solution to each uveal tract. This gives almost a 0.5-percent (wet weight) concentration of pigment, together with the soluble protein extracted from the uveal tract. Tricresol is then added to 0.5 percent. The mixture is then agitated several hours in a shaking machine with glass beads. It is then incubated for 48 hours, and its sterility tested. Thereafter it is decanted under sterile conditions and stored in treatment bottles for use.

B. TECHNIQUE OF TEST

An injection of 0.1 cc. of the pigment solution is made intracutaneously in the forearm. As controls, 0.1 cc. of salt solution, containing 0.5-percent tricresol, and preferably 0.5-percent beef serum, is injected as a control. The test is read at 30 minutes, at 24 hours, and at 48 hours clinically. It is then left for 14 days at the end of which time the pigment-containing skin is excised and prepared for microscopic study.

C. RESULTS

The tests are reported here on the microscopic reading only. They are read as positive, doubtful positive, negative, nonspecific

* From the Wilmer Ophthalmological Institute of The Johns Hopkins University and Hospital.

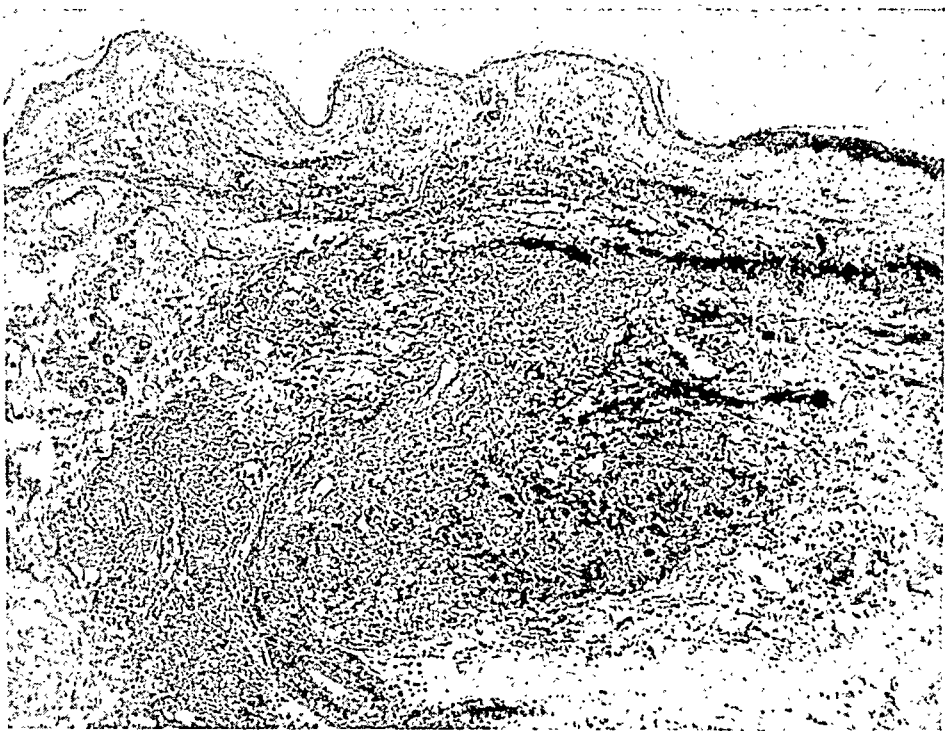


Fig. 1 (McPherson and Woods). Positive reaction.

reaction, or infected. The following are the criteria for the various readings:

Positive Test. All of the pigment is phagocytosed by the epithelioid and giant cells. The area of the section is densely infiltrated with lymphocytes, epithelioids, and giant cells, which are evenly dispersed throughout the section and (fig. 1) in some places form nodules—giant cells circumscribed by epithelioid cells.



Fig. 2 (McPherson and Woods). Doubtful-positive reaction.

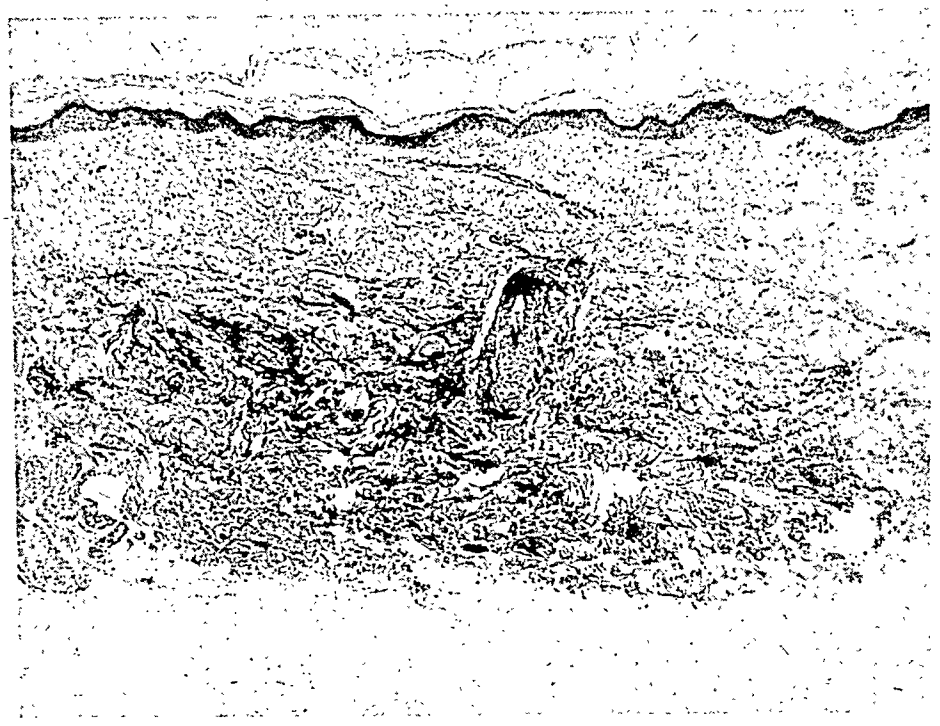


Fig. 3 (McPherson and Woods). Negative reaction.

Doubtful Positive. A portion only of the pigment is phagocytosed by the epithelioid and giant cells, the remainder being inertly distributed throughout the dermis. The cellular reaction of lymphocytes, epithelioid and giant cells is less intense than in the positive reactions, and is spotty in its distribution. There is no typical nodule formation (fig. 2).

Negative Reaction. All the pigment lies inertly distributed in the dermis, usually in large clumps. There is no phagocytosis and



Fig. 4 (McPherson and Woods). Nonspecific reaction.

no cellular reaction other than an occasional lymphocyte (fig. 3).

Nonspecific Reaction. The greater portion of the pigment lies inertly distributed in the dermis. There is a moderate cellular reaction chiefly of lymphocytes and wandering mononuclear cells. There may be an occasional epithelioid cell containing a little phagocytosed pigment, but such cells are extremely scanty (fig. 4).

Infected. The pigment is largely unphagocytosed in the dermis. The entire section is infiltrated with polymorphonuclear leukocytes, which occasionally phagocytose some of the pigment. There is often severe necrosis (fig. 5).



Fig. 5 (McPherson and Woods). Infected.

Material

The material on which this study is based is (1) 30 cases of sympathetic ophthalmia; (2) 139 cases of intraocular operations or injuries involving the uveal tract, in some cases healing uneventfully, in others complicated by a postoperative or posttraumatic uveitis; and (3) 43 cases of endogenous uveal disease from constitutional causes without a history of injury. In many of the patients there were repeated tests available for study. The following are the results in these three groups.

Results

I. Sympathetic ophthalmia

There are 30 individual cases in this group. In 22 of these, the diagnosis was histologically proven by examination of the exciting eye. In eight patients the diagnosis was unproven, the reasons being either that the exciting eye had never been enucleated and there was no reason for enucleation in the stage in which the patient was first seen, or the eye had been enucleated elsewhere and the sections were unobtainable for study. However, in none of these cases did there appear any reasonable doubt of the diagnosis. Therefore, both the 22 histologically proven and the 8 clinically diagnosed cases are grouped together.

The results of the pigment tests in these

TABLE 1

RESULTS OF PIGMENT TESTS IN 30 CASES OF SYMPATHETIC OPHTHALMIA

Individual	Hospital Number	1st	2nd	3rd	4th	5th	6–8	9–12	1 yr. +	2 yrs. +	Remarks
W.A.	204638			neg.	++++ pos.		++++ pos.		neg.		
L.B.	409440				++ doubt.						
R.B.	384219			++ doubt.							never retested
H.B.	327584		++++	++++							
M.B.	124865	++++									
A.B.	217703	++									never retested
M.R.C.	207520	++++	neg.								
M.G.C.	170244	neg.									never retested
A.S.G.	305525			neg.							never retested
M.H.	155979			++++		++++	++++	++++			
S.J.H.	313990				++++						
B.K.	191216							++++	++++	++++	positive 2 yrs. 4 mos. after onset—still active
H.L.	375439								neg.		active 18 mos. after onset, and was negative—no repeat
M.M.	397715	neg.		neg.							never retested after 3rd mo.
S.M.	104603			++++ ++++	++			++++		neg.	inactive at end of 2 yrs.
J.P.	307122		++								never retested
H.P.	372462	neg.		neg.							never retested
P.L.R.	250487						++				inactive after 18 mos.
H.R.	072199	neg. ++++									negative on 14th day —positive on 30th day
E.T.	410364	++++									
H.V.	113134	++									never retested
M.W.	247541	++++									
A.A.	U.75495						++++				
O.B.	249495	++++									
F.D.	259772								++	neg.	
E.J.	107915	++++									
E.S.	24138	(5) ++++									5 positives in 1st mo. —2 yrs. "necrotic"
W.S.	U.75341									++++	1st attack sympathetic 1913—onset 20 yrs.—seen first 2 yrs. after exacerbation—still active
L.S.	100802						++++ ++++		++ neg.		negative after 16 mos.
M.S.	135106			++++ ++++							

25 positives and doubtful positives = (18 positives—7 doubtful) = 83 %.
5 negatives—tested = 4 tested in first 3 mos. and never retested. 1 tested 18 mos. after onset—still active.

30 patients are given in Table 1. Eighteen of these 30 cases, or 60 percent, gave straight positive reaction, while seven, or 23 percent, gave doubtful, or weakly positive reactions. Of these 25 strongly or weakly positive reactions, 10 occurred in the first month of the disease, while four patients tested in the first month were negative. Two patients were examined for the first time in the second month of the disease, both being positive. Four patients were tested for the first time in the fourth month of their disease, and all four tests were positive. The remaining four straight positive reactions were found in patients tested for the first time anywhere from the fourth month to the second year after the onset of the disease. One patient who gave a negative result on the first examination in the third month of the disease became positive in the fourth month. Of the five negative tests, four were done in the first three months of the disease, and the patients were not tested thereafter. The one remaining negative patient was first tested at the end of 18 months after the onset of symptoms.

This evidence would indicate that the tendency, if not the rule, is that the test becomes positive by the fourth month after the onset of symptoms, and in the majority of cases, becomes positive within the first month. If this is true, as it appears to be, the fact that the test was negative in f[illegible] patients must be explained by the ti[illegible]

which the test was done. Thus in four of the five negative patients the tests were done in the first three months. Had they been repeated later, positive results might have been obtained. The fifth case was tested 18 months after the onset of the disease, when the sensitivity may have faded, there being several cases in the positive group which were positive in the early stages of the disease and became negative by the end of the first year.

On the strength of this evidence—that 25, or 83 percent, of the cases gave strongly or weakly positive reactions to pigment while the five negative cases occurred in stages where collateral evidence indicates a negative test might well occur—it seems a reasonable deduction that hypersensitivity to uveal pigment is a fairly regular concomitant of sympathetic ophthalmia.

II. Pigment hypersensitivity in injuries and operations involving the uveal tract

If it is granted that hypersensitivity to uveal pigment is part of the disease picture of sympathetic ophthalmia, the immediate question is whether or not a hypersensitivity to pigment occurring after an operation or trauma to the uveal tract, but without clinical evidence of sympathetic ophthalmia, should be regarded as an indication or harbinger of impending sympathetic disease. This question can be answered only by an over-all study of the results of pigment tests in patients with injuries or operations involving the uveal tract, and a comparison of the results of these pigment tests with the subsequent clinical course of the patients.

There are a total of 139 cases of various penetrating wounds of the eye involving the uveal tract and intraocular operations involving the uveal tract in which, for one reason or another, tests for pigment hypersensitivity were done. None of these patients had or later developed sympathetic ophthalmia. This material falls into two groups.

TABLE 2

Pigment reactions in traumatism of uveal tract, posttraumatic or postoperative complications

Type of Case	No.	Positive ++++	Doubtful Positive ++	Negative	Non-specific	Infected
Penetrating wounds of Uveal Tract—Enucleation of Injured Eye	37	3	3	29	1	1
Recurrent Postoperative Uveitis	37	7	7	18	1	4
Postoperative Infection or Hemorrhage	20	3	2	15	0	0
Totals	94 or 100%	13 or 14%	12 or 13%	62 or 66%	2 or 2%	5 or 5%

Group A. Patients who ultimately lost their eyes as a result of the injury or operation, or who suffered postoperative uveitis, infection, or hemorrhage. There were a total of 94 patients in this group. *Group B.* Patients in whom the course after injury or operation was uneventful and who healed without complication. There were a total of 45 patients in this group.

Group A. The results of the test for pigment hypersensitivity in this group are shown in Table 2. In 13 patients, or 14 percent, the tests were strongly positive. In 12, or 13 percent, the tests were doubtful positive. In 62, or 66 percent, the tests were entirely negative. In seven patients the test was either nonspecific or infected.

Group B. The results of the test for pigment hypersensitivity in this group are shown in Table 3. No positive tests were found. Seven, or 16 percent, showed doubtful positive reactions. The remaining 38, or 84 percent, were entirely negative.

TABLE 3

PIGMENT REACTIONS IN TRAUMATISM OF UVEAL TRACT—UNEVENTFUL RECOVERY

Type of Case	No.	Positive	Doubtful Positive	Negative	Non-specific	Infected
Penetrating Wounds of Eye—Uneventful Recovery	38	0	3	35	0	0
Operations on Uveal Tract—Uneventful Recovery	7	0	4	3	0	0
Totals	45	0	7 or 16%	38 or 84%	0	0

Comparing these two groups it is at once evident that the occurrence of a strongly positive pigment test after an injury or operation involving the uveal tract is a harbinger or a warning of a stormy postoperative course, but it is not an indication that sympathetic ophthalmia will develop.

Doubtfully positive and negative tests are manifestly of no prognostic significance, occurring in much the same proportion in postoperative or posttraumatic cases, regardless of whether there are posttraumatic or postoperative complications or uneventful healing.

III. PIGMENT HYPERSENSITIVITY IN ENDOGENOUS UVEAL DISEASE

There are 42 patients in this category on whom pigment tests were done and the injected skin studied histologically. These cases fall into two distinct groups. In the first group are 37 cases of endogenous uveal disease from various constitutional causes, and in the second group five cases of the amazing Vogt-Koyanagi syndrome—uveitis with dysacousia, poliosis, vitiligo, and alopecia. The results in these two groups are shown in Table 4.

In the 37 patients with ordinary uveitis from constitutional causes, there were no positive tests. Doubtful positive tests occurred in five patients and negative or nonspecific in 32 patients. The notable finding is the complete absence of positive tests. The doubtful cases are difficult to evaluate. They suggest that occasionally some incomplete immunologic reaction involving pigment may occur. It is interesting that the disease was bilateral in four of these five cases with endogenous uveitis and doubtfully positive tests. The possibility of some tissue reaction in bilateral uveitis might be explored.

In the Vogt-Koyanagi syndrome, the test was positive in three of the five patients tested. The etiology of this disease complex is unknown. All that can be said is that clinically and histologically the ocular picture of the disease resembles sympathetic ophthalmia.

DISCUSSION

In the cases which form the basis for this study, clear-cut positive skin tests for pigment hypersensitivity occurred only in three conditions: (1) in sympathetic ophthalmia; (2) in the prolonged uveitis after injuries or

TABLE 4

PIGMENT TESTS IN ENDOGENOUS UVEAL DISEASE

Type of Cases	No.	Positive	Doubtful Positive	Negative	Non-specific	Infected
Uveitis from Constitutional Causes	37	0	5	30	2	0
Vogt-Koyanagi Syndrome (Uveitis—dysacousia, poliosis, vitiligo, alopecia)	5	3	0	2	0	0

operations involving the uveal tract; (3) in the Vogt-Koyanagi syndrome.

The mechanism of these positive tests can be well understood. It has been clearly shown that uveal pigment possesses organ-specific and lacks species-specific immunologic properties, although it has not been shown whether this is an attribute of the matrix of the pigment-containing cells or of the melanin granules. The relative insolubility of the melanin, with some unpublished experimental work in the Wilmer Institute, suggests the first possibility. Thus theoretically, and indeed experimentally, the pigment (using the term in the sense of pigment-containing cells) can act as an antigen in the homologous animal. When pigment hypersensitivity occurs after an ocular injury or disease, the obvious explanation is that uveal pigment is absorbed from the eye, the cells of the body react to the pigment, and a generalized hypersensitivity ensues. In sympathetic ophthalmia and in the Vogt-Koyanagi syndrome further absorption of pigment from the eye results in a local hypersensitive reaction in the eye manifested by phagocytosis of the pigment; epithelioid, giant cell, and lymphocytic cellular infiltration; and nodule formation. Likewise, a similar reaction occurs when the pigment is introduced artificially in the skin.

In the cases with persistent posttraumatic or postoperative uveitis which show positive skin tests, the mechanism of sensitization is the same; but when the process stops, sympathetic ophthalmia does not occur. The eye shows only the picture of nonspecific endophthalmitis. The obvious explanation for this is that after the establishment of the pigment hypersensitivity by the initial absorption of pigment, there is no further absorption from the eye, and hence no local hypersensitive reaction. When the hypersensitive skin is injected with uveal pigment, it reacts in the classic manner.

Does the occurrence of hypersensitivity to uveal pigment in sympathetic ophthalmia throw any light on the riddle of the etiology of the disease? In consideration (a) of the fact that pigment hypersensitivity may develop after ocular injury and without sympathetic ophthalmia and (b) of the identical histologic picture of pigment hypersensitivity in the skin and sympathetic ophthalmia, in 1935 one of us (A. C. W.) advanced the following hypothesis. Pigment hypersensitivity is not the actual cause of sympathetic ophthalmia, but it is a prerequisite for its development. It sets the stage for the occurrence of the disease, and determines the histologic pattern. Some other unknown factor, possibly specific, but quite possibly nonspecific, initiates the disease. In the light of the findings reported in this paper, and the explanation offered for the occurrence of positive skin tests to pigment without sympathetic ophthalmia—namely, that after hypersensitivity to pigment is established there is no further absorption of pigment and hence no local hypersensitive reaction with the characteristic histologic picture—there are three obviously different ways of viewing the possible relation of pigment hypersensitivity to the pathogenesis of sympathetic ophthalmia.

These are (1) that once local ocular hypersensitivity to pigment has developed, the further or continued absorption of pigment produces a local hypersensitive reaction, clinically and histologically manifested as sympathetic ophthalmia. Thus some factor which favored or produced the continual absorption of pigment would be necessary for the outbreak of the disease. Such a factor might be related to the nature of the trauma, to some local condition, or to some specific or nonspecific infection.

The second explanation is that (2) after pigment hypersensitivity is established, some specific unknown infective agent initiates the disease. The further absorption of pigment is secondary and produces a hypersensitive reaction which determines the histologic picture of the disease, but is not

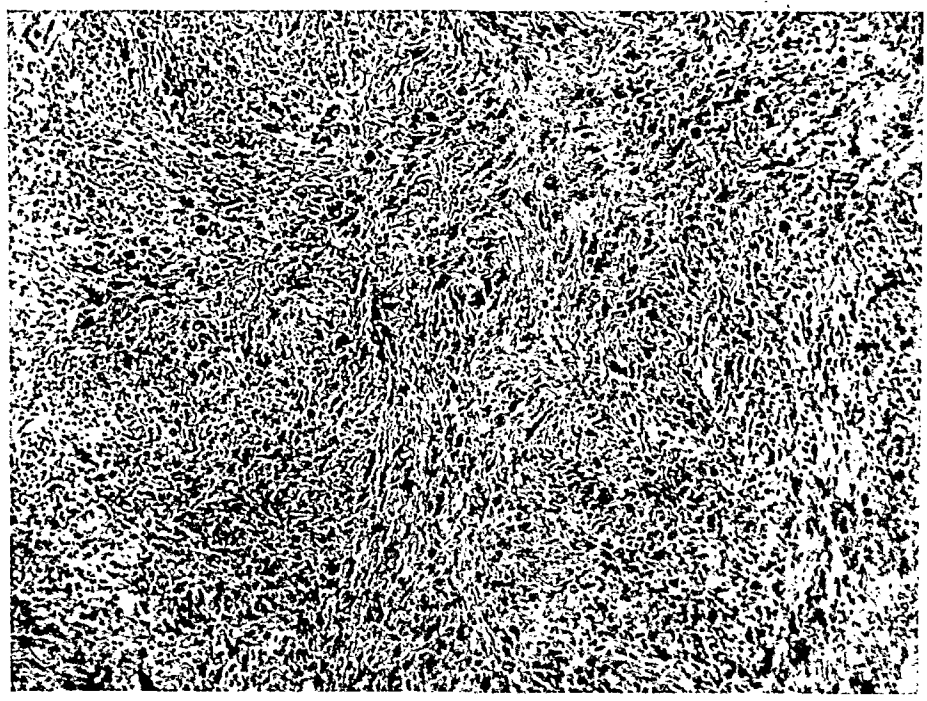


Fig. 6 (McPherson and Woods). Flat section of positive skin test.

per se the actual cause of sympathetic ophthalmia.

The third viewpoint would be (3) that the absorption of pigment after an ocular injury and the subsequent development of pigment hypersensitivity is a chance phenomenon and in no way related to the pathogenesis of sympathetic ophthalmia. However, when one considers the identical histologic picture of a flat section of the positive skin test and a flat section of the choroid in sympathetic ophthalmia (figs. 6 and 7), it does not seem



Fig. 7 (McPherson and Woods). Flat section of the choroid in a case of sympathetic ophthalmia.

probable that the last viewpoint is valid and that the pigment hypersensitivity is without significance. At the least, it would appear that it is the factor responsible for the characteristic and identical histologic picture.

Three of the five patients with Vogt-Koyanagi syndrome gave straight positive reactions and two patients gave negative reactions. It is interesting, although not statistically significant, that the incidence of straight positive reactions (60 percent) in this remarkable disease is almost exactly the same as the incidence of straight positives in sympathetic ophthalmia. The reason for the occurrence of positive reactions to pigment in patients with this disease must obviously be systemic absorption from the melanin-containing cells. That such absorption occurs in the eye is certainly not surprising. The disease is characterized not only by phagocytosis of the pigment of the uveal tract in the eye, but also by vitiligo and poliosis-bleaching and loss of pigment in the skin and in the hair. Here again, as in sympathetic ophthalmia, what precipitates the disease is not known. Both diseases may well be due to the same cause.

The doubtful or weakly positive tests present a problem. They occur with much the same frequency in sympathetic ophthalmia, postoperative and posttraumatic cases with and without a subsequent uveitis, and in uveitis from constitutional causes. When such reactions are encountered in sympathetic ophthalmia, they can easily be regarded as evidence either of a diminishing or developing pigment hypersensitivity, as the case may be. An examination of Table 1 shows that in sympathetic ophthalmia, although skin hypersensitivity may develop within the first month after the onset of ocular symptoms, in some cases it may not develop until the fourth month. Once developed, it may fade and disappear after a year. Thus there must obviously be both a developing and a waning phase, which in sympathetic disease would account for the weak or doubtful reactions. In other conditions in which doubtful positives occur—after injuries or operations with or without a complicating uveitis, and in uveitis from constitutional causes—one must hypothecate some different mechanism, either slight and insufficient absorption of pigment, or some unknown factors affecting either the antigenic activity of the pigment or the reaction capacity of the organism. In any event, the doubtful positive reaction in postoperative and posttraumatic cases and in uveitis from constitutional cause has no diagnostic or prognostic significance, occurring with the same general frequency in all three conditions.

Finally, what clinical significance should be attached to positive, doubtful positive, or negative skin reaction to uveal pigment? From this study, the answer seems fairly clear.

A positive test occurring after an injury or operation involving the uveal tract especially in the presence of a persisting traumatic uveitis should put the ophthalmic surgeon on guard. A positive reaction does not mean that sympathetic ophthalmia is imminent or inevitable. It does mean that it is a possibility. This possibility should be carefully weighed in the decision to enucleate or not to enucleate the injured eye. In general, our feeling is that if all is going well and it is probable that the injured eye will have some useful vision, then a positive pigment test should be disregarded. On the other hand, if the eye appears clinically as a possible sympathogenic eye, or if there is little prospect for the preservation of any useful vision, then enucleation is indicated.

The interpretation of a doubtful positive reaction is more difficult. In outspoken sympathetic ophthalmia, the doubtful or weak positive may be regarded as evidence either of a developing or waning hypersensitivity. In conditions other than frank or suspected sympathetic ophthalmia, the doubtful positive reactions have obviously little diagnostic significance.

Negative or nonspecific reactions give

only slight comfort to the surgeon. A study of Table 1 reveals that in four of the 30 cases of sympathetic ophthalmia tested for skin hypersensitivity in the first three months, the skin test was negative when first done, although in two patients it later became positive. In these patients, the development of hypersensitivity in the skin apparently lagged behind its development in the eye. Thus a negative test after an injury does not preclude the possibility of sympathetic ophthalmia. However, in the presence of a reasonably favorable clinical course, a negative test does make the occurrence of sympathetic ophthalmia very unlikely.

Summing this up, the diagnostic and prognostic significance of the skin sensitivity test is limited. Positive tests are causes for alarm and increased vigilance. Doubtful and negative tests lend slight comfort and indicate in general a better prognosis. However, the margin of error in both positive and negative tests is so great that their interpretation should be made only in the consideration of the clinical course.

Johns Hopkins Hospital (5).

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FUNCTIONAL HOME EXERCISES IN CASES OF EYESTRAIN

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The criterion for giving or not giving orthoptic treatment does not depend upon the presence of a demonstrable heterophoria, but upon the presence of an actual asthenopia. If the patient complains of symptoms after refractive correction, orthoptic treatments are indicated, but if there are no symptoms in spite of the presence of heterophoria, such heterophoria being of the inherent type, then treatments are contraindicated. Inherent exophoria may be due to anatomic causes, and the etiology of this condition indicates that, normally, it does not have a related asthenopia.

A developed exophoria of more recent onset shows, on the other hand, that a breakdown has occurred in the functional ability of the eyes to restrain a latent deviation by means of such reflexes as fusion, convergence, and so forth. It is the persistent effort of the subconscious mind to maintain normal binocular vision in the presence of ocular imbalance which causes the development of symptoms. These symptoms may range from slight discomfort to extreme neurogenic fatigue and the production of psychoneuroses. Treatment is therefore directed toward the attainment of a smoothly working dynamic apparatus, so that the individual can deal both physiologically and psychologically with any visual situation in any presentation and still be within the limits of ocular comfort.

In all cases there must be a full range of convergence, but in exophoria and esophoria the latent deviation must also be dealt with by actually varying the accommodation-convergence relationship for any given distance. In exophoria, besides teaching full convergence over the normal range, we endeavor to train excess convergence for a given amount of associated

accommodation; or, in other words, to teach relative relaxation of accommodation while the convergence is exerted to the utmost.

In the case of esophoria, it is still necessary to teach full convergence, since this is a normal function, together with a lessening of the rigid accommodation-convergence link which exists. In this way the esophoric patient is taught to accommodate without overconverging or while relaxing the associated convergence. A full range of divergence must also be present. In both exophoria and esophoria, the patient acquires a foveal suppression habit, especially in the case of latent divergence. Antisuppression treatment is, therefore, always necessary.

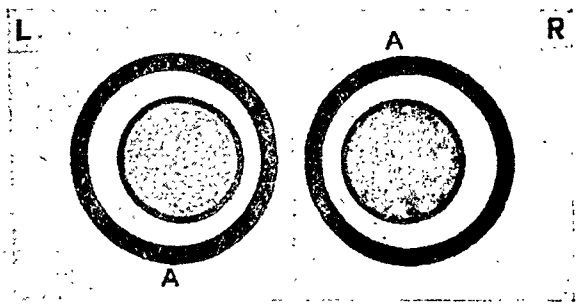


Fig. 1 (Eyles). These figures are printed on separate white cards which are 2 by 3 inches in size. The center circle of the card marked L is colored a medium green; that of the card marked R is a medium red.

It is noted that when the normal ocular functions such as convergence, divergence, good fusion range, and stereoscopic vision are fully restored, there is complete freedom from symptoms even though a heterophoria may still be demonstrated by disassociation tests.

Severe symptoms may be present even when there is orthophoria for distance and near, in which case convergence insufficiency is usually the cause. The convergence reflex was the last to develop phylogenetically, and it is often easily disrupted either under the strain of excessive use or through under use, as in the case of the faulty ocular rigidity (almost a "fixus") which some persons acquire. These persons apparently have a horror of ocular movement, especially disjunctive. The treatment of convergence insufficiency is very satisfying, since symptoms quickly disappear.

Another group of patients, the presbyopic, need some functional adjustment. Their reading addition is conducive to the increase of exophoria and, since accommodation is not normally used, to the lack of convergence incentive.

Orthoptic treatments should prove much more effective than the use of base-in prisms, in correcting these various conditions. Functional anomalies require a dynamic functional cure rather than a physical adjustment which cripples the normal innervational and physiologic processes. Because of this, orthoptic treatments attempt to establish corrective conditioned reflexes, or to reinforce existing conditioned reflexes, on a sound physiologic basis.

Exercises for home use

The following exercises (to be carried out as the doctor recommends) are intended primarily for home use. In them an attempt has been made to formulate a graded series for the elimination of suppression and the development of full convergence, full divergence, controlled convergence-accommodation relationships and stereoscopic appreciation. The patient is given the six cards* (figs. 1 to 3), together with a page of directions. The technical notes which follow the exercises are a useful supplement for the ophthalmologist or orthoptic technician.

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* Dr. Walter B. Lancaster has helpfully suggested that each pair of pictures may be attached to a piece of cardboard and, when the patient has learned to fuse them, the cardboard can be cut in two and the pictures held one in each hand and then separated laterally.

Two minutes only are to be spent on these exercises at a time. Do them twice daily until you can do them all, then once daily for one week, followed by once every other day for a week.

Exercise 1. Hold the first pair (fig. 1) of cards side by side in your hand at about three quarters of an arm's length, or reading distance. Hold a pencil with the other hand, just in front of the cards and in the center of them. Look at the pencil point as you gradually move it toward your eyes. You will notice four blurred sets of circles in the background instead of two. When the pencil is about halfway between the pictures and your eyes, the two middle sets of circles will join up, making three in all. Hold the pencil still, and notice that the middle picture is a tunnel and has "depth"; that is, you are looking into it. There is an "A" above and below the tunnel. Keep looking at this tunnel and you will be able to remove the pencil without losing the picture. Is the middle of the tunnel red or green, or a mixture of both colors? Make a conscious effort to see both red and green.

Exercise 2. Watch the tunnel obtained as in Exercise 1, and bring the cards toward your eyes, almost touching your nose, then back to arm's length. Try to see the tunnel clearly.

Exercise 3. Watch the tunnel at about three quarters of an arm's length, and part the cards sideways, slowly. The tunnel will become smaller and smaller until the pictures break into four.

Exercise 4. Hold the cards close to your eyes, touching your nose, and you will see a blurred tunnel with its center red and green. Withdraw the cards from the eyes, slowly, watching the tunnel which will become clearer. A red and green picture will appear on either side of the joined picture.

Exercise 5. If you find Exercise 4 difficult, do this one. Hold the cards at three quarters of an arm's length or reading distance and look beyond them. You will notice three sets of circles. Watch the middle tunnel, which is the joined picture.

Exercise 6. In both Exercises 4 and 5, the tunnel, which is the middle joined picture, appears to be inverted; that is, the small circle is nearer to you than the

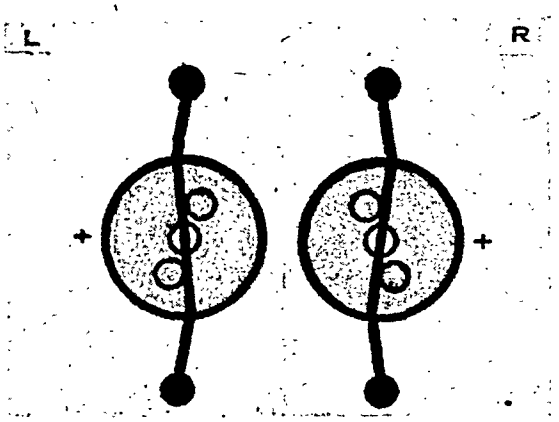


Fig. 2 (Eyles). The card size and figure colors are as described in Figure 1. The three tiny circles are colored as follows: top circle, purple; center circle, white; bottom circle, orange.

larger circle. The center of the circle should be both red and green fused. See it clearly, and bring the cards toward your eyes and back again to arm's length.

Exercise 7. Still watch the tunnel, and part the cards sideways. It is possible to part them about one inch before they break into four.

Exercise 8. Take cards Number 2 (fig. 2). Repeat Exercises 1 to 3. In this case notice that in the middle picture the line from the top ball comes toward you, then turns backward through the circle, and finally returns toward you and the lower ball. There is a small cross on either side of the middle picture.

Exercise 9. Obtain the middle picture as before, and look from the purple ball to the yellow ball and vice versa six times. The yellow ball is nearer to you.

Exercise 10. Do Exercises 4 to 7 with

cards Number 2. The stereopsis is reversed.

Exercise 11. Obtain the middle tunnel as in Exercises 4 and 5. Look from the purple ball to the yellow ball and vice

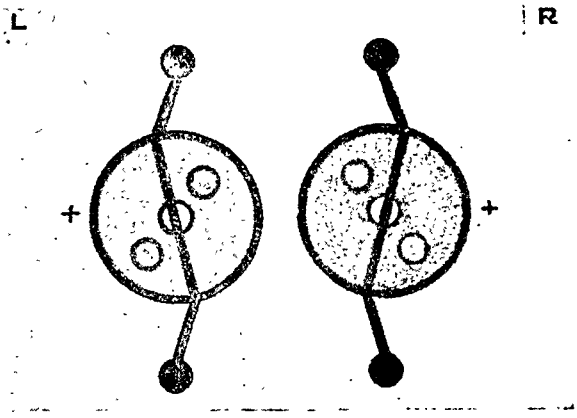


Fig. 3 (Eyles). The size and all colors are as indicated in Figures 1 and 2.

versa. Now the purple ball is nearer.

Exercise 12. Repeat all with cards Number 3 (fig. 3).

Technical notes

Exercise 1. For training convergence and fusion. Antisuppression exercise. If the middle picture appears green, then there is suppression of the left eye, and the right eye is the master eye. If the middle picture appears red, then there is suppression of the right eye, and the left eye is the master eye. If it varies, then there is alternating suppression. When there is suppression of one eye, the patient should concentrate on seeing the suppressed color. This is a good exercise for suppression on convergence.

Exercises 2 and 3. For training convergence, and relaxing accommodation while converging. Especially for treating exophoria and accommodational spasm at near (ciliary spasm), and presbyopia with convergence insufficiency.

Exercises 4, 5, and 6. If the middle picture appears green, there is suppression of the right eye. If the middle picture appears red, there is suppression of the left eye, in divergence.

Exercises 4 to 7. Especially for treating esophoria. Produces accommodation while relaxing convergence. Exercises divergence.

Cards Number 2 and 3. Angles of fusion of the two lines are 5 and 10 degrees. This is a difficult fusion exercise. Looking from the purple to the yellow balls is good convergence exercise while maintaining the static convergent position in Exercise 9 and the divergent position in Exercise 11. In all exercises depth perception is exercised.

Exophoria. Exercises 1, 2, and 3 are necessary to obtain good convergence. Relax the eyes by finishing with Exercise 5.

Esophoria and ciliary spasm. Exercises 1, 2, and 3 to obtain smooth convergence. Concentration upon Exercises 5, 6, and 7 to lessen th esophoria, ceasing Exercises 1, 2, and 3 as soon as possible.

Convergence insufficiency and presbyopic adjustment. Exercises 1, 2, and 3 especially. Relaxing with Exercises 5, 6, and 7 afterward.

Hyperphoria. Fusion of the two cards is obtained by raising one of them a little. Vertical vergences are exercised by gradually lowering the card previously raised, and keeping the tunnel fused.

Conclusion

A fusional reserve well beyond ordinary requirements will be built up by these exercises.

Since the muscle balance often changes quickly after doing them, the ophthalmologist may find it advisable to check the patient's measurements at least once every two weeks.

402 Cobb Building (1).

THE VERGENCE TEST—AN EVALUATION OF THE VARIOUS TECHNIQUES*

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The vergence test constitutes an important phase of a routine refraction. It offers very tangible evidence as to the binocular efficiency.

In spite of the importance of the vergence test in routine refraction, there seems to be a question as to how generally the test is used. There apparently exists, in the minds of many, a question as to the reliability of the test. Moreover, they feel that the information obtained does not justify the expenditure of time. This attitude is seemingly due, in a large degree to the variability in results obtained. Such a reaction is understandable, because we know that a wide variation in readings may exist, not only between the different patients tested, but even in retesting the same patient. Undoubtedly, the test would be used more routinely if the reading would check on repetition; if different patients would respond similarly; and if examiners could depend upon each other's findings. In other words, definite, dependable standards should be established.

UNIFORMITY OF PROCEDURE NEEDED

Granting that various factors enter into the problem, it is evident that one factor which definitely leads to variability in results is the lack of uniformity of procedure. Analysis of available data shows a wide variation in both technique and interpretation of the findings. Such a situation inevitably leads to confusion.

An efficient technique should be evolved which is standardized. In addition, the clinician should have a clear conception as to the interpretation of the results and their relative value in contributing to the analysis of the case being examined. With this standardization of technique, and the resulting greater consistent readings, the clinician would be more willing to spend precious time to do the test.

It is the object of this presentation to attempt to analyze the more common methods of testing vergence in use today, and to attempt to evaluate them. It seems logical that a definite technique could be evolved which would embody all the advantages of the various techniques, and be a step toward securing more constant and dependable results.

The problem may be divided into two phases: first, a consideration of the various steps to be determined in the vergence test; and, second, the technique for determining these steps.

VARIOUS STEPS TO BE DETERMINED

In the first consideration, which has to do with the various steps to be determined, there seems to exist a difference of opinion as to what constitutes a satisfactory procedure. A review of the medical literature shows that very little organized investigation has been carried out on the subject. Judging from the information available, a large percentage of the profession employs the vergence test, but varies its procedure. For example, Pascal[1] and Roper[2] advocate that the blur, break, and recovery points should be determined; whereas, Tait[3] and Burian[4] advocate the determination of only the break and recovery points. As a whole, it appears that most clinicians limit their observation to only the break point.

* Read at the 82nd annual meeting of the American Ophthalmological Society, San Francisco, California, June, 1946. This paper was accompanied by elaborate charts, information concerning which may be obtained from the author.

The majority of the literature available is comprised of the work of physiologists, and this work was instigated chiefly by Sheard[5] and Fry.[6] Their research, which is based upon investigation both in the laboratory and in the clinic, is as a whole in agreement. According to their data, there is evidence to support the fact that an adequate vergence test should include a test for adduction, which embraces the determination of the blur, break, and recovery points for both distance and near. In testing for abduction, the determination of the blur, break, and recovery is made for near, but only the break and recovery for distance. In the case of the supraduction, only the break and recovery are determined. This group of observers maintains that a complete picture of the vergence power is obtainable only when the above routine is followed.

Physiology of the vergence test

Although it is outside the scope of this paper to explain the physiology, and discuss the various interpretations advanced concerning these various steps, it seems advisable to summarize very briefly the consensus held by the majority of the workers in this field. It is thought that the chief contribution of the blur, break, and recovery points give to the analysis of the case is a more detailed picture of the accommodative-convergent relationship. In them, we have a means of analyzing the various phases of this association, bringing to light any abnormal relationships.

Fry[7] states, "In the blur-point test, prism power is gradually increased in an effort to throw the images off corresponding points of the two retinas. The reflex fusional mechanism compensates the effect of the prisms by making the eyes turn as the prism power is increased. As long as the increase in the power of the prism is compensated solely by the operation of the reflex fusional mechanism, the target remains clear. When blurring does occur, it is the limit of fusional convergence, and means that the accommodative mechanism is thrown out of focus by over-accommodation in the base-out test, and under-accommodation in the base-in test. These changes in accommodation assist in maintaining fusion, because every time accommodation increases or decreases, the associated convergence must follow suit.

"Accommodation remains relatively constant from the base-in to the base-out blur point. At the base-out blur point a rapid increase in accommodation occurs, and at the base-in point a rapid decrease. These changes in accommodation continue at the same rate all the way from the blur point to the break point. Positive fusional convergence is used to bring the eyes from the phoria position to the base-out to blur position and from this point on an increase in convergence is associated with it. Negative fusional convergence is required to bring the eyes from the phoria position to the base-in to blur position, and from this point on accommodation must be decreased in order to obtain further divergence of the eyes."

The break point represents the maximum convergence or divergence effort which can be made in order to maintain single vision. It represents the extent of the reserves set aside by the brain to hold the function steadily in force. Addition of prism power from blur to diplopia gives an additional measure of the degree to which accommodation and convergence are associated.

The recovery, or the reversion to fusion, involves the sensitivity of retinal elements in the extra-macular region. It estimates the efficiency and rapidity with which binocular fixation adjustments are made, and it probably has no bearing on the efficiency with which single binocular vision is maintained after being once established for a given fixation. It gives a measure of the "desire" for binocularity.

If the patient takes the attitude of doing all he can to recover fusion, the recovery finding will be much higher than if he had taken a passive attitude and waited for the two images to fuse of their own accord. When such an effort is made to fuse the images, presumably what happens is that a voluntary movement of convergence occurs first, and then as soon as the diplopia is reduced to the point at which the reflex fusional mechanism can operate, this mechanism helps to complete the recovery of fusion.

Fry[8] states, "The movement to recovery fusion is often referred to as a reflex. The application of like stimuli to non-corresponding points of the two retinas is supposed to constitute the adequate stimulus for evoking the reflex. The nearer the two stimuli come to falling on corresponding points, the more effective they are in evoking the reflex, and if the image on one retina falls too far away from the point corresponding to the image on the opposite retina, no response can be obtained. Undoubtedly, the operation of such a reflex mechanism must play a dominant role in the reversion to fusion, but it is necessary to reckon with a certain amount of voluntary control over convergence."

Interpretation of abnormal findings

This very briefly indicates some of the opinions held concerning the physiology of the vergence tests. To elucidate on the interpretation of the various abnormal findings would exceed the scope of this paper. It is noteworthy that experimental data reported attribute practical significance to the various abnormal relationships.

The absence of a normal accommodative-convergence relationship indicated by a high, low, or absence of the blur point, is of diagnostic significance. Likewise, a high or low break point and a high or low recovery point is of value in estimating the binocular efficiency.

Fully cognizant of the many valuable contributions to the subject, it is obvious that the final status of the blur, break, and recovery points has not been fully established. As long as there exists a disparity of opinion concerning their value, the subject is still unsettled and calls for more study.

Fry,[9] who is one of the outstanding contributors, states, "I am very humble about this problem, and if I heeded my scientific inclinations, I would not try to formulate an opinion. But from the point of view of teaching students, it is necessary to formulate some statement of the problem, and the formulation that I have presented is really one which we are accepting tentatively as a basis of clinical procedure until it can be replaced by a more satisfactory formulation of a problem."

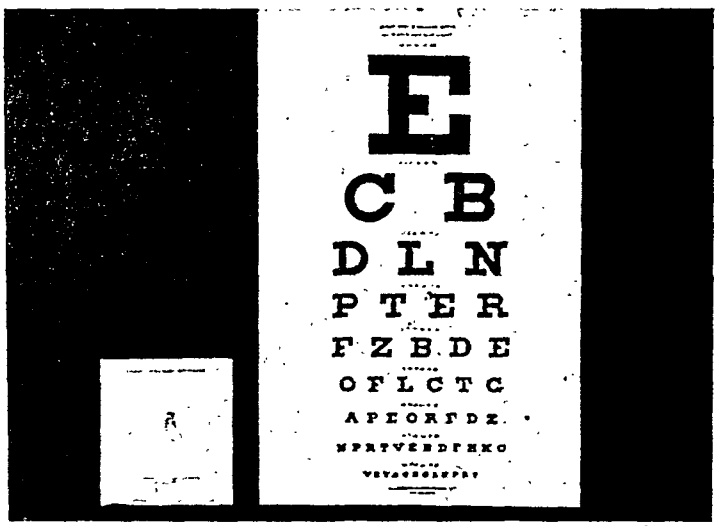
A unified effort should be made to establish a definite evaluation of the various phases of the vergence test. If the results are based upon an adequate scientific background, the status of the test will become fully established, and we will know what is of practical value and what is of scientific interest only. A common understanding will be reached in deciding as to what routine should be followed in order to obtain the maximum practical knowledge in doing the vergence test.

Methods of doing vergence test

The other consideration, namely, the method of doing the vergence test, is an important factor in our problem. The literature shows a wide variation in techniques and instrumentation. For example, the use of the prism is typical. Some advocate a rotary prism, others advocate the prism bar; whereas, others advocate a separation of the target used. The most commonly used target is a spot of light; others use various types of targets, such as a single letter, a line of letters, or a complete chart such as the Snellen chart, all of which are constructed to stimulate

macular fusion with more or less disregard for perimacular and peripheral fusion.

It is evident that such variation in method should produce variable readings, and thus make it impossible for two examiners to compare results. It is logical to believe that the various techniques are not equally accurate. Steps, therefore, should be taken to select the most efficient method and to make it a standard. If a standardized technique were adopted, more uniform results could be expected. This, in turn with a knowledge of the interpretation of the findings, would stimulate the examiner to make the vergence test a part of his routine investigation, and consider it as important as testing for astigmatism.



A B

Fig. 1 (Fink). A is a reduced Snellen chart to be used at near point. B is a standard Snellen chart.

Standardization study undertaken

With this in mind, the following investigation was undertaken. One hundred cases were analyzed and the data obtained were used in conjunction with other available data to formulate a method of procedure. Various techniques and instruments were compared, both for the type of prism used, and also the type of target most suited. It was considered desirable to eliminate all factors in instrumentation which would contribute to variation in readings.

Refractive procedure followed

All cases were refracted under cycloplegia, and only the cases with 20/20 vision in each eye and a small refractive error were selected. In addition, only cases showing a small amount of heterophoria, normal accommodation, and PcB. were used. By being selective, a greater possibility of what may be considered normal vergence range could be obtained.

The procedure was as follows: The full refractive error was worn during the examination. Accommodation for each eye was tested. Near point of convergence was likewise checked. Muscle balance was determined by the prism-displacement method. This was checked for both distance and near. Only cases whose muscle balance were within what may be considered normal limits were employed. Cases showing a hyperphoria greater than one prism diopter were discarded. The cases showing one diopter of hyperphoria had it corrected by prisms.

VERGENCE-TEST PROCEDURE

In doing the vergence, the jump method (prism bar) was compared with the results using the rotary prism. Adduction and abduction were measured both for distance and near.

Only the lateral ductions were included in the investigation, because the additional testing of the vertical ductions would prolong the test, producing more fatigue, and would not appreciably influence the conclusions.

In checking the vergence at 20 feet, the following steps were taken: For adduction—the blur, break, and recovery points were determined. For abduction—the break and recovery points were determined. At 15 inches both for adduction and abduction the blur, break, and recovery points were recorded.

The following targets were compared both for distance and near. A standard spot of light was employed both at 20 feet and at 15 inches. A standard Snellen chart was used for the 20-foot determination, whereas, the reduced Snellen chart was used at 15 inches.

A third target, as devised by the author, was used for comparison. This consisted of a line of letters corresponding to the 20/20 line such as used on the Snellen chart. Behind this line of letters was a large "E" one foot in diameter, which was rotated slowly by a small motor. A similar chart was used for the 15-inch test in which small print was used, with a rotating "E" four inches in diameter placed behind it.

The fourth target compared was one in which stereoscopic vision was employed. Polaroid lenses were placed in the phorometer, and the patient was tested at 20 feet by projecting a picture on a screen. This process was repeated at 15 inches. When the patient was tested at 20 feet, the room was in a darkened condition so that objects in the room would not influence results. It is the opinion of some students of this subject that by using stereoscopic vision we simulate ocular experience encountered in daily life where the whole retina is involved. They maintain that binocular action is dependent not only on the macula, but also on perimacula and peripheral areas of the retina, and a true test of the vergence power should be the result of such a stimulation of the entire retina, rather than merely macular.



A B

Fig. 2 (Fink). A is a rotating target to be used at near. B is a rotating target to be used at distance.

The cases examined had preliminary training so that they had a clear understanding of what was expected of them. The element of fatigue was carefully avoided. Some cases were discarded when the coöperation was questionable.

Discussion

An analysis of the data obtained from the study suggests the following conclusions:

It is important to emphasize that fatigue will alter the findings. The test should therefore be carried out with a minimum number of repetitions. When fatigue is evident, rest should be taken.

Proper rotation of the prisms should be employed. Rotating the prism too rapidly is apt to break the fusion quickly, resulting in abnormal duction findings. Likewise, too slow a rotation places undue strain on the muscles involved, and will also alter the findings.

The full correction should be employed, including the correction of the vertical imbalance of one degree or over.

Rotary prisms seem to be superior to the prism bar or separate prism. The gradual increase in using the rotary prism gives a more constant result than the steplike increase as experienced when using the prism bar. The phorometer is the most satisfactory instrument for this.

The test should be done at both 20 feet and 15 inches. The 15-inch test is the more informative.

To obtain the maximum information, it is necessary to test the blur, break, and recovery points. In distance testing with the base-out prism, the three steps should be noted. With the base-in prisms, only the break and recovery points are noted. In testing at 15 inches, the blur, break, and recovery points are noted for both base-out and base-in tests.

In testing for the blur points, great care must be exercised. Considerable difficulty is encountered frequently in the recognition of the blur point, especially when the blur and break occur almost simultaneously. The patient should concentrate on the smallest print he can see, and indicate the point when the print is completely blurred. By using this technique, a more definite reading can be obtained. The blur point can be simulated by inserting a half-diopter sphere before the eyes, which will cause the letters to blur. This will give him a better conception of what to watch for.

The break point is comparatively easy to determine, and is more consistent if the attention is directed to the entire target when the blur point is reached. The patient is instructed to hold the target single as long as possible. When the break occurs, he will be suddenly aware of two widely separated targets and may or may not have been conscious of the process of separation of the images.

The recovery point is variable if a definite technique is not carried out. The patient is instructed to concentrate on the whole target and to try to unite the separated images, thus having convergence take an active part. This convergence, plus the fusion desire, causes the establishment of single vision.

The target producing the most consistent results was the rotating type. It was superior to the others in that the motion produced a more consistent stimulus to the perimacular area, so that when the break point was reached, the patient was immediately conscious of it. Likewise, the recovery-point reading was more consistent because the stimulus was uniform. It should be emphasized that the recovery-point reading is very uncertain and variable unless the patient is fixing on the entire target, which will stimulate both the macula and perimacula. To fix on small letters at this point materially alters the reading.

Next to the rotating target in efficiency was the Snellen chart. The regulation chart was used for distance and the reduced chart for close. From a practical standpoint, this target can be used, although the results were not so consistent as the rotating target. However, it was superior to the spot of light.

The spot of light was the most inefficient. It produced a wide variation in results because it stimulated only the macula, ignoring the perimacular area; reflexes confused the patient; the bright light fatigued the patient; the blur point was practically impossible to determine; the break and recovery points were frequently missed and varied widely. Repeated trials were frequently necessary which added to ocular fatigue.

The stereoscopic target using polaroid seemed to offer even greater possibilities than the other targets. It has the advantage in that it tests the macular area, the perimacular, and also the peripheral area of the retina. It thus simulates what we actually experience in daily life. It gives us a truer picture of our ocular coördination than the more artificial methods. It is possible that with this method the rotary prism should not be used, but rather the vergence power tested by a separation of the two superimposed pictures making up the target. This method, however, is as yet not feasible, but it is very possible that it will ultimately be the method of choice. This change in technique should produce more consistent results, and will give us a truer picture of the efficiency of the binocular apparatus.

The comparison of the polaroid method with the rotary target was favorable. The readings did not agree in amount but the relationship in readings was in fair agreement. The objective is quickly grasped by the patient, and the blur, break, and recovery points recognized with comparative ease. Of the various targets tested, it seems to offer the greatest promise because it simulates more closely conditions in daily life, and is a better stimulus to our desire for stereoscopic vision.

Summary

To formulate a routine to be followed in testing the vergence, the following procedure is suggested. Based on the study of the above cases, it incorporates techniques which seem to produce more consistent results, are more understandable to the average patient, lessen the time factor, produce less fatigue, and give the maximum information obtainable.

1. The test is briefly explained to the patient.
2. Fatigue is avoided. A short interval of rest is valuable if the patient shows signs of fatigue.
3. The room should be quiet, and the period free of interruption.
4. The room is illuminated in a normal manner.
5. The correction is used, and if the hyperphoria is one diopter or over, it should be corrected.
6. The phorometer with rotary prism is preferable.
7. The prism should be rotated at the proper speed.
8. The rotating target or the Snellen chart is used both for distance and near.
9. Distance base-in test: Attention is directed to the whole chart and not to a specific line. Base-in prisms are rotated before the eyes in the manner indicated above. A recording is made of the amount of prism necessary to create diplopia. The rotation of the prisms is then reversed, having the patient make an effort to unite the images and the point recorded as the return fusion occurs.
10. Distance base-out test: A similar method of procedure is used in making this test as was used in the base-in test, with the exception that we employ a line

of small letters representing the patient's highest distance visual ability. The selection of the smallest type the patient can read is of extreme importance, because even a slightly larger fixation object is apt to give a much higher reading.

The patient's attention is directed to this line of small letters; base-out prisms are introduced in increasing amounts; and the point recorded at which the patient reports he can no longer read the letters. This is the distance blur-out point.

Next, direct the patient's attention away from the small blurred letters to the entire target and instruct him to keep it single as long as possible. The base-out prisms are increased in amount and the point recorded at which diplopia occurs. The patient is asked to try to unite the two targets, and the prisms are then rotated in a reverse direction. A record is made of the amount of prism, allowing for refusion of the target.

11. Near-point base-out test: The technique is similar to that used in testing the distance base-out test. The patient's attention is directed to the reading of the smallest type possible on the near-point target. Base-out prisms are slowly increased in amount before the eyes as the patient attempts to maintain the necessary accommodative adjustments for keeping this fine type legible. The point at which the type becomes illegible, or blurs out, is the blur-out point.

After the blur-out point has been reached, the patient's attention is referred to the entire target, and he is instructed to keep it single as long as possible. The increase of base-out prisms is continued until diplopia results. This is the break point. The prismatic power is next reduced and the patient is instructed to fuse the two images. This point is recorded as the recovery point.

12. Near-point base-in test: The technique for this test is identical with that of the foregoing test, with the exception that base-in prisms are used.

13. Vertical ductions: These are tested for the break and recovery points both for distance and near.

This briefly outlines a feasible routine to be used in testing the vergence. Appreciating the fact that such a procedure is time-consuming, and that such an expenditure of time may not be indicated in every refractive case, it will, when the indication arises, serve as a guide to a complete analysis of the vergence power, and give a more complete picture of the accommodation-convergence relationship. Although the above recommendations are based on a comparatively small group of cases, and therefore cannot be considered except as suggestive, they serve at least to point the way to further investigation. It is important to point out that the inclusion of the blur, break, and recovery points in the above routine is tentative. The data obtained concerning them in the series of cases here presented are suggestive. More data are necessary before a final opinion can be formulated concerning their clinical value.

Conclusions

The vergence test is an important part of our daily routine. It is generally admitted that the various techniques used for this test do not give consistent results. An attempt is made to determine which is the most efficient and the most dependable. Certain changes in techniques seem to increase the efficiency of the test. These changes in techniques, according to the data, produce more dependable readings, produce less fatigue of the patient, are more understandable to the patient, save time for the examiner, and give a more correct interpretation of the findings.

1029 Medical Arts Building (2).

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INTRAOCULAR FOREIGN BODIES IN SOLDIERS*

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Retained foreign bodies were found in 731 of 3,882 eyes of soldiers studied at the Army Institute of Pathology during World War II. Although nearly all of these foreign bodies were introduced during combat and training, a few were the result of preinduction injuries, with recent exacerbations of pain and inflammation leading to enucleation. All globes with penetrating wounds were examined by X ray and were searched for foreign bodies. In many instances the particles were so small or so deeply embedded in organizing hemorrhage or inflammatory membrane that they were not recovered from the gross specimens and only became visible on microscopic examination. These could not be subjected to magnet test, but sections containing them were stained with Prussian blue. Those which gave a positive iron reaction were classified as probably magnetic, although the degree of their magnetic quality could not be determined; whereas, those giving no reaction were regarded as nonmagnetic. The Federal Bureau of Investigation assisted in the more specific identification of many of the foreign bodies by spectroanalysis. In many eyes the particles were multiple (figs. 1 and 2), and in a few, both magnetic and nonmagnetic materials were found. The following table demonstrates a preponderance of retained nonmagnetic foreign bodies in eyes of soldiers who, in all but a few instances, had sustained military injuries.

INTRAOCULAR FOREIGN BODIES

Ferrous	273
Nonmagnetic	452
Both	6

Ferrous foreign bodies (figs. 2 and 3), although outnumbered by nonmagnetic ones, formed the largest relatively homogenous group. Some were more strongly magnetic than others, and it is possible that many which were weakly magnetic on direct contact may have been clinically nonmagnetic.[2] Siderosis, with deposits in the cornea (fig. 4), lens (fig. 5), filtration angle, iris, ciliary



Fig. 1 (Wilder). Multiple ferrous foreign bodies in cornea, ciliary region, lens and vitreous. Scar of entrance of intraocular foreign bodies at the limbus. Enucleation 23 days after injury in action by bomb explosion. A.I.P. Negative 97290.

* From the Army Institute of Pathology.



Fig. 2 (Wilder). Multiple ferrous foreign bodies in an inflammatory cyclitic membrane. Magnet extraction of one steel particle was performed on the day of injury six weeks before enucleation. A.I.P. Negative 99319.

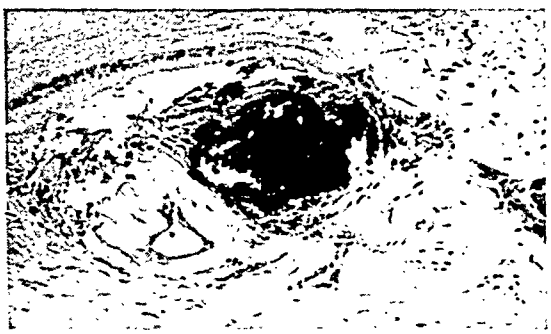


Fig. 3 (Wilder). Ferrous foreign body in lens capsule incarcerated in an inflammatory cyclitic membrane. Enucleation one year following a penetrating wound by a screw driver. A.I.P. Negative 99322.

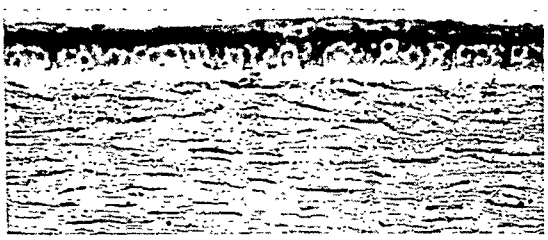


Fig. 4 (Wilder). Siderosis bulbi, cornea. Iron pigment phagocytized by the cells of the interlamellar spaces. Enucleation two years after injury. A.I.P. Negative 100247.



Fig. 5 (Wilder). Siderosis bulbi, lens. Iron pigment in an anterior capsular cataract. Enucleation nine months after injury. A.I.P. Negative 100248.

epithelium (fig. 6), and retina (figs. 7 and 8), occurred in 27 eyes with retained ferrous particles. In one eye, a rather extensive iron reaction was noted only 23 days after injury, but in this case many ferrous particles provided multiple foci of diffusion. In some instances in which ferrous foreign bodies had been retained for much longer periods, early encapsulation by scar tissue (fig. 9) had prevented dissemination of the metal, and only a local iron reaction was obtained with Prussian blue. In hematoxylin and eosin sections basophilic staining, as well as pigmentation, was frequently ob-



Fig. 6 (Wilder). Siderosis bulbi, ciliary epithelium. Iron pigment in the normally nonpigmented inner layer. Enucleation 11 months after injury. A.I.P. Negative 100246.



Fig. 7 (Wilder). Siderosis bulbi, retina near equator. Iron pigment around a retinal vessel. Enucleation two years after injury. A.I.P. Negative 99252.



Fig. 8 (Wilder). Siderosis bulbi, peripheral retina. Iron pigmentation and atrophy. Enucleation two years after injury. A.I.P. Negative 99250.

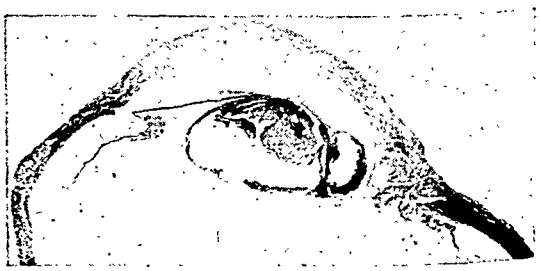


Fig. 9 (Wilder). Scar tissue around the site of a ferrous foreign body in the posterior chamber preventing the dissemination of iron pigment. Enucleation two months after injury. A.I.P. Negative 97284.

served around the sites of the ferrous material (fig. 10), but rarely around other metals and never to so marked a degree.

The nonmagnetic foreign bodies comprised a variety of materials. Among the metal substances, copper, brass, lead, nickel, and zinc alloy were identified; among the nonmetallic, glass, vegetable matter, eyelashes, rock, shale, and clay predominated.

Copper and brass were most numerous among the nonmagnetic metals. Unfortunately chalcosis could not be demonstrated by special staining, and it was, therefore, impossible to study the intraocular distribution of copper.

Many nonmagnetic foreign bodies were readily identified by gross or microscopic examination more specifically than by magnet test. Copper fragments (fig. 11) could be recognized both in microscopic sections and on gross examination by their characteristic color. Lead (fig. 12), in comparatively large pieces, was sectioned in the celloidin blocks with little damage to the microtome knife. Glass, of course, was easily identified on gross examination, and vegetable matter and eyelashes (fig. 13) on microscopic examination. Nonmagnetic foreign bodies were found not only as primary missiles or in association with magnetic material, but also as material retained after extraction of a magnetic missile or as implants along the path of a primary missile which had passed completely through the eye. Eyelashes were the most common of the secondary foreign bodies. In one instance a fragment of chrome-green paint remained in the choroid, although the piece of metal from the bumper of a jeep which it had camouflaged had been extracted by magnet. Intraocular particles of stone, clay, and vegetable matter frequently were retained after land-mine explosions. In severe head injuries, skin (fig. 14) and bone (fig. 15) were sometimes im-



Fig. 10 (Wilder). Iron pigment and basophilic staining around the site of a ferrous foreign body in the vitreous chamber. Enucleation 41 days after injury. A.I.P. Negative 97286.



Fig. 11 (Wilder). Copper wire in early anterior capsular cataract. Lens capsule recoiled outward at site of entrance. Chronic iridocyclitis with posterior synechia. Enucleation six days after injury. A.I.P. Negative 99321.



Fig. 12 (Wilder). Lead in inflammatory tissue in the vitreous chamber. Enucleation five months after injury. A.I.P. Negative 99318.



Fig. 13 (Wilder). Vegetable matter and cilium in inflammatory tissue in the vitreous chamber, following a land mine explosion. Enucleation two months after injury. A.I.P. Negative 97289.



Fig. 14 (Wilder). Epidermal epithelium with keratic debris in a vitreous abscess. A zinc alloy primary missile and hairs were also retained until enucleation four days after injury. A.I.P. Negative 97361.



Fig. 15 (Wilder). Implanted bone incarcerated in a cyclitic membrane following a skull wound. Enucleation nine months after injury. A.I.P. Negative 97356.



Fig. 16 (Wilder). Hyperplastic conjunctival epithelium around a thorn incarcerated in an inflammatory cyclitic membrane. Enucleation four months after injury. A.I.P. Negative 97296.

planted and behaved as inactive foreign bodies, unlike conjunctival epithelium (fig. 16) which finds the interior of the globe a fertile field for growth.

Some of the eyes in this series were removed because of the severity of the initial injury and before secondary pathologic changes had appeared. In these, partial evisceration, disorganization, massive intraocular hemorrhage (fig. 17), and collapse of the globe were the kinds of damage which led to early enucleation. All stages of organ-

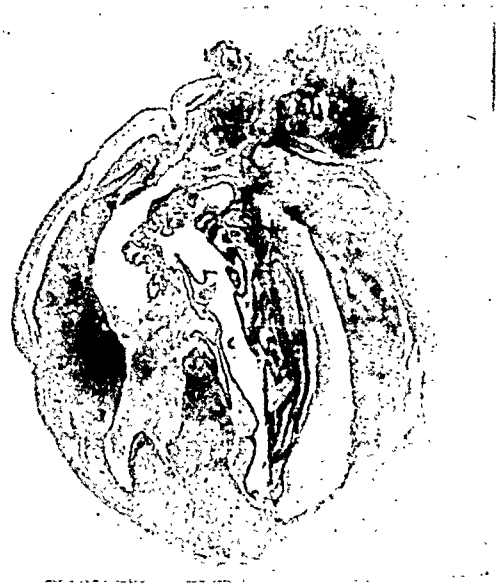


Fig. 17 (Wilder). Expulsive hemorrhage following a penetrating wound at the limbus by a copper fragment retained until enucleation nine days after a booby trap explosion. A.I.P. Negative 84004.

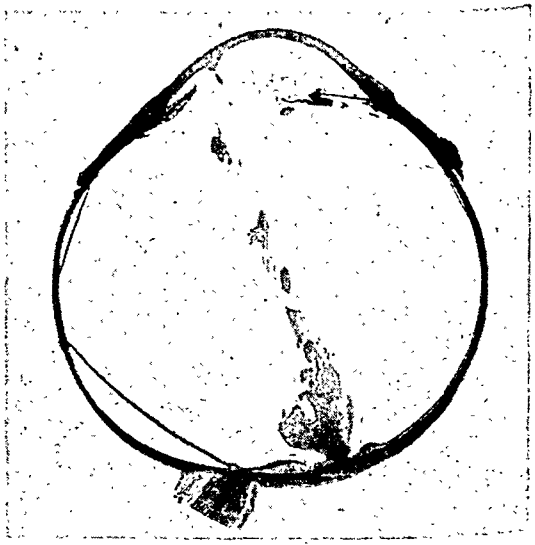


Fig. 18 (Wilder). Beginning organization of hemorrhage in the track of a lead foreign body, extending from the corneal wound of entrance to the chorioretinal wound of lodgement at macula. Enucleation 16 days after injury from gun discharge. Magnet extraction attempted on the day of injury. A.I.P. Negative 83982.

izing hemorrhage were present in eyes removed after longer postoperative periods (figs. 18 and 19).

Abscesses were frequently seen around the sites of foreign bodies of various types, almost invariably around vegetable matter (fig. 20). In the vitreous chamber, the subsequent formation of a pyogenic membrane resulted in retinal detachment (fig. 21) and phthisis bulbi (fig. 22). Glaucoma, a less frequent sequela of intraocular foreign body, was present in association with siderosis bulbi. It also occurred occasionally when the missle lodged in the anterior chamber and the inflammatory process was confined to the anterior segment (fig. 23). Foreign-body granulomas appeared around all kinds of foreign bodies, but the formation

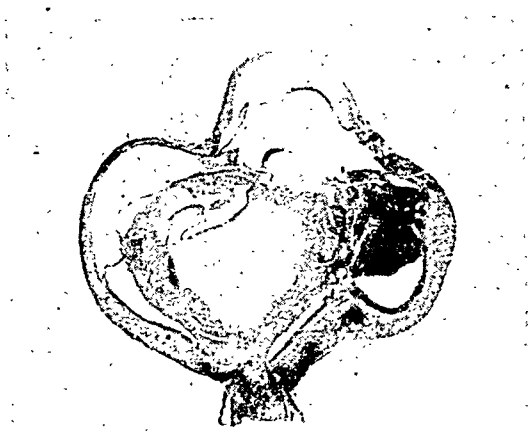


Fig. 19 (Wilder). Organized hemorrhage forming a traction band between the scar of entrance at the limbus and the chorioretinal scar of lodgement of a lead foreign body. Cicatricial distortion of globe. Enucleation six months after injury. A.I.P. Negative 97836.



Fig. 20 (Wilder). Abscess around a vegetable fragment in the angle of the anterior chamber and in its track through the lens. Enucleation 24 days after injury. A.I.P. Negative 97293.

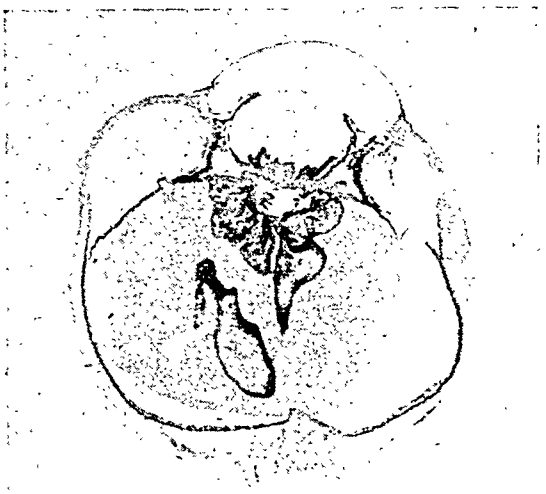


Fig. 21 (Wilder). Vitreous abscess at the site of a brass foreign body. Detachment of retina by a pyogenic cyclitic membrane. Early phthisis bulbi. Enucleation two months after injury. A.I.P. Negative 99314.



Fig. 22 (Wilder). Phthisis bulbi following lodgement of vegetable matter in the vitreous chamber 11 years before enucleation. A.I.P. Negative 99316.

of giant cells seemed to be stimulated particularly by eyelashes (fig. 24) and vegetable matter (fig. 25). In some instances large syncitial cells were arranged around implanted hairs in such a way as to suggest proliferated sheath cells. Phagocytized melanin granules were usually present in them, however, confirming the opinion that they were more probably true histiocytic giant cells. The tendency of vegetable matter to stimulate a giant-cell reaction is evidenced in a case in which cotton fibers and carbon particles were introduced into the vitreous chamber by a dynamite explosion. Endophthalmitis developed and the eye

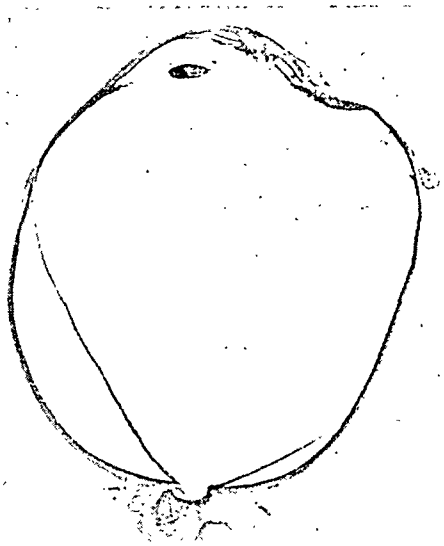


Fig. 23 (Wilder). Chronic glaucoma following lodgement of a vegetable matter in the anterior chamber 14 years before enucleation. A.I.P. Negative 99313.

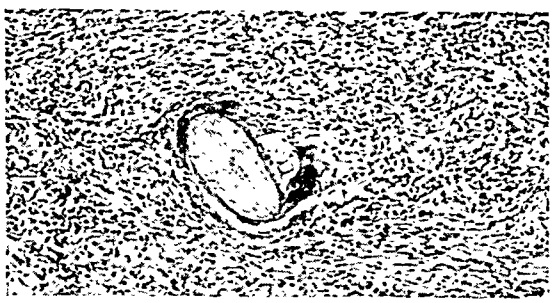


Fig. 24 (Wilder). Giant cell reaction to cilium in an inflammatory cyclitic membrane. Enucleation five weeks after injury. A.I.P. Negative 97363.

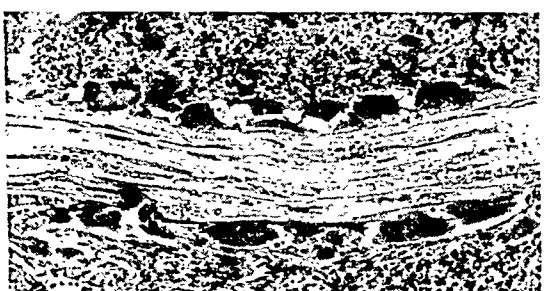


Fig. 25 (Wilder). Giant cell reaction to vegetable matter in an inflammatory cyclitic membrane. Enucleation two months after injury. A.I.P. Negative 97288.

was enucleated six weeks following injury. Incarcerated in an inflammatory cyclitic membrane, the cotton fibers (fig. 26) were all surrounded by giant cells, whereas none appeared around the carbon particles (fig. 27).

Sympathetic uveitis developed in five patients with retained intraocular foreign bodies. In one instance, lead (fig. 28) had been introduced in combat two months before enucleation and in another, wood (figs. 29 and 30) had been introduced in a preinduction injury 36 years before enucleation. In the latter, following the old corneal perforation, the eye retained a small amount

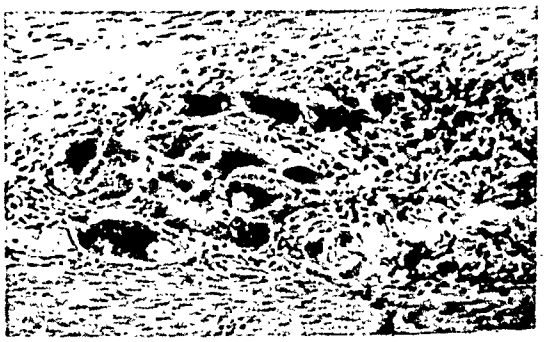


Fig. 26 (Wilder). Giant cell reaction to cotton fibers in an inflammatory cyclitic membrane. Enucleation six weeks after dynamite explosion. A.I.P. Negative 99317.

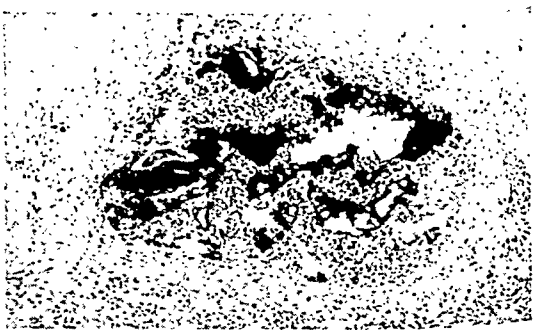


Fig. 27 (Wilder). Same eye as in Fig. 26. No giant cell reaction to carbon particles in the cyclitic membrane. A.I.P. Negative 99320.



Fig. 28 (Wilder). Sympathetic uveitis evidenced by granulomatous inflammation of the uveal tract involving the iris. Lead foreign body in the iris. Posterior synechia. Enucleation two months after injury. A.I.P. Negative 97294.

of vision until three months before enucleation, when it became inflamed and blind. Uveitis appeared in the sympathizing eye one month before enucleation. One eye retained a fragment of glass until enucleation 1½ months after injury. One was removed three months following the introduction of an unidentified nonmagnetic foreign body. In the fifth case the time interval between injury and enucleation was not given, but about one week after injury, severe uveitis was reported to have developed in the sympathizing eye. The foreign body was magnetic.



Fig. 29 (Wilder). Recent sympathetic uveitis in an eye with wood foreign bodies retained 36 years after a penetrating wound through the cornea. A.I.P. Negative 97358.

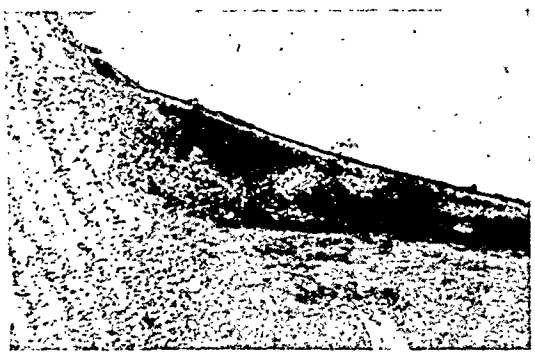


Fig. 30 (Wilder). Same eye as in Fig. 29. Choroid at optic disc. Sympathetic uveitis. A.I.P. Negative 97362.

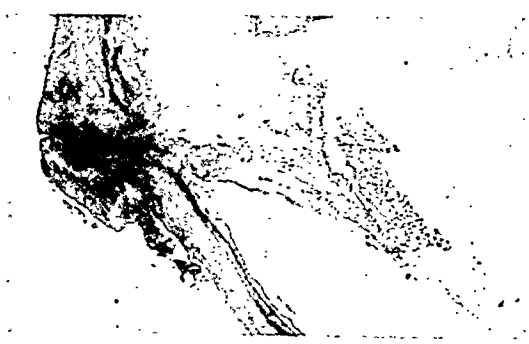


Fig. 31 (Wilder). Colonies of cocci in a vitreous abscess following a penetration of the sclera by a copper fragment which lodged in the vitreous. Enucleation two weeks after the explosion of a dynamite cap. A.I.P. Negative 97291.

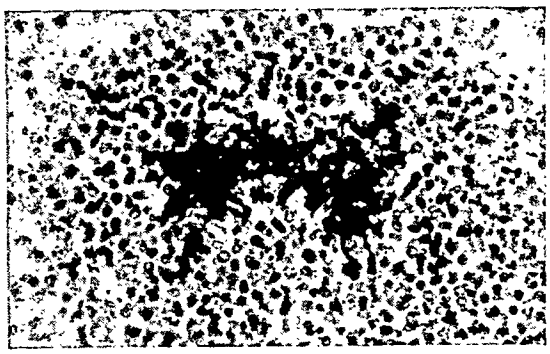


Fig. 32 (Wilder). Colony of unidentified fungi in a vitreous abscess. A minute nonmagnetic foreign body was found in the abscess on gross examination. Enucleation followed penetrating wound sustained in Italy. Duration unknown. A.I.P. Negative 97283.



Fig. 33 (Wilder). Wood fragment prolapsed with retina through corneal wound in purulent panophthalmitis. Enucleation eight days after injury. A.I.P. Negative 97355.

A variety of infections followed introduction of foreign material into the eye. Masses of cocci (fig. 31), bacilli, and unidentified fungi (fig. 32) were sometimes seen in vitreous abscesses. Saprophytic fungi were frequently found in and around wood particles (figs. 33, 34, and 35).

Comment

A wide variety of foreign bodies was found in eyes of soldiers following injuries in training and combat. Of these approximately 37 percent were magnetic, 62 percent



Fig. 34 (Wilder). Same eye as in Fig. 33. Brown yeast-like organisms, probably saprophytic, in vitreous abscess. A.I.P. Negative 99240.



Fig. 35 (Wilder). Same eye as in Figures 33 and 34. Saprophytic fungi associated with wood particle in vitreous abscess. Double contoured cell and mycelium. A.I.P. Negative 99241.

nonmagnetic, and 1 percent mixed. This apparently confirms previous observations[1, 2, 3] that in military injuries nonmagnetic intraocular foreign bodies predominate. They do, undoubtedly, in eyes submitted for pathologic examination, but many instances of successful magnet extraction do not come to the pathologist's attention; and, even in eyes that are enucleated, nonmagnetic foreign bodies are often secondary to ferrous missiles which may have been extracted. The infections and reactions associated with the different types of foreign bodies ran the gamut from staphylococcus infection, resulting in purulent panophthalmitis, to the mild reactive inflammation associated with siderosis bulbi and intraocular hemorrhage without infection. The formation of giant cells was particularly abundant around vegetable matter and eyelashes. Of particular interest were five cases of sympathetic uveitis associated with retained nonmagnetic material in four eyes and with a retained ferrous foreign body in one. Phthisis bulbi was a common end result, and glaucoma was comparatively rare, as in any series of penetrating wounds.

I wish to thank Lawrence P. Ambrogi and Eleanor V. Paul for X-ray studies, careful gross examinations, and magnet tests, as well as for their preparation of sections which always included the foreign body sites.

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THE SURGICAL CORRECTION OF PARESIS OF THE SUPERIOR OBLIQUE*

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It is well recognized that paresis of the superior oblique is, with the exception of paralysis of the external rectus, the most common paresis of any individual ocular muscle. In the past three quarters of a century, cases of underaction of this muscle have been reported with increasing frequency, but until 1934 when Wheeler[1] reported upon his procedure for the advancement of the tendon, the surgical relief of paresis of the superior oblique was confined to procedures upon its yoke or direct antagonist muscles, with occasionally a recession of the superior rectus, or a resection of the inferior rectus of the same eye. Even since Wheeler's report, the vast majority of attempts at correction of the condition have dealt with the yoke or direct antagonist muscles and, only in rare instances, has the tendon of the superior oblique been operated upon. Whether or not this is due to the deeply ingrained belief of most ophthalmologists that it is dangerous to operate upon the superior oblique, I cannot say, but it is in an attempt to dispel this fear that this study and case reports are presented.

HISTORY

The malposition of the eyes which constitutes strabismus has been recognized from the earliest period of medical history, but not even the anatomy of the muscles concerned in ocular movements was understood with approximate accuracy until studied by Fallopius[2] in the 16th century. In the middle of the 18th century John Taylor[3] claimed to straighten cross-eyes by operation. Sir Charles Bell,[4] in 1823, divided the recti and oblique muscles of the eyes of lower animals and concluded that the former had to do with the voluntary and the latter with the involuntary movements of the eye. In 1827 Anthony White[5] suggested that by cutting the ocular muscles one could correct strabismus but the suggestion was not acted upon until Dieffenbach[6] operated.

Meanwhile, the treatment relied upon for squint was the wearing of a mask with openings through which the eyes could see only when properly directed, as suggested by Paulus Aegineta[7] in the 7th century; or the occlusion of the fixing eye proposed by Erasmus Darwin,[8] in 1778. In 1831 Strohmeyer[9] performed a tenotomy on the tendo achillis and followed up his first partial success by operating on muscles and tendons in all parts of the body. In 1838 Strohmeyer did a "myotomy for strabismus" on a cadaver. The era of operation upon the eye muscles may be said to begin with the announcement of Dieffenbach (1839) that he had obtained a perfect result in a case of convergent strabismus by division of the internal rectus muscle.

ANATOMY

The muscle arises by a short tendon just anterior and medial to the optic foramen, from which it is separated by the medial rectus, in the angle between the zonule of Zinn and the periorbital fascia. The belly of the muscle runs forward along the nasal wall of the orbit, close to the internal rectus but separated from the latter by the nasociliary nerve and ophthalmic artery and crossed by their ethmoidal branches. A few mm. behind the

* Presented as a candidate's thesis for membership in the American Ophthalmological Society, June, 1946.

orbital margin at its upper nasal angle the muscle becomes tendinous and passes through a cartilaginous ring, the pulley or trochlea. This is the physiologic origin of the muscle. The tendon then bends backward, laterally and slightly downward, pierces Tenon's capsule and passes beneath the superior rectus to be inserted into the sclera in the superior posterior lateral quadrant of that structure. The tendon is enveloped by a prolongation of Tenon's capsule from its insertion to the pulley, and is, on the average, 20 mm. in length.

Embryologically Whitnall[10] states that the reflected portion of the muscle, that is, the tendon, from the trochlea to the insertion in the sclera, is fleshy in most mammals, and in the lower vertebrates the whole muscle is represented by the reflected portion only, this arising from the medial angle of the orbit near the origin of the inferior oblique.

The line of insertion of the tendon crosses the vertical meridian of the globe obliquely and is curved with a backward directed convexity. In the anterior part the tendon is narrow and almost rounded but near the insertion it spreads out in a fan-shaped insertion.

The distance from the corneal margin to where the tendon crosses the vertical meridian has been measured by Fuchs[11] who found it to be from 16 to 17.9 mm., and by Weiss[12] who found the anterior edge of the obliquely placed line of the tendon to lie 13.85 mm. from the cornea and 14.66 mm. from the optic nerve, while the posterior end was 18.8 mm. from the cornea and 7.56 mm. from the nerve.

Fortin[13] has stated that the insertion of the superior oblique into the sclera lies just above the macular region and attributes many of the cases of retinal detachment in the macular area to the pull of the tendon of the superior and inferior obliques upon the sclera in this region.

The trochlear or fourth nerve crosses over the direct portion of the muscle from the medial side to enter its substance at about 12 mm. from the origin while the blood supply is derived from the superior muscular branch of the ophthalmic artery.

The trochlea or pulley of the superior oblique consists of a finely grooved and curved plate of hyaline cartilage which is attached to the periosteum of the frontal bone by fine strands of fibrous tissue, thus forming a tube through which the tendon slides. The tendon, as it passes through the trochlea, is invested by very lax areolar tissue with a poorly formed endothelial lining but according to Macalister[14] there is hardly a true synovial membrane lining the trochlea. The elongation of Tenon's capsule which envelops the tendon up to the pulley is fixed to and terminates at the latter. Embryologically the pulley was a specialized part of the sheath of the muscle at its origin, which was situated near the orbital margin, but the need for a longer muscle belly in mammals has led to the development of the pulley and the retrogression of the origin backward toward the apex of the orbit.[10]

Maddox[15] has suggested that the reason why the superior oblique has a pulley is that since the speed with which a muscle's point of insertion moves is proportional to its length, it is necessary for the superior oblique, the virtual origin of which as regards its action is from the pulley, to have a long, fleshy, reflected portion extending to the back of the orbit if it is to keep pace with the movements of the recti.

Whitnall[10] suggests that as regards this advantage over the inferior oblique, the reason may be that prolonged looking downward is more important for daily work than looking upward and, therefore, the excursions of the eye due to the superior oblique are more amply provided for than those of the inferior oblique.

Physiology

The principal action of the superior oblique is to turn the eyeball down and

inward. There are two subsidiary actions of the muscle, the first being abduction of the eyeball and the second intorsion of the upper part of the vertical meridian. The main action of the muscle increases when the eye is turned inward and becomes practically nil when the eye is abducted. Thus, it is seen that when the globe is turned medially by the internal rectus and then depression is desired, the superior oblique of that eye exerts the strongest force upon the eye that is possible. When the eyeball is turned outward, the tendon of the superior oblique is situated so that it is almost at right angles to the anterior posterior axis of the globe and consequently its main action, that of depression of the bulb, is reduced to zero. At the same time, however, the secondary actions of the muscle increase when the globe is turned outward, because the tendon of the muscle lies in such a position that its effect on intorsion and abduction is greatest. Conversely, when the globe is adducted, the effect of the superior oblique on abduction and intorsion is markedly decreased.

Another function of the superior oblique, combined with the inferior oblique, has been advanced by various authors among whom are Theobald,[16] Fuchs,[17] Duane,[18] Jackson,[19] and Bielschowsky.[20] This is that the two obliques act in opposition to the four recti when they tend to pull the globe back into the orbit. Samuel Theobald[16] advanced the theory that the principal function of the obliques, assuming that they did resist the action of the four recti in pulling the globe back into the orbit, was to cause the eye to rotate, "with precision, about a fixed center, a provision so essential to accurate vision, and, especially, to perfect binocular vision."

That the physiologic function of the superior oblique has been interfered with is shown in two reports, one by Peter,[21] in 1934, and the other by Sanford Gifford,[22] in 1942, in which transplantation of the tendon of the muscle to the tendon of the internal rectus was performed in cases of paralysis of the third nerve. In each case the eye, in the primary position, was rotated outward, and in each case the external rectus was recessed prior to the transplantation of the superior oblique. Both authors reported that abduction was limited by the total procedure, but failed to mention that the eye could be adducted to any degree beyond the midline as a result of the operative interference. This leads one to the speculation that the cosmetic improvement in these cases was due to the recession of the external rectus and not to the transplantation of the superior oblique.

In support of the theory of the transference of function in the transplantation of the extraocular muscles is the work of Olmstead, Margutti, and Yanagisawa,[23] in 1936, who conducted experiments on the extraocular muscles of dogs, cats, and monkeys in which various muscles were transposed with a view to finding out whether coördinated movements after operation might not be the result of the interaction of the undisturbed muscles, and, if real transference of function does occur, whether there is possible a brief period of readjustment, or learning, which would indicate that the original conducting pathways are predetermined, and new ones must be laid down to meet the changed conditions.

After the series of experiments in which muscles were tenotomized and other operations in which muscles were transplanted, these authors came to the conclusion that the first movements of eyes of animals coming out of anesthesia after operation were in the direction that one would expect if impulses to muscles were coming out over the usual pathways, but gradual adjustment to the new situation took place with the lapse of time.

Leinfelder and Black,[24] in 1942, studied the effect of the superior oblique, along with the other extraocular muscles, in re-

covery of muscular function following tenotomy of the recti muscles. These authors outlined a series of experiments in which the physiologic effects of the superior oblique could be controlled and interpreted while effectual transposition of the muscles was being accomplished in successive operations.

These operations consisted in tenotomizing and resecting the superior oblique in monkeys, either before or after other transposition operations were done. These experiments showed that interference with coördinated rotations did not occur as long as two muscles retained their normal anatomic and physiologic relationships. This is illustrated by the recovery of coördination when only the four recti were transposed; whereas, failure of recovery occurred when the superior oblique was also tenotomized.

The authors conclude that the two intact oblique muscles might be considered capable of giving the proprioceptive impulses necessary for recovery of associated movement; whereas, only one muscle is inadequate. In other words, the superior oblique has no special function in giving the necessary proprioceptive impulses when it is acting alone.

It would seem then that the basic physiology of the superior oblique reverts to the action of depression of the globe as its main function with intorsion and abduction as the secondary functions. It is true that there may be other functions of the muscle, but these are at present purely within the realm of speculation, and it is with the obvious functions of the muscle and the alterations thereof that this paper is concerned. There is here no thought of altering these functions, but merely of the most logical manner of increasing them in cases of paresis of the muscle.

Pathologic physiology

Bielschowsky[25] has stated that, if, in a case of orthophoria, a single muscle becomes paretic, deviation in the primary position is always present, being latent or manifest according to the intensity of the paresis and the function of the paretic muscle. In a case of heterophoria the paretic deviation is modified by the anomalous position of rest. In any case of paresis the position of rest must be altered by the loss of tonus of the paretic muscle and the intact tonus of the other muscles. If this is the only reason for deviation, orthophoria will be restored as soon as the paresis is cured. This cannot happen if the deviation is caused, in addition, by the development of a secondary contracture of the antagonist of the paretic muscle, due to a change in its structure. In any case of typical paresis of a single muscle the angle of deviation increases or decreases according to whether the movement of the eye is in the direction of action of the paretic muscle or of its antagonist.

Diagnosis of muscular palsy can be made if movement of the paretic eye in a certain direction is limited, but it must be remembered that even a paretic muscle can bring the eye to the normal limit by means of an excessive innervation. In many cases of palsy an anomalous position of the head is a characteristic sign, which is often explained as an endeavor to make up for the function of the paralyzed or weakened muscle by turning the head in the direction in which the eye muscle had been acting before it was paralyzed.

Bielschowsky has modified this rule to the effect that the patient chooses the least inconvenient position of the head by which the paretic muscle is sufficiently disburdened so that binocular single vision can be obtained. In cases of trochlear nerve palsy the head is tilted toward the shoulder of the sound side and at the same time rotated on the vertical axis so that the paretic eye is rotated outward.

Trochlear nerve paralysis is the most frequent type of paralysis of a single vertically acting muscle and the most striking

sign of this is habitual torticollis. The ocular origin of this kind of torticollis was first recognized by Cuignet.[26] He, however, could not explain the connection any more than could Landolt[27] in his paper on the subject.

Prior to Landolt, A. Nagel,[28] in 1871, had supposed that in cases of slight paresis of an elevator or depressor muscle, a vertical and rotary deviation would be caused by tilting the patient's head toward one side, a supposition based on the discovery that a parallel rotation of the eyes around the visual axis is produced by tilting the head toward the opposite side.

In a case of right trochlear nerve palsy if the head is tilted toward the right shoulder, there will arise a vestibular excitation of the vertical motor muscles which are able to produce a parallel rotary movement of the eyes to the left, the movement being produced in the left eye by the two inferior muscles and in the right eye by the two superior muscles. The paralyzed right superior oblique cannot compensate the elevating and adducting component of the superior rectus, from which a vertical and lateral deviation of the right visual line must result; whereas, in the normal person both the visual axes would be stationary.

If the head of the patient with the paretic right superior-oblique muscle is tilted toward the left side, both inferior muscles of the right eye and the superior muscles of the left receive the vestibular innervation to rotate the eyes around to the right. This movement can be performed without the coöperation of the paretic muscle. Consequently, no deviation of the visual axis will result. The more the sound muscles are burdened, the more favored will be the paretic muscle. The habitual tilting of the head in trochlear nerve palsy is thus understandable. If the head is tilted toward the shoulder of the sound side, the paretic superior oblique is favored and binocular single vision is obtained.

Bielschowsky[29] believes that in cases of "incurable" paralysis of the superior oblique a contraction of the inferior oblique muscle of the same eye prevents the decrease of the vertical deviation in looking upward as seen in typical cases, and finally the deviation becomes entirely independent of vertical movements.

Etiology

Many cases of superior-oblique paralysis have been reported in opthalmic literature, most of them having been one or two isolated cases. It is well recognized that next to paresis of the external rectus, paresis of the superior oblique is the most frequently occurring weakness of an individual muscle.

Snell,[30] in reporting some cases of traumatic paralysis of the superior oblique, in 1919, stated that approximately 60 percent of the cases of traumatic disturbances of the superior oblique make a satisfactory recovery wthin eight months. He held that the disturbances of this muscle due to indirect injury were most likely to recover, and even those due to direct injury where the muscle or its tendon has not been completely severed, have ceased to cause diplopia or annoying symptoms after a few months.

Sorsby,[31] in 1932, reported a case of paralysis of the superior oblique due to a knife wound, which penetrated the upper inner angle of the orbit. Savin,[32] in 1934, reported the case in which a boxer was struck in the face and immediately had a diplopia which proved to be consistent with paresis of the superior oblique. This persisted for months and was finally relieved to some extent by a recession of the homolateral superior rectus.

Probably the most comprehensive single report on the etiology of paresis of the superior oblique is that of Bielschowsky,[29] in 1939, who holds that there has been an undeniable increase in the percentage of cases of paralysis of the trochlear nerve. He does not feel that this in-

crease can be attributed to an improvement in methods of investigation, since all the cases included in the statistics he reports had been examined solely by him. Up to 1908 all cases of trochlear nerve paralysis amounted to 10 percent of all cases of paralysis of the extraocular muscles, or not quite half as many as the the cases of paralysis of the abducens nerve. From 1908 to 1932, the percentage of cases of superior-oblique paralysis increased to 20 percent and that of abducens-nerve paralysis remained the same as before or about 25 percent. This author believes that the striking increase is due to the introduction of Killian's operation and similar radical operations on the frontal sinus. In support of this belief, the author reports 15 out of 80 cases seen by him between 1923 and 1932 which had definitely been caused by operations on the frontal sinus.

All cases of paralysis of the extraocular muscles will show approximately the same relative etiology. In other words, there is no specific cause which singles out one individual muscle. It is the general consensus that trauma is the most frequent cause of these disturbances in ocular motility. Syphilis is thought to play a prominent part and next in frequency are cases of congenital origin and those due to encephalitis. Two rare cases are mentioned by Bielschowsky of paralysis of the abducens nerve due to severe loss of blood. These recovered spontaneously within a year's time. Pareses of various extraocular muscles have been reported as a complication of diabetes.

In support of the theory of Bielschowsky[29] mentioned above that the striking increase in pareses of the superior oblique is due to the great increase in radical frontal sinus operations, one has but to consider the approach to the frontal sinus in a radical operation, as seen in various illustrations in texts and monographs on exposure of this air space, to wonder why there are not 100-percent pareses of the superior oblique in this operation.[33, 34] It can be granted that the operation is necessary to relieve a condition that is amenable to nothing else but radical surgery, and that the resultant paresis of the superior oblique generally clears up spontaneously, but at that point we arrive at an impasse. We must agree that the radical operation for frontal sinusitis is necessary in some cases and that the best approach so far devised is that most commonly in use by the majority of otolaryngologists. The pulley of the superior oblique can easily be damaged by this approach either by a slip of the chisel, an overbite of the rongeur or simply damaged by the retractor. The ophthalmologist should regard this operation as a necessary evil, and, in those cases in which spontaneous recovery does not occur, he should be prepared to correct as far as possible the distressing diplopia that results from such surgery.

Paresis of the superior oblique

Signs and symptoms

As has been mentioned previously, the most striking sign of paresis of the superior oblique is habitual torticollis with the head most frequently tilted toward the opposite side from that of the paretic muscle. There is, of course, a hypertropia which increases when the eye is carried into the field of action of the superior oblique. Subjectively, there is the vertical diplopia increasing when the paretic eye is carried down and in, and, in some cases, a tilting of the images due to a disturbance in the torsion effect of the superior oblique. In addition to these symptoms many patients will have nausea, and even occasionally vomiting, particularly when an attempt is made to carry the head straight after an habitual torticollis has been established.

Surgical correction

The direct attack upon the superior-oblique muscle, either in paresis or over-

action, has been, for the great majority of ophthalmologists, something to be avoided at all costs. The principal objection seems to have been that the tendon of the muscle is too difficult of access.

Jackson[19] stated that because of its deep insertion, operative interference upon the tendon of the superior oblique near its insertion is not practicable. He advocated transplantation of the superior rectus for paresis of the superior oblique and, by his procedure, the tendon of the superior rectus was recessed and also placed slightly more temporally in order to exert more influence in causing intorsion of the globe. Landolt[35] recommended advancement combined with resection of the inferior rectus in cases of underaction of the superior oblique of the same eye.

Snell[30] held that when operation had been decided upon in paresis of the superior oblique the choice was between a tenotomy of the superior rectus of the same side and a tenotomy of the inferior oblique of the same side.

Banister[36] advocated advancing or tucking the inferior rectus of the affected eye sufficiently to bring the eye on a level with the other eye in the primary position. Savin[32] reported a case of diplopia due to paresis of the superior oblique relieved by recession of the superior rectus of the same eye.

Jaensch,[37] in reporting on a case of binocular trochlear paralysis, advocated recession of the inferior recti as the first step and this was to be followed by myectomy of the inferior oblique, if necessary.

White,[38] in discussing paralysis of the superior oblique, gives the following criteria for operative correction: if the hyperphoria is moderate, a recession or tenotomy of the inferior rectus of the opposite eye gives good results. If there is a secondary contracture of the inferior oblique of the same eye, causing a marked hyperphoria or hypertropia in the upper field, a tenotomy of the homolateral inferior oblique is indicated. If the vertical deviation is marked, White thinks it may be safer to tuck the superior oblique first, this to be followed by a tenotomy of the inferior oblique of the same eye, a recession of the inferior rectus of the opposite eye or both, depending on the subsequent measurements.

Spaeth[42] recommends recession of the contralateral inferior rectus in paresis of the superior oblique, while Dunnington,[43] in 1931, in quoting Duane's table of choice, advocated tenotomy of the inferior oblique of the same eye or recession of the inferior rectus of the opposite eye.

Jackson,[39] Peter,[21] Wiener,[40] Sanford Gifford,[22] and Wegner[41] have all reported cases of transplantation of the tendon of the superior oblique to the insertion of the internal rectus in cases of oculomotor palsy, holding that the tendon of the oblique when transplanted in this condition tends to act as an internal rotator.

As far as can be determined, surgery on the muscle itself in cases of disturbances of motility due to the superior oblique has been described by four authors. Hughes and Bogart,[44] in 1942, described their method for recession of the trochlea in cases of overaction of the superior oblique. Axenfeld[45] reported myotomy of the inferior oblique followed by "extirpation" of the trochlea for cosmetic purposes by exclusion of both obliques. Van der Hoeve[46] stated that tenotomy of the superior oblique was seldom performed, but that according to Czermak and Elschnig one method is to progress from the conjunctiva after detachment of the superior rectus. Wheeler[1] reported his method for advancement of the underacting superior oblique, in 1934.

My interest in the surgical correction of paresis of the superior oblique was stimulated by the report of Wheeler[1] on his advancement procedure for underaction of the muscle. The method which I now use is essentially a modification of Wheeler's procedure and was devised simply because it seemed to offer a little surer

method of achieving the desired result. In the six cases of paresis of the superior oblique which are reported in this paper, seven operations were performed. Wheeler's method was followed in the first three operations. After failure with this procedure, the writer's modification was introduced in the second operation on the third case and followed in the last three cases.

Resection of the tendon

Because of the posterior location of the insertion of the tendon of the superior oblique, general anesthesia is almost indispensable and, in the six cases reported, intravenous sodium pentothal was found to be an ideal anesthetic.

A traction suture is placed through the sclera just above the upper limbus and the eye turned well down by this means. The conjunctiva is incised over the insertion of the superior-rectus tendon. Tenon's capsule is opened and the rectus delivered on a muscle hook (fig. 1).

This muscle is freed of its subconjunctival attachments by means of sharp dissection with scissors and a double-armed 4-0 plain-catgut suture is passed through the tendon close to the insertion. The tendon is then cut between the suture and the globe and the superior rectus is retracted and freed by blunt dissection from the underlying tendon of the superior oblique. An additional traction suture may be placed through the stump of the rectus (fig. 2).

A muscle hook is passed backward over the globe and under the tendon of the superior oblique which it engages. Another double-armed 4-0 plain-catgut suture is passed through the tendon at a variable distance from its insertion, depending upon the amount of correction that is necessary (fig. 3).

The tendon is cut just distal to the suture and the free portion of the tendon then cut free from the globe at its insertion (fig. 4). The two ends of the suture are passed through the stump of the tendon and tied (figs. 5 and 6). The superior rectus is sutured back into position and the conjunctiva closed with plain catgut or fine silk.

The advantages of this modification of Wheeler's operation are two. In the first place, in the original procedure described by Wheeler, the tendon of the superior oblique is tucked without providing for the apposition of raw surfaces and, after one failure with this method, in which the adhesions failed to form at all, the writer came to the conclusion that if two raw surfaces were brought in apposition the chances of a firm union would be much better. Subsequent operations have proved this to be true. In the second place, the work of Fortin[13, 47] and Genet[48] and others has shown that the two oblique muscles of the eye have their insertions in the sclera close to, or in, the macular region. In view of this, it would seem that the insertion of sutures through the sclera in this region would definitely tend to produce more trauma to the macular region than the introduction of sutures merely through the stump of the original insertion into the sclera.

A word should be interjected at this point as to the ease or difficulty in operating upon the tendon of the superior oblique. The principal objection to surgery upon the tendon itself has been voiced by von Graefe[49] and Jackson,[19] both of whom stated, in effect, that the tendon was too difficult of access to permit surgery upon it. Wheeler,[1] himself, in describing his operation states, "It cannot be said that the operation is convenient or easy, but technically it is entirely possible and reasonable."

With the above premises the writer must disagree. The approach to the tendon of the superior oblique is certainly not too difficult for any competent ophthalmic surgeon and once the tendon is exposed, the remainder of the procedure is not complicated nor technically difficult.

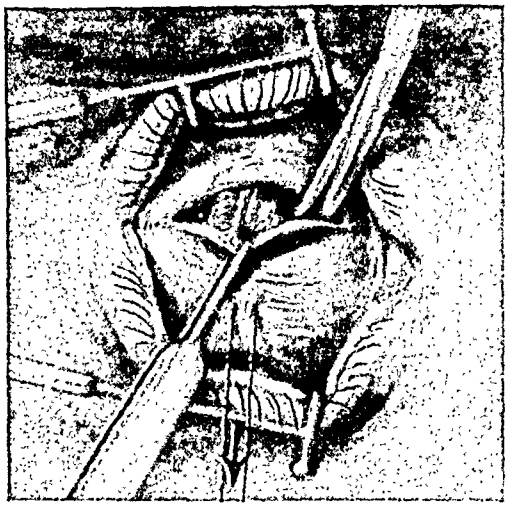


Fig. 1 (McGuire). Exposure of superior rectus.



Fig. 2 (McGuire). Exposure of tendon of superior oblique.

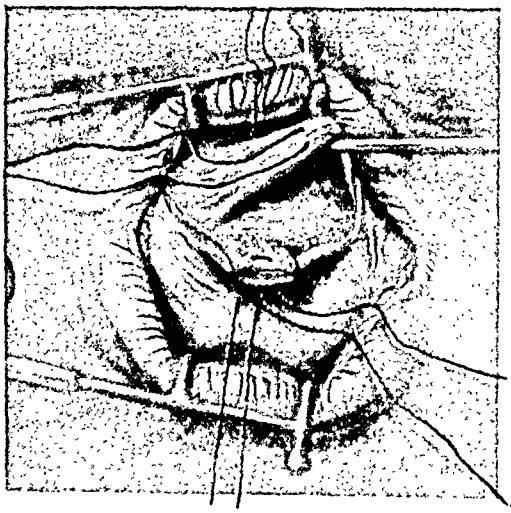


Fig. 3 (McGuire). Suture through tendon of superior oblique.

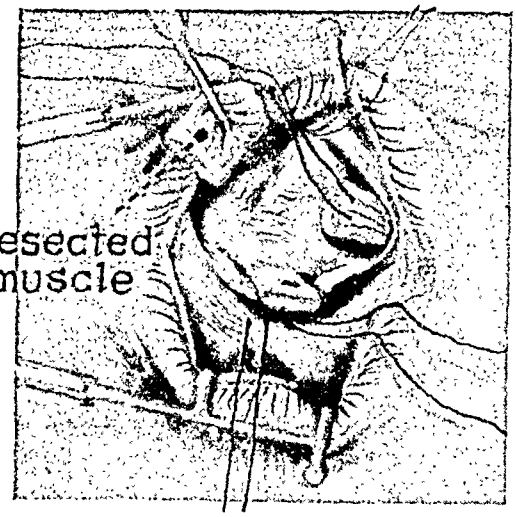


Fig. 4 (McGuire). Tendon of superior oblique cut and distal portion excised at insertion.

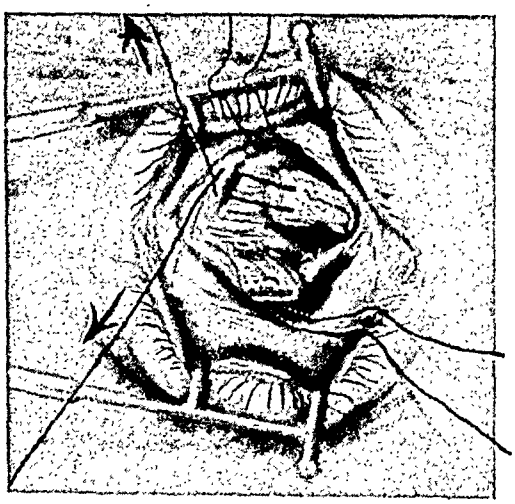


Fig. 5 (McGuire). Suture passed through stump of superior oblique.



Fig. 6 (McGuire). Shortened tendon of superior oblique in position.

No definite rules can be given as to the amount of tendon to be resected, but an immediate overcorrection is to be desired. An estimate of the amount of tendon to be resected can be obtained by having the globe turned strongly down and in by means of the traction suture and, with the eye in this position, grasping the tendon with a muscle forceps at various distances from the insertion and then doubling the tendon over upon itself by carrying the forceps toward the insertion. If the forceps are placed upon the tendon in such a position that when they are moved over to the insertion the tendon is fairly tight, the ideal amount of tendon to be resected will have been determined. The suture should then be placed in the tendon at this point and the tendon between the suture and the insertion resected.

Postoperatively there is generally more reaction following this procedure than is usual with operation upon the recti muscles and this is no doubt due, in large measure, to the fact that the insertion of the tendon is so far posterior on the globe. The reaction will subside markedly within a week or 10 days and it has not been found necessary to do more than firmly bandage the operated eye at any time.

Case reports

Case 1. M. J. G., aged 34 years, a Lieutenant in the USNR, was admitted to the hospital under the general diagnosis of strabismus. His chief complaint was diplopia when the head was held straight. Aside from the usual childhood diseases with uneventful recoveries, the past history was entirely irrelevant. There was no history of head injury or other trauma. This officer stated that he had really never noticed diplopia until he had entered the service, but that he had always tilted his head toward his left shoulder. On entry upon active duty, he felt that he was conspicuous because he was in uniform and had a head tilt. He then determined to straighten his head in order to appear more natural. However, he found on attempting this that a marked diplopia was produced and he became so nauseated that at times vomiting occurred. He was consequently admitted to the hospital for treatment and disposition.

Physical examination on admission was entirely negative with the exception of the eyes. Laboratory studies revealed nothing of significance. Vision in each eye was 20/20. The media were clear and the fundi and intraocular pressure were normal. Muscle-balance tests by the screen and parallax method of Duane produced the following findings: Right hypertropia of 50 prism diopters and esotropia of 10 p.d. for both distance and near in the primary position. In the cardinal directions of gaze for near the findings in prism diopters were: eyes up and right RHT 20, ST 10; eyes right RHT 30, ST 10; eyes down and right RHT 30, ST 10; eyes up and left RHT 40, ST 5; eyes left RHT 50, ST 10; eyes down and left RHT 54, ST 10. There was a corresponding vertical diplopia, which increased when the eyes were carried into the field of action of the right superior oblique, and it was noted that this officer carried his head habitually tilted toward the left shoulder. On the basis of these findings, a diagnosis was made of paresis of the right superior oblique of congenital origin. It was felt that the hypertropia was the primary difficulty and that the esotropia would not bother him if the vertical deviation was corrected.

Under intravenous sodium pentothal anesthesia an advancement of the tendon of the right superior oblique was performed according to the technique described by Wheeler. Postoperatively there was moderate reaction, but this subsided markedly within 10 days. Three weeks after operation muscle balance was right hypertropia 14 and esotropia 10 prism diopters for both distance and near in the primary position. Additional measurements were: U&R RHT 0, EST 10; R RHT 10, EST 10; D&R RHT 10, EST 10; U&L RHT 10 EST 10; L RHT 15, EST 10; D&L RHT 22, EST 10. There was no further subjective diplopia although a vertical diplopia could still be elicited by the usual methods. The head tilt was markedly improved, but there was still some present to take care of the relatively slight imbalance which remained. Six months after operation the results were essentially the same as noted three weeks postoperatively. It is of some interest to note that this officer, following his operation, went to sea on an aircraft carrier and that as late as Christmas, 1945, stated in a letter to me that he had had no further symptoms and that he was very grateful for the operative result.

Case 2. H. M. W., aged 19 years, was admitted to the hospital with chief complaint of diplopia —duration lifetime. The patient stated that there had been a vertical diplopia present as long as he could remember, but that he could overcome this by tilting his head. He did not remember when he first discovered this. The past history was irrelevant and the physical examination and laboratory routine were negative with the exception of the eyes. Vision was 20/20 in each eye. The only significant finding in the examination of the eyes was in the muscle balance. There was a

right hypertropia for both distance and near of 14 prism diopters. Other measurements were: U&R orthophoria; R RHT 4; D&R RHT 8; U&L RHT 16; L RHT 20; D&L RHT 25. There was a corresponding vertical diplopia increasing in eyes down and left and a head tilt of moderate degree toward the left shoulder. A diagnosis of paresis of the right superior oblique was made and an advancement of the tendon by the Wheeler method was performed under intravenous anesthesia. Seven weeks postoperatively there was a residual right hypertropia of 4 prism diopters for both distance and near in the primary position, RHT 4 in eyes left and RHT 7 in eyes down and left. In the remainder of the cardinal positions orthophoria prevailed. The remaining vertical imbalance was compensated for by a slight head tilt, but this was not nearly so marked as the tilt prior to operation. Subjectively the patient felt much improved.

Case 3. J. R. F., aged 26 years, was admitted to the hospital with a diagnosis of "paralysis of ocular muscle." This young man stated that he was well until about a year before admission when he began to notice some blurring of vision. His general health had been excellent prior to the onset of this symptom and had remained so ever since. There was no complaint of diplopia. The past history and the laboratory studies were irrelevant. Neurologic and general physical examinations were negative with the exception of the eyes. Vision in each eye was 20/20; media were clear; fundi and intraocular pressure were normal. Muscle-balance tests gave the following results: right hypertropia of 7 prism diopters for both distance and near. Other measurements were: U&R orthophoria; R orthophoria; D&R RHT 5; U&L RHT 8; L RHT 14; D&L RHT 26. Although the patient had never complained of diplopia, there was a head tilt to the left and when the head was straightened there was a definite diplopia which corresponded to the muscle balance and increased in eyes down and left. A diagnosis of paresis of the right superior oblique was made.

Under sodium-pentothal anesthesia, a Wheeler advancement was carried out on the tendon of the right superior oblique. The postoperative course was uneventful, but upon examination two weeks after the operation, the muscle balance remained essentially unchanged, and it was apparent that nothing had been accomplished by the operation. It was believed that probably the suture between the tucked superior oblique and the sclera had pulled out before adhesion had taken place.

Five weeks after the first operation the original operative field was explored and the tendon of the superior oblique was found in its original position without any shortening effect whatever from the Wheeler procedure. At this time a resection of the tendon, as previously described, was carried out. The postoperative course was uneventful and the patient was shortly discharged to duty. Five months after operation this man was seen as an out patient for a final check at which time he stated that since his discharge from the hospital he had been doing office work without difficulty and that his symptoms had been relieved. There was an orthophoria in all cardinal directions of gaze except in eyes down and left where there remained a residual right hypertropia of 6 prism diopters.

Case 4. A. J. B., aged 26 years, was admitted with diagnosis of "insufficiency of ocular muscle." The main complaint was of diplopia when the head was held in the upright position. This condition had been present since childhood when the patient had fallen from a tree and struck his head on the roots, becoming unconscious for a short period. The general physical, neurologic and laboratory examinations were entirely negative as were X-ray studies of the skull. Ocular examination revealed vision to be 20/30 in the right eye corrected to 20/25 by a +0.5D. cyl. ax. 45°; and in the left eye to be 20/20. The media were clear, the fundi and tension normal. Muscle balance showed a right hypertropia of 10 prism diopters for distance and 12 for near in the primary position. Other measurements were U&R EX 5; R orthophoria; D&R RHT 8; U&L RHT 4, EX 5; L RHT 18; D&L RHT 32. There was a corresponding vertical diplopia increasing in the field of action of the right superior oblique, and a head tilt to the left. On the basis of the history and the muscle findings a diagnosis was made of paresis of the right superior oblique of traumatic origin. A resection of the tendon of the right superior oblique was then performed under sodium-pentothal anesthesia. Following his discharge from the hospital, the patient was followed in the outpatient department and three months after operation stated that he felt much relieved by the surgical procedure. At this time there was orthophoria for both distance and near in the primary position with a residual right hypertropia of 3 prism diopters in eyes left and of 9 p.d. in eyes down and left.

Case 5. J. W. F., aged 23 years, was admitted to the hospital with the diagnosis of "insufficiency of ocular muscle." He gave a history of having had double vision for as long as he could remember when the head was held straight, but this diplopia was eliminated by tilting the head to the right. General physical, X-ray and laboratory examinations were negative. Vision in each eye was 20/20 and the eyes were normal throughout with the exception of the extraocular muscles. In the primary position there was a left hypertropia of 14 prism diopters for both distance and near. Other measurements were: U&R LHT 5; R LHT 18; D&R LHT 27; U&L orthophoria; L LHT 8; D&L LHT 12. There was a corresponding vertical diplopia.

A diagnosis of paresis of the left superior oblique was made and under sodium-pentothal anesthesia a resection of the tendon of this muscle performed. The postoperative course was not unusual and one month after operation there was orthophoria for both distance and near in the primary position, and there was no vertical imbalance except in eyes down and right where there was a left hypertropia of 6 prism diopters.

Case 6. W. H. B., a man, aged 49 years, was admitted to the hospital with a diagnosis of frontal sinusitis. There was a history of intermittent bilateral frontal headaches of one month's duration. Clinical and X-ray examinations of the sinuses failed to reveal any pathologic changes. Laboratory studies were negative in all respects. The headaches increased rapidly in severity and on neurologic consultation it was felt that he probably had a subdural hematoma although there was no history of injury. A trephination was done on the skull and a fairly large subdural hematoma was found on the right side and evacuated. Following the operation, the patient began to complain of diplopia and then stated that this had been present for about the same length of time as his headaches but that he had neglected to mention the symptom. Approximately three weeks following the cranial operation the patient was seen in consultation by the eye service. The ocular examination was entirely negative with the exception of the muscle balance. There was a left hypertropia of 6 prism diopters for both distance and near in the primary position. Other measurements were: U&R LHT 8; R LHT 16; D&R LHT 23; U&L orthophoria; L orthophoria; D&L LHT 4. A diagnosis of paresis of the left superior oblique secondary to intracranial damage was made. Six weeks later the muscle findings were the same as measured above and it was believed that he was not going to regain the use of the superior oblique by spontaneous recovery. Consequently, a resection of the tendon of the left superior oblique was performed under sodium-pentothal anesthesia. The postoperative course was uneventful and two months later the diplopia had cleared up and there was orthophoria in all directions of gaze except in eyes down and right where there was a residual left hypertropia of 4 prism diopters.

COMMENT

Prior to 1934, when Wheeler[1] described his operation for advancement of the tendon of the superior oblique, paresis of this muscle had been treated surgically by one of three methods or a combination of these, that is, tenotomy of the inferior oblique of the same eye, recession of the inferior rectus of the opposite eye, and recession of the superior rectus of the same eye, with the first two methods being preferred by most operators. In rare instances the homolateral inferior rectus has been advanced. It would seem that none of these methods directly attacks the main problem. Complete paralysis of the superior oblique is rare and what the ophthalmologist is confronted with in the vast majority of cases of disturbance of motility of this muscle is an underaction, or a paresis, of the muscle. Granted that such is the case, the most logical primary surgical procedure in relieving the distressing symptoms of this condition is upon the paretic muscle itself. If such a procedure does not result in relief of the condition, the other methods may then be put into use. However, it is believed that with resection of the tendon of the superior oblique in paresis of this muscle as the primary step, secondary procedures will seldom be necessary and the patient will be saved the inconvenience, not to mention the expense, of several operations, the results of which cannot even be estimated in advance.

In regard to the oft propounded theory that the tendon of the superior oblique is too difficult of access to permit easy operation the writer firmly believes that the sooner this is forgotten, the better. With adequate exposure, by means of a traction suture pulling the eye down and in, the difficulties of access to the tendon are theoretical rather than real.

SUMMARY

A brief historical review of the earliest surgery upon the extraocular muscles is presented.

The anatomy, physiology, pathologic physiology, and the etiology of paresis of the superior oblique is discussed.

The surgical correction of underaction of this muscle is reviewed and a modification of Wheeler's advancement operation is presented.

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NOTES, CASES, INSTRUMENTS

A NEW DRAINAGE OPERATION FOR THE RELIEF OF GLAUCOMA*

OSCAR LAVINE, M.D.,
AND KARL H. LANGENSTRASS, M.D.
Washington, D.C.

Drainage operations in the field of glaucoma therapy meet only with incomplete and uncertain success. As an example one may consider the iridencleisis operation and its postoperative events. The scleral incision tends to close immediately and tightly, due to the inherent elasticity of the scleral tissue. The incision heals quickly and firmly because large areas of the mesodermal surfaces are in intimate contact. The included iris tends to undergo pressure atrophy as the result of sharp compression by the scleral lips. This event renders the operation practically valueless. A similar unfavorable outcome may be observed fairly frequently in all drainage operations now in vogue for the relief of ocular hypertension.

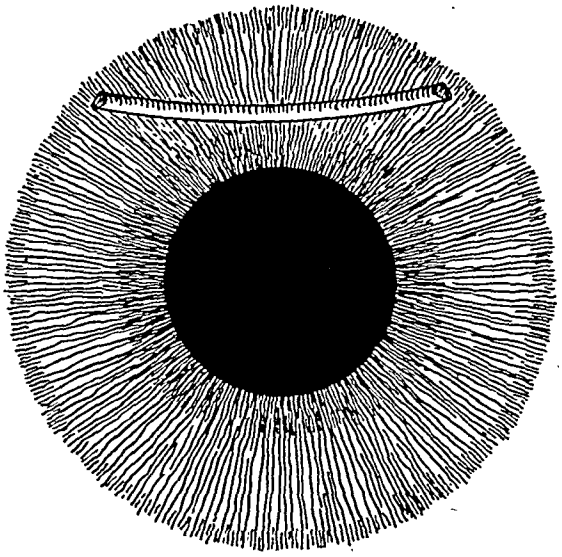


Fig. 1 (Lavine and Langenstrass). The corneal groove.

In reviewing the reasons for such failure, the following possibility was considered. All drainage operations form, or try to form, a passageway through connective tissues. As soon as the draining instrument (knife, keratome, spatula) is withdrawn, however, the draining canal collapses. The raw connective-tissue surfaces come in close contact. Fibroblasts proliferate. The channel starts to be closed almost immediately by scar formation. The glaucoma syndrome returns, because fluid production again exceeds fluid absorption.

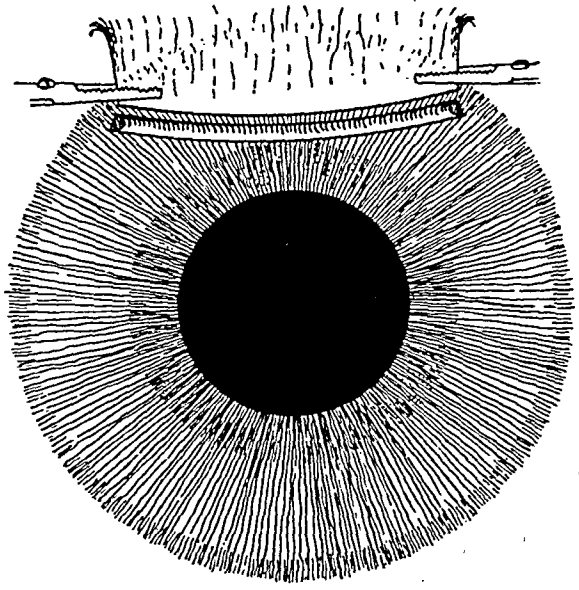


Fig. 2 (Lavine and Langenstrass). First conjunctival flap.

It would seem that a satisfactory drainage opening should ultimately be so constructed that its opposing walls receive a lining which has little or no tendency to fuse. To line the channel with epithelium in order to create a real physiologic duct

* From the Ophthalmologic Service of St. Elizabeth's Hospital.

would hold out hope for more favorable and lasting results.

Since it is well known that corneal fistulas heal very poorly, if at all, it seems desirable to take advantage of this fact and to make the drainage opening in the peripheral zone of the cornea. However, the fluid from the anterior chamber should not flow directly into the conjunctival sac. It should first find its way into a thin-walled, epithelium-lined channel or duct. This duct should then open into the conjunctival sac at some distance. A sort of safety valve would thus be created, and aqueous fluid would force its way out into and through the drainage channel only during periods of increased intraocular pressure. At times of normal, or subnormal, intraocular pressure, the epithelium-lined channel would collapse and thus constitute an effective barrier

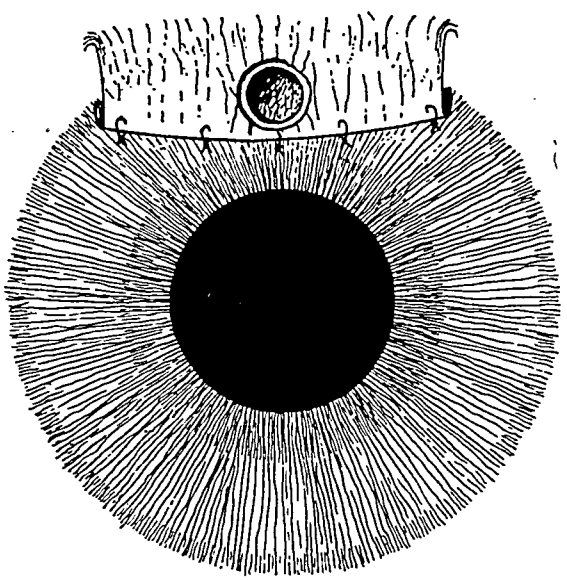


Fig. 3 (Lavine and Langenstrass). Sutures completed. Corneal trephine opening visible through second conjunctival flap.

against possible infection of the anterior chamber and also against the development of prolonged hypotonia.

The following procedure is therefore recommended. A very narrow strip of cornea is deprived of both epithelial and subepithelial tissue. The resulting corneal groove is arranged along a horizontal line under the upper lid. Five millimeters above the superior limbus, a conjunctival incision is made parallel to the corneal

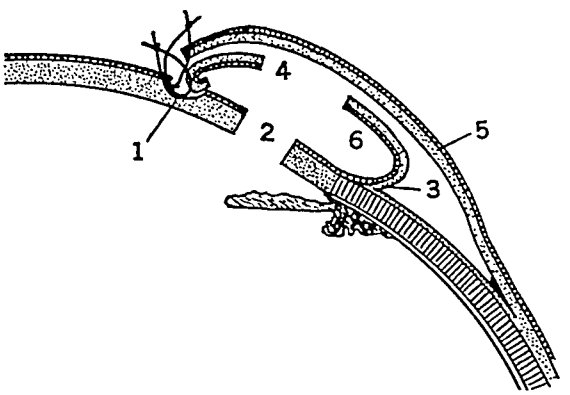


Fig. 4 (Lavine and Langenstrass). Diagram of result. (1) Corneal groove. (2) Corneal trephine opening. (3) First conjunctival flap, inverted. (4) Circular conjunctival excision. (5) Second conjunctival flap, not inverted. (6) Epithelium-lined epicorneal duct.

groove. A conjunctival flap is dissected free and reflected downward over the upper cornea. Its free conjunctival edge is sutured to the roughened area in such a way as to have its mesodermal surface rest against the raw tissue in the corneal groove. To cover the mesodermal surface of this conjunctival flap, a second conjunctival flap is brought down from the region of the upper fornix. Conjunctivocorneal sutures are drawn through its free edge and left untied. The next stage of the operation constitutes the creation of a corneal fistula. A small circular excision is made in the first, or central, conjunctival flap about 1 mm. inward from the limbus. A corneal trephine opening is now made through the center of that small conjunctival window. An Elliot trephine, 1.5 mm. in diameter, is used. A small piece of iris is excised beneath the region of the corneal fistula. The sutures of the second or outer conjunctival flap are now tied.

This operation creates a permanent

corneal fistula. That fistula is covered by an epithelium-lined conjunctival flap. This flap acts as a safety valve. The fistula is protected from infection by a fairly long epicorneal duct. That duct is entirely lined with epithelium. Corneal epithelium forms the floor. The conjunctival epithelium of the first, or central, conjunctival flap lines its roof. These two surfaces are smooth and have little or no tendency to fuse. This epithelium-lined epicorneal duct collapses (and thus guards the corneal fistula) at times of relatively normal intraocular pressure. The duct opens and functions as a capillary drain whenever the intraocular pressure exceeds a certain critical level.

Technical details of this procedure have been worked out in a series of operations on human cadavers and in animal experiments. We have recently had an opportunity to perform the operation on several patients with chronic glaucoma. We are not reporting clinical data in this preliminary communication, except to say that we were favorably impressed with the ease of execution of the method and with the smooth postoperative course. Whether the pressure reduction will continue to maintain itself indefinitely at a desirable level remains to be seen.

SUMMARY

A theory is offered to account for the transient effect of many drainage operations in glaucomatous eyes. A new operation for lasting pressure reduction is proposed. A corneal fistula is connected with an artificially created epithelium-lined duct. The duct remains permanently open. It acts in the manner of a safety valve, closing the fistula at periods of normal or near normal pressure. The relatively long collapsible duct tends to reduce the opportunity for contamination of the anterior chamber to a minimum.

1801 Eye Strect, N.W. (6).

A CASE OF FIXED STRABISMUS*

LUIS MARTÍNEZ, JR.,† M.D.
Guadalajara, Jal., Mexico

The case which I am about to record is rare, and I have encountered no similar one in our national records and hardly any in the foreign literature. The patient is Mr. J. R. F., aged 60 years, residing at Mexicali, Lower California (Baja California). He came to see me on April 3, 1944. He was accompanied by a member of the family, because he could not obtain sufficiently useful vision even with the compensatory inclination of the head which is habitual in some cases of strabismus.

Inspection showed bilateral convergent strabismus, the most pronounced that I had ever seen in my professional practice. The cornea of the right eye was almost completely concealed at the internal canthus, and that of the left eye was exposed only as regards its outer half (fig. 1). The onset of the trouble had occurred 30 years previously, and there had been slow and progressive increase of the deformity to the point of complete incapacity for work. The patient's occupation had been that of a farmer.

No ocular movement could be demonstrated. There was a chemotic spot in the outer part of the left bulbar conjunctiva. There was apparently no action of the superior or inferior rectus of either eye, or of the obliques. It was impossible to investigate White's sign as to differentiation between involvement of the rectus and oblique muscles. After the usual laboratory examination, I proceeded to operation, in the performance of which I had the advantage of the assistance of Dr. Enrique Avalos González. The operation

* Read before the Asociación para Evitar la Ceguera en México, August 11 to 16, 1947.
† Translated by Dr. William H. Crisp, Denver, Colorado.

was performed on April 5th, beginning with the left eye. The plan was to execute retro-implantation of the internal rectus and the Blascowicz operation on the external rectus.

The conjunctival incision had to be made more or less blindly, because it was impossible to move the eye with the fixation forceps. I succeeded in taking hold of the internal rectus, and cautiously introduced the strabismus hook, using cautiously sustained but energetic traction.

I sectioned the insertion of the muscle. This behaved like a fibrous, inextensible, extremely short and tense band which fixed the eyeball in the nasal portion. Immediately upon division of this band, it was possible to move the eyeball in all directions. We proceeded to suture the internal rectus in front of the equator, in view of the possibility of subsequent overaction of the external rectus. We then did the Blascowicz operation on the external rectus, resecting this muscle to the extent of leaving the position of the eye somewhat overcorrected. The external rectus gave the impression of being narrowed and slender, and extremely flaccid.

At the moment of freeing the eye, and in the presence of decided limitation of the operative field, we failed to become conscious of adhesion of the inner and upper part of the cornea to the inner end of the lower eyelid in the region of the lacrimal punctum. There was thus exposed an adherent leukoma, and the manipulation resulted in perforation of Descemet's membrane, emptying of the anterior chamber, and an iris hernia. The last was excised.

Operation on the second eye was attended by the same difficulties as in the left eye. In performing the Blascowicz operation on the external rectus we were surprised to find a torn condition of a good many of the fibers of the muscle. This condition was explained when some



Figs. 1 and 2 (Martínez). Showing the condition of the patient before and after operation.

days later an excellent colleague told me that he had attempted and achieved mobilization of this eye by means of fixation forceps!

The recto-implantation of the right external rectus was supplemented by two long fixation sutures which were tied firmly about 1.5 cm. beyond the external canthus, over a cushion of gauze, in order to insure overcorrection.

The postoperative course was extremely satisfactory, as may be noticed from Figure 2. The patient was dismissed on May 2, 1944, with perception of shadows for the right eye and vision of 5/10 in the left eye, without correction.

Discussion

There can be no doubt that the retraction syndrome resulted from fibrous degeneration of the internus muscles. In such a case it is sometimes impossible to establish the diagnosis completely before operation. After such an operation, normal movements are not to be expected, but from the esthetic and utilitarian point of view, as in the present case, the result is encouraging. Microscopic examination of the contracted muscle clearly shows fibrosis to be responsible for the strabismic fixation, although the essential cause for such a condition is not known. Fixation may be either unilateral or bilateral.

119 Avenida Pedro Loza.

SUBRETINAL HEMORRHAGE SIMULATING SARCOMA OF THE CHOROID*

A CLINICAL PATHOLOGIC REPORT

JOSEPH LAVAL, M.D.

New York

HISTORY

Mrs. G. M., aged 48 years, was seen by Dr. Benjamin Esterman on April 13, 1945, with a history of blurring and tearing of the left eye of three days' duration. The eyes had been entirely normal in the past and aside from having required reading glasses, they needed no attention.

Examination disclosed the right eye to be normal, with 20/30 vision corrected to 20/20, clear media, normal fundus and tension. The left eye had vision of 20/200 due to a large central scotoma extending downward and nasally. Inspection through a dilated pupil disclosed a pigmented mass at the macula, about 6 disc diameters in size and about 5 diopters elevated. It was quite round and extended to the upper temporal portion of the left disc. A retinal artery and vein coursed over its surface but none of the vessels in the fundus were engorged. There were no exudates, hemorrhages, or other pathologic conditions in any portion of the fundus. Ocular tension of the left eye was 16 mm. Hg (Schiøtz). There was no pulsation, exophthalmos, or limitation of motion of either globe.

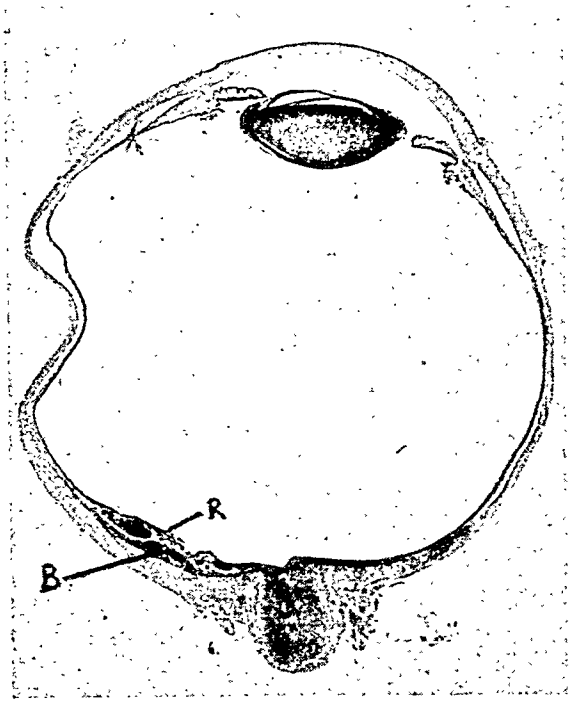


Fig. 1 (Laval). There is blood (B) lying between choroid and retina (R). The latter is detached as far as the disc in the region of the hemorrhage.

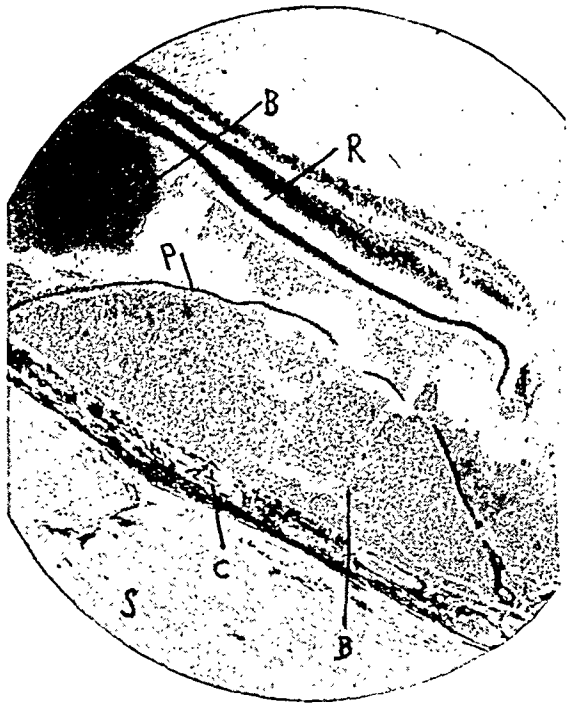


Fig. 2 (Laval). The pigment epithelium (P) is broken in three places allowing the blood (B) from the choroid (C) to break through and detach the retina (R). (S) is the sclera.

A diagnosis of melanosarcoma of the left choroid was made and confirmed by Dr. R. T. Paton. A general physical examination disclosed no evidence of metastasis. The blood pressure was 120 mm. Hg (systolic) and 80 mm. Hg (diastolic). An enucleation was performed April 18, 1945.

* From the laboratory of the Manhattan Eye, Ear and Throat Hospital.

PATHOLOGIC REPORT

The globe was normal in size and shape. There were no extraocular masses. On section, a dark solid mass was noted in the macular area extending to the disc (fig. 1).

Microscopic studies showed no abnormalities in the globe except for the region of the macula and the adjacent area (fig. 2). Here a large hemorrhagic mass was present, lying between the choroid and the detached retina. The pigment epithelium had been separated from the choroid by the mass of blood which had broken through the pigment epithelium in three distinct places. The blood which seeped through these three areas caused the detachment of the retina to follow. There was no blood in the vitreous. The choroidal vessels were quite full, but there was no evidence of sclerosis in the retinal or choroidal vessels. There was some perivascular infiltration with round cells at some of the larger choroidal vessels but no involvement of the vessel walls. Serial sections of the globe showed no evidence of tumor.

COMMENT

It occasionally happens that an eye is enucleated for a possible malignant melanoma only to find a subretinal hemorrhage on sectioning the eye. In the past 15 years this is the third time I have seen it at the laboratory of the Manhattan Eye, Ear, and Throat Hospital. This particular case is quite interesting because of the possibility of a disciform macular degeneration developing if the eye had not been enucleated. However, it is now two years since the original macular hemorrhage in the left eye and nothing has developed in the right eye. The retinal vessels in the right eye, according to Dr. Esterman who sees the patient a few times a year, are normal. The patient still has a normal blood pressure, her blood sugar is normal, and the urinalysis has never shown any abnormal findings. The perivascular infiltration of round cells about some of the larger choroidal vessels is the only indication of vascular disease and its significance is hard to evaluate.

136 East 64th Street (21).

BOECK'S SARCOID

REPORT OF CASE WITH AN UNUSUAL PRECIPITATING FACTOR

MORRIS KAPLAN, M.D.
Denver, Colorado

Boeck's sarcoid is generally considered to be a rather rare disease, and yet a perusal of recent literature proves it to be surprisingly common. The disease has been well described, especially by Levitt in the *Archives of Ophthalmology*, in 1941.

The eye is one of the favorite sites for this general disease and many cases are first seen by the oculist. In reports totaling 100 cases, 43 presented ocular involvement. Of these 43 cases, 28 were of uveitis, 7 involved the lids, 9 the lacrimal glands, and 6 the conjunctiva. Ten cases ended in phthisis bulbi and 7 of these 10 cases were bilateral. Thus seven percent of the cases ended in complete blindness. As is well known, the disease is almost identical with tuberculosis, differing from it only in absence of caseation in its tubercules and in absence of acid-fast organisms. The diagnosis is usually missed at first and is later established by tissue studies of biopsy specimens or by X-ray studies of the chest or of the phalanges.

CASE REPORT

The case herein described presents several unusual features. A 52-year-old woman, touring in South America, reached down to pet a dog in a private home. With great force, the dog bit her over the right eye. The upper jaw struck

the upper lid just below the brow and the lower jaw struck the lower lid at the orbital margin. The two resultant skin lacerations were treated almost immediately by a physician, who gave a prophylactic injection, the nature of which the patient did not ascertain. The eye itself seemed entirely uninjured. Three days later she noticed a painless swelling in the middle of the upper lid. This continued to enlarge for several days, causing a very noticeable bulging of the upper lid. It remained painless. About five weeks later, she presented herself at this office for treatment.

Just before she left for South America, she had had a routine refraction and examination at which time no appreciable irregularities were noted. She now presented this painless mass within or behind the right upper lid. It was freely moveable and measured 2 by 2 by 3 cm. The lid was quite protuberant and in mild mechanical ptosis. No other deviation from the normal was seen and the eye itself remained quite normal.

The mass felt exactly like an organized hematoma, which was considered as the most likely diagnosis. Local treatment consisted mostly of hot applications. Under this regimen, the mass became somewhat larger and moved from the midline of the lid to the outer third. The new ptosis was unsightly and, since the diagnosis now seemed obscure, surgical removal was decided upon.

Under local anesthesia the mass was easily isolated. It was found to extend back into the retrobulbar space into the orbital fat. It was easily removed. It was indurated, felt like cartilage, and had a yellowish hue. It obviously was not a hematoma. The wound healed uneventfully in a few days and the area resumed its normal appearance.

Laboratory report

Gross. The specimen consists of an elongated, gray-white to gray-yellow fragment of tissue removed from the right orbit. The sectioned surface is grayish white streaked with yellow.

Microscopic. Microscopic examination of the nodule removed from the region of the right eye shows it to be composed of fibrous tissue in which are well-circumscribed nodules consisting of epithelioid cells. In these collections are multinucleated giant cells of the Langhans' type. Cuffing the collections of nodules in some areas are small accumulations of lymphocytes. Caseation necrosis is not demonstrable. Special stains fail to reveal the presence of acid-fast bacilli.

Diagnosis. Boeck's sarcoid of the right orbit.

Internist's report

The patient was referred to her internist, who also had examined her thoroughly before she left for South America and had found no irregularities. She again underwent exhaustive study, and no appreciable abnormalities were found. X-ray reports were as follows.

Chest, both feet, and hands. Examination of this individual's chest reveals minimal spondylitis in the dorsal spine. There is no other evident abnormality. The dome of the left diaphragm is rather hazy and indistinct. The pleura is otherwise negative. The cardiac and aortic shadows are of normal size, shape, and position. The left hilar shadow is rather prominent, with a rounded configuration suggesting mediastinal adenopathy. The superior portion of the right hilar shadow assumes a rounded, smooth-bordered appearance which would be consistent with a small node on the right. The markings radiating from the left hilum into the left base are definitely intensified and more soft and granular than usually seen. The lung fields are otherwise essentially clear.

Summary. The findings in the chest are

not conclusive but may be considered supporting evidence of the pathologic report of biopsy.

Comment

Because of the biopsy report, anteroposterior views of the small bones of the hands and feet were obtained. There are small rounded, sharp, sharply demarcated excavations on the outer aspect of the articular surface of the terminal phalanx of the middle finger bilaterally and on the outer aspect of the right index finger. There are small osteophytes lying intimate with the joint spacing of the distal interphalangeal articulation of the middle fingers bilaterally. The excavations described could be on the basis of sarcoid depositions. The vertical trabecular pattern in the phalanges of the hands may be slightly exaggerated. This has been described as an early change in the presence of sarcoid. There is no other X-ray evidence of bone or joint change.

The internist recommended that no treatment be instituted and that the patient be observed at regular intervals.

It seems reasonable enough to agree with the pathologist that this is a case of sarcoidosis. It does not seem reasonable to assume that this sarcoid was caused by the dog bite, or could have been caused by any trauma, or could have grown so quickly if it had. It is not impossible that the tumor could have existed in the retrobulbar tissues above the eyeball and that the violent trauma could have caused its rupture forward behind the lid.

If a tumor of such size had existed two weeks before the accident when a routine examination was made, some interference with ocular movement should have been evident. This was not the case. There was no diplopia and no exophthalmos.

807 Republic Building (2).

THE PROBLEM OF STRABISMUS IN CHILDHOOD*

With especial reference to convergent strabismus in infancy and early childhood

James W. Smith, M.D.
New York

Superstition and fear on the part of misinformed parents, and the lack of a standardized diagnostic and therapeutic approach by ophthalmologists, are responsible in part for the unsolved problem of strabismus. Parents regard the eye as the most delicate organ in the body and view with horror the prospect of surgery on a child 2 or 3 years of age. They seek refuge in the story of the neighbor's boy who outgrew his esotropia —unaware that he only achieved this result after total and irreparable amblyopia. Usually a grandmother can augment the parents' fear with several examples of convergent strabismus followed postoperatively by divergent strabismus.

Blame for the latter result must be charged to ophthalmic confusion created by conflicting and often prejudiced schools of thought.[1] A convergent case can only be converted into divergence by excessive tenotomy of the internal recti muscles or failure to diagnose preoperatively the presence of a complicating vertical strabismus.

Causes of squint

Originally, I followed the teachings of Worth and Duane, but the neuro-anatomists and physiologists have challenged their views. Bielschowsky and Chavasse disagree in part with Worth and ignore

* From the Departments of Ophthalmology, New York Post Graduate Medical School and Hospital, Columbia University, and the Hospital for Joint Diseases. Read before the New York Society for Clinical Ophthalmology, January 6, 1947.

Duane's views on congenital superior rectus weakness. Chavasse[2] has originated a new entity—inhibitional palsy of the contralateral antagonist. Adler[3] upholds Bielschowsky's views that an isolated primary vertical motor paralysis is most commonly due to paralysis of the superior oblique muscle, but is willing to concede that the vast majority of cases of secondary vertical motor paralyses (that is, convergent squint associated with a noncomitant vertical deviation) more nearly fit into the picture of paralysis of a superior rectus.

I cannot understand the recent references in the literature regarding the frequency of superior oblique paralysis. Bielschowsky, in his large clinic at the University of Breslau, observed only 80 cases during the years 1923 to 1932. At a previous meeting in this Academy, I[4] reported only 50 cases from private practice over a 25-year period. When authorities disagree, the student, without facilities for guided clinical observation, must grope in the dark field of trial and error.

Conditions favoring development of squint

Conditions which favor the development of squint are anisometropia, opacities of the media, fundus disease, disorders acquired in infancy, and congenital anomalies that make the vision in one eye much worse than in the other. Other factors are heredity, hypermetropia, and the presence of a congenital vertical deviation. Chavasse considers "congenital defect of the fusion faculty" to be akin to a miracle and cites many traumatic and inflammatory lesions (prenatal and in infancy) that can produce muscle imbalance and acquired fusional impairment.

We operate too late to regain fusion and vision. Our so-called good results refer in the main to eyes that are cosmetically acceptable to parents. The child's disappointment is not evident until adult life when he is handicapped by the lack of binocular single vision and stereopsis.

Convergent strabismus

At what age does unilateral convergent strabismus manifest itself? In Worth's[5] series 13 percent of the cases appeared before the first year; 18 percent between 1 and 2 years; 25 percent between 2 and 3 years; 19 percent between 3 and 4 years; 11 percent between 4 and 5 years; 7 per cent between 5 and 6 years; and 7 percent after 6 years of age. In 75 percent of the cases, deviations were apparent before the end of the fourth year. Essentially, alternating strabismus appears even earlier in infancy. In 34 percent of the alternating cases, diagnosis was made before the first year, and in 19 percent, between the 1st and 2nd year of life. (13 percent were seen between the 2nd and 3rd year, and 16 percent between the 3rd and 4th year.) In 53 percent of the cases, the alternating strabismus was present before the end of the second year, and a total of 84 percent was apparent before the end of the fourth year. (About 2.3 percent of school children, aged 5 to 14 years, were found to have convergent strabismus, and about 0.2 of 1 percent had divergent strabismus.)

Constructive restoration

At what age does the infant manifest fusion? By the end of the first year the child evidences a definite desire for binocular single vision. We all know that the fusion faculty normally reaches its full development before the end of the sixth year. This fact, coupled with the high incidence of convergent strabismus before the end of the fourth year, indicates that our best opportunity for constructive restoration is between the ages of 2 to 6 years.

The exact measurement of the strabismus in degree of arc or prism diopters is

only of academic interest. Hirschberg's corneal light-reflex test, in which each millimeter of deviation represents about 15 prism diopters, is the best method that can be used with infants. After the second year more accurate determinations can be made with prisms and the cover test.

Estimation of the error of refraction is of vital importance. Under complete cycloplegia, retinoscopy reveals many cases with 2 to 8 diopters of hypermetropia and astigmatism. If the convergence excess is not complicated by vertical muscle imbalance, wearing glasses with full correction constantly will decrease the deviation or relieve the strabismus completely. In this age group, ointments induce more reliable cycloplegia than drops.

Visual tests for infants

A crude record of visual ability is desirable. By the time the average parent can be induced to bring an infant with fixed unilateral strabismus for examination, vision in the deviating eye is subnormal. My purpose in utilizing visual tests is to impress upon the mother how much damage has been done and to enlist her coöperation against further deterioration. The present-day tendency of waiting until the child can read the illiterate E or Snellen test types often reveals advanced amblyopia at the age of 3 or 4 years.

Evans[6] recently demonstrated his visual tests for infants, utilizing the movement of iron filings of various sizes on a white plastic tray. An infant interested in the filings being moved by a magnet on the underside of the tray will resent having its fixing eye covered thereby affording an excellent clue to amblyopia. At the ninth month the visual acuity is at least 6/72; at two years, 6/12; at three years, 6/9; and later, when the Snellen charts can be discerned, 6/6.[2] White marbles varying in size from ½ to 1½ inches in diameter can also be used to test vision in young children. This procedure can be performed in a few minutes and succeeds with most children old enough to walk. At a distance of 18 to 20 feet, the 1½-inch sphere corresponds roughly to 6/60 or 20/200 and the ¾-inch sphere, to 6/24 or 20/80. Improvement in vision after wearing glasses or following occlusion can be demonstrated to the parent as the patient proceeds to see smaller sized marbles.

Know child psychology

I have seen competent physicians who were long on knowledge but short on child psychology. Nervous mothers may cause children to cry in the waiting room, but the same children rarely display their temper in the presence of a sympathetic and kind doctor. The young child comes only for amusement. Its confidence, and your time, can be saved best by making a game out of the consultation.

Any device, musical or electrical, that engages the tot's attention should be utilized to gain your diagnostic goal. Come down to the child's level—even if you have to get down on the floor to observe muscle actions or for ophthalmoscopy or retinoscopy. Occasionally your best efforts will be thwarted by a spoiled brat. Be ready to admit failure cheerfully and send the bounder home with a lollipop or a penny. You will probably have better luck next time.

Muscle measurements in children are reliable only if the patients are completely relaxed. Unlike consultations on adults, time is unimportant. The child can return again and again until the necessary information has been obtained.

We see too many children with total amblyopia because some ophthalmologist found it inconvenient and time consuming to perform an accurate refraction upon or to treat an unruly child of 2 or 3 years.

The patients in the younger age range

afford us the best opportunity for correction of strabismus with less surgery, or in favorable cases without surgery. Even more gratifying is the preservation of binocular single vision by persistent treatment if started early.

Prescribing glasses

If the vision with glasses is subnormal in one eye, the ophthalmologist is duty bound to restore vision to normal, if possible, by atropinization or occlusion of the fixing eye. Early diagnosis and the early institution of treatment before amblyopia becomes marked will effect gratifying return of function in favorable cases within two months.

I have prescribed nonshatterable glasses in cases of accommodative convergent strabismus for patients 18 months of age. To the mother's amazement, the decrease in deviation and/or the visual improvement was so marked that the tiny tots insisted upon wearing the glasses constantly. These children will also permit the introduction of ½-percent atropine ointment in the fixing eye.

Occlusion to be effective must be total and continuous for days or weeks at a time. While this treatment is heroic and resented by the patient, it permits a rapid evaluation of the possibilities for visual restoration and decrease in the angle of squint.

Orthoptic training

Selected children between the ages of 3 and 6 years will coöperate with the orthoptic technician in an attempt to regain binocular single vision with the aid of one of the major amblyoscopes. Although the ideal time for fusion training is supposed to be prior to the sixth year, I have seen adults regain vision in an amblyopic eye following injury or disease in the normal eye.

When the strabismus is unilateral and these medical techniques are ineffective, early operation is indicated. Even the ardent advocates of orthoptic training deplore delay in these cases. I operate on high degrees of convergent strabismus with low insignificant hypermetropia between the age of 2 to 4 years. Only in these patients have I been successful in restoring binocular single vision.

Comment

Before concluding this topic, I want to stress the importance of diagnosing and treating convergent strabismus at the earliest age possible, if we wish to achieve normal vision in both eyes, binocular single vision, and normal fusion power. The therapeutic measures that may be employed to achieve an ideal result are: (1) Correction of errors of refraction. (2) Occlusion of the fixing eye. (3) Atropinization of the fixing eye. (4) Orthoptic training. (5) Surgery.

"Both as regards incidence of *onset*, and hope of cure, the age of innocence is the critical age."[2]

Divergent strabismus

Accommodative convergence insufficiency and nonaccommodative convergence insufficiency resulting from psychic disorders and debilitating systemic conditions are the chief causes of divergent strabismus in childhood. The early clinical signs are marked exophoria for near with normal near point of convergence. Later, in the stage of transient exotropia, the convergence near point recedes, exophoria is present for distance, and the prism divergence increases. If untreated, the transient exotropia is converted into a continuous strabismus. In the last phase, contracture of the external rectus and stretching and weakening of the internal rectus produces absolute impairment of inward and excess of outward rotation.

Examine for myopia

The arrest of these changes in the accommodative cases can be effected by a more vigorous approach to the problem of myopia. Children should be examined in the preschool period for stigmata of myopia. An exophoria for near or mild precrescent changes temporal to the optic nerve are premonitory signs of myopia, even in the presence of 20/20 and emmetropia. Too many children are permitted to indulge in all forms of convergence abuse, such as reading on their backs or even worse, sprawled on the floor with their eyes about four inches from their stacks of poorly-printed comics. When they are eventually referred by their school teachers, 3 to 5 diopters of myopia and varying degrees of transient exotropia are present. Early and full correction has forestalled the development of accommodative convergence insufficiency in about 10 percent of my cases with progressive myopia. Ocular hygiene should be explained to the parent and patient. Glasses must be worn constantly. The time interval between examinations must be set by the refractionist and not by the parent to avoid the necessity of marked increases in the lens prescription.

Fortunately, the fusion apparatus is fully developed in these patients and, after glasses have been prescribed, convergence exercises will do much to offset the advance of the divergence tendency.

Early management essential

Although we advocate early operations in convergent strabismus with low hypermetropia, in divergent strabismus, surgery is reserved for the advanced cases of long duration with extreme deformity. In fact, many cases operated upon prior to the age of 10 years will have a recurrence of almost the same degree of divergence requiring secondary surgery. A final word regarding congenital weakness of the elevator and depressor muscles. Many cases of divergent strabismus in which surgery not only failed but actually resulted in convergent strabismus are due to a complicating vertical muscle imbalance. In a previous paper,[7] I stressed the diagnostic importance of head tilt and associated skeletal deformities as positive evidence of vertical muscle imbalance in every case of convergent and divergent strabismus.

Once again, I would like to appeal for the early management of convergent strabismus. More patience with these little patients means perfect binocular single vision. Some of the divergence cases can be prevented or arrested by better ophthalmic supervision in the treatment of myopia.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

March 20, 1947

DR. BURTON CHANCE, M.D., *chairman*

ABSORPTION FROM THE VITREOUS

DR. LUDWIG VON SALLMANN (by invitation) presented a paper on "Some Factors Operative in Absorption from the Vitreous," an abstract of which follows.

In view of the difficulties in examining the fluid exchange in the posterior segment of the eye by the orthodox method, a new approach was selected with the practical aspect of the problem in mind. The experiments were grouped: (1) According to phenomena of diffusion in the vitreous and of its liquefaction. (2) In relation to the activity of the ciliary epithelium. (3) According to the influence of the basal metabolism. (4) On the basis of clinical methods used to speed up absorption from the vitreous.

The dependence of the diffusion of hemoglobin on the structural integrity and the viscosity of the vitreous was studied by injecting pigs' hemoglobin into fresh intact pigs' vitreous. In exposing the latter to a temperature of 37.5°C., the hemoglobin diffused throughout the vitreous within 18 hours; whereas, the spreading was very slow at refrigerator temperature. When hemoglobin was injected after autolysis of the vitreous had taken place upon storage of the preparations for 24 hours at room temperature, no difference in the diffusion of the hemoglobin was noticed at various temperatures. It was concluded that autolytic liquefaction, or lowering of the viscosity of the vitreous, had resulted in the speedy diffusion in eyes which had been exposed to 37.5°C. in the first series of experiments.

The effect of liquefaction on diffusion or spreading and absorption of foreign matter was investigated in an extensive series of *in vivo* experiments on 24 rabbits. Partial liquefaction was induced by injecting various amounts of a purified and concentrated hyaluronidase prepared by Dr. Karl Meyer from bull testes; this mucolytic enzyme acts on the substrate of the vitreous. The enzyme dilutions were introduced together with suspensions of the animals' own red cells, which served as the test substance. Early spreading of the red cells and moderately accelerated absorption were observed clinically and histologically in the eyes which had received more than 10 gammas of the enzyme. When the dose exceeded 50 gammas, the treatment elicited a conspicuous inflammatory response from the inner membranes of the eye. Even 2 of 5 eyes of the 50-gamma series reacted with marked signs of inflammation. The rest of that group and the eyes injected with 10 or 25 gammas exhibited early loosening of the clot of red cells and somewhat earlier absorption without apparent toxic side action. It seemed that the partial liquefaction induced by the mucolytic enzyme caused the early spreading of the red cells in the vitreous, and this in turn may have facilitated the speedier breakdown of the erythrocytes and their absorption. It is evident that at the present time the toxic action of a medium dose of the enzyme obviates its practical use.

The problem of active absorption possibly exercised by the ciliary epithelium was studied on the basis of R. Hoeber's

work on the active transfer of a group of sulfonic dyestuffs through the wall of the proximal tubules of frogs' kidneys. Hoeber found that this transfer depended on the polar-nonpolar configuration of the dyestuffs, since the dyes, with the sulfonic groups attached to one of the benzene or naphthalene rings, were transferred through the wall in contrast to the dyes in which each of the benzene or naphthalene rings carried a sulfonic radical. The present experiment on albino rabbits, albino rats, and frogs, with the use of various techniques, did not give evidence that the dye in the vitreous had penetrated the ciliary cells or had accumulated in intracellular vacuoles except in one instance among 60 eyes. Despite the negative results, further studies are warranted.

The influence of the basal metabolism on resorption was again studied on suspensions of the animals' own red cells injected intravitreally. Five litters of albino rats (34 animals) were divided into three groups so that litter mates were distributed among the three series. The first group of 12 rats were thyroidectomized by Dr. G. K. Smelser when the rats were two weeks old. The second group of 12 animals received daily subcutaneous injections of thyroxin (1 mg. per 100 gm. body weight). After the injection of a small amount of the animal's own red cells, the density and extent of the cell deposits in the vitreous were estimated by ophthalmoscopy and graded. The 68 eyes were examined three times a week, and the graded findings were tabulated so that the resorption could be expressed in curves when plotted against time. Thyroxin had no clear effect on the growth of the animals or on resorption of red cells from the vitreous when compared with a control series of 10 untreated normal animals. The thyroidectomized rats showed greatly retarded growth and, in general, flat resorption curves; that is, the red cells disappeared more slowly from the vitreous than in the 20 control eyes.

The last group of experiments was designed along the lines of clinical methods used in the therapy of hemorrhages and other opacities of the vitreous. The effects of subcutaneous and subconjunctival injections of hypertonic salt solutions, of iontophoresis, and of artificial fever were examined. The animals' own red cells or a concentrated solution of inulin introduced into the vitreous was the test substance. Only the short bouts of fever repeated daily for two weeks had, in rats, an indisputably beneficial effect on the rate of disappearance of the red cells from the vitreous (40 animals).

Discussion. Dr. Irving H. Leopold. The vitreous humor has been the subject of investigation by numerous men for many years and has involved a knowledge of special techniques, of physical chemistry, and of ophthalmology. Duke-Elder, Robertson, Hodgeson, Goedbled, Baurmann, and others have worked on this problem for years. None have contributed more to our present knowledge of the vitreous than has Dr. von Sallmann. It was a pleasure to hear him speak on aspects of the vitreous humor, because on this subject he is certainly an authority.

The vitreous humor is a colloidal structure, and as a colloidal structure may exist as a sol or a gel. Sols are colloidal states in which the solid particles are dispersed in a fluid medium, and gels are colloidal states in which the solid particles, so to speak, join hands, and form a framework in which the liquid medium is dispersed.

Most of the evidence, and much of the more recent evidence has been contributed by Dr. von Sallmann, is in favor of the vitreous humor being a gel. It is not a very stable gel. The liquid and the solid phase are in an unstable equilibrium, and

this can be upset easily. When the vitreous gel is disturbed, the transparency of the vitreous is altered.

There are two ways, roughly, in which the vitreous transparency can be changed with the production of vitreous opacities. First, by disturbing the gel of the vitreous and secondly, by the influx of new materials such as red cells, exudates, and foreign bodies. Examples of the first mechanism are senile vitreous opacities. These are thought to be due to the aging of the gel, changing it into the sol state. All gels tend to break down to the sol state as they age. Myopic vitreous opacities are thought to result from movement of the vitreous gel in an enlarged globe. Liquefaction of the vitreous gel by proteolytic enzymes may result in opacities.

The other group of opacities are due to the influx of new material, such as red cells, which Dr. von Sallmann discussed tonight. We all recognize the problem of intraocular hemorrhage as a serious one. Anterior-chamber hemorrhage is still an unanswered therapeutic problem, but vitreous hemorrhage offers an even greater therapeutic problem. In vitreous hemorrhage we are not only concerned with the resorption of blood, but we have to maintain the status quo of the vitreous gel; or reconstruct it, if it is disturbed. Dr. von Sallmann has given us some ideas on the method of reabsorption of the cells, but at the same time has suggested methods which disturb the structure of the vitreous body.

It is interesting to observe workers in other fields of medical science turning to the eye as an aid in solving their own problems. This has happened in the case of the spreading factor. Dr. von Sallmann has reviewed their observations and added more of his own in order to solve some ophthalmologic problems. Duran Reynals found that if vaccinia virus were injected into the testes of rabbits, one could be more certain of takes than if the injections were made in other areas of the body. He could get much more severe infection by such injections. He then found that if an extract of the testes were injected into the skin prior to vaccinia injections, he could also facilitate systemic spread of the virus and increase the number of takes. He thought that the testes extract facilitated the spread of the vaccinia by hydrolyzing the viscous mucoproteins in the connective tissues.

These spreading factors were then found to hydrolyze hyaluronic acid. As you know, Karl Meyer and his coworkers isolated this mucopolysaccharide from the vitreous humor. Other investigators then turned to the vitreous humor, an excellent substrate of hyaluronic acid, as a place in which to compare and study the activity of various spreading factors. They measured the ability of the various spreading factors to reduce the viscosity of the vitreous humor. Most spreading factors are thought to act through hydrolysis of hyaluronic acid. However, ascorbic acid is also known to reduce the viscosity of the vitreous. It does not work theoretically, as the other spreading factors, and for that reason, many people do not consider it a spreading factor. Nevertheless, it can, when properly employed, reduce the viscosity of the vitreous humor, and it is quite possible that it may help in this manner in the resorption of vitreous hemorrhage. Vitamin C has been used in the past as a therapeutic agent in intraocular hemorrhage. It was thought that it built up intercellular cement substance and reduced the capillary permeability, thus preventing further bleeding. It was not generally realized that it might reduce the viscosity of the vitreous, and facilitate greater distribution of red cells and earlier resorption. It may not be as toxic as hyaluronidase and, perhaps, can be injected directly into the vitreous without

producing the untoward effects of hyaluronidase.

The observations of the influence of thyroidectomy on reabsorption of blood are worthy of note. In 1936, Jeandelize and Drouet reported on cases of recurring vitreous hemorrhage. They reported that all of their patients with this disorder had some degree of hyperthyroidism, and felt that they could prevent recurrences by irradiating the pituitary body thus producing lowered thyroid activity. It is interesting that the lower thyroid activity may work toward the prevention of hemorrhagic recurrences, and at the same time retard the resorption of existing hemorrhages.

For years fever therapy or shock therapy have been recommended for resorption of vitreous hemorrhage, usually without any well-founded, controlled experiments to back up the recommendations. Dr. von Sallmann has given us controlled data to show the value of artificial fever.

There is some question about the circulation of fluid in the vitreous humor. As you know, the vitreous body is not thought to have any metabolism. It is supposed to be a product of the surrounding cells. It probably does not utilize oxygen or produce carbon dioxide. Regardless of this lack of necessity for metabolic interchange, there is some evidence of a flow of fluid through the vitreous. This has been demonstrated in rabbits, but not satisfactorily in man. This flow is thought to be from the ciliary body toward the optic nerve. Certainly the diffusion of the red cells would not tend to substantiate the idea of such a direction of flow in the vitreous. The diffusion was in all directions from the site of injection into the vitreous.

Dr. Francis Heed Adler. I had not intended to discuss this paper largely because of a feeling of inadequacy. I rise, as they say in parliamentary language, to a point of order; that is, to object to the statement in Dr. von Sallmann's speech in which he mentioned my name as contributing to our knowledge of the vitreous. Although I have been interested in some of the physiologic problems of the vitreous, the work to which he referred is chiefly work in my laboratory done by Dr. Irving Leopold, and the full credit should be given to him.

It seems to me from what has been said about hyaluronidase that that is practically a closed door. The danger threshold between the effect that is experimentally demonstrable lies too close to production of retinal damage, which is also demonstrable. This is comparable to some anesthetics, which perhaps are good anesthetics, but the threshold of anesthesia is very close to that of death.

I would be interested in having Dr. von Sallmann comment further on the question of thyroxin, particularly in relation to the water-binding properties of thyroxin, and on the anterior pituitary hormone and the part it plays, in producing exophthalmos. I wonder if he has taken into consideration the relation between thyroxin and the anterior pituitary hormone in this particular condition, and whether he has anything further to say on this particular subject, because I think that it is a lead which offers us something.

Finally, I can confirm from the clinical point of view the effects of fever therapy on the absorption of vitreous hemorrhage. It is certainly one of the chief therapeutic measures that we have to draw on at the present time.

Dr. Ludwig von Sallmann. I want to thank Dr. Leopold and Dr. Adler for their interesting discussion. I am sorry that I cannot offer anything on the relationship of the thyroxin experiments to the pituitary function. I did not go into detail on the thyroxin injections, because the results were rather erratic. Sometimes

a fairly significant increase in absorption of the red cells was obtained, but in other instances there were flat absorption curves.

Dr. Francis Heed Adler. Why did you use thyroxin? What theoretical consideration led you to suspect that you might get some effect from thyroxin on the absorption of the vitreous hemorrhages?

Dr. Ludwig von Sallmann (closing). Hans Eppinger studied the effect of thyroid preparations on the water threshold, in 1914, and he described the speedy absorption of tissue fluid in certain types of edema. These observations on the water threshold and the stimulation of the basal metabolism by thyroxin were the theoretical bases of my experiments.

George F. J. Kelly,
Clerk.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

January 6, 1947

DR. BENJAMIN FRIEDMAN, *president*

The program was devoted to a discussion of ophthalmic problems in children.

VISUAL FUNCTIONS IN INFANTS

DR. ALFRED KESTENBAUM said that the time of development of the various forms of eye movements were shown in tests performed on about 70 infants. Optically elicited movement (O.E.M.) means movement toward a peripherally appearing object and hence is a function of a peripheral retinal point. The O.E.M. is a gliding movement which tries to keep the image of a moving object on the macula and hence is a function of the macula. Up to the age of 4 to 6 months there is no gliding follow movement; it is substituted by a cogwheel movement. Optokinetic nystagmus appeared at the age of 3 to 6 months. Acoustically elicited eye movement appears very late, usually not before six months of age. Vestibular reaction of the eye on head rotation, present immediately after birth, was found to be at first in the form of a simple deviation.

Dr. Kestenbaum stated that visual acuity can be estimated by the following procedures: (1) Examination of the direct and of the indirect pupillary reaction: at birth; (2) Marcus Gunn's pupillary test (for optic-nerve lesions): at birth; (3) pseudo-anisocoria test (for optic-nerve lesions): at birth; (4) follows movement test (for disturbance of macular vision): 4 to 6 months; (5) optokinetic nystagmus test (for disturbance of macular vision): 3 to 6 months.

The field of vision can be examined by the O.E.M. test in the form of the fact-test at from 2 to 4 weeks. Eye motility can be studied by: (1) O.E.M. test (possible only if the visual field is preserved): 2 to 4 weeks; (2) vestibular compensation test: at birth. Phoria and tropia can be studied by screening tests.

Marcus Gunn's test consists of alternation between illumination of the right eye with occlusion of the left eye and illumination of the left eye with occlusion of the right eye. If in the first case a pupillary contraction occurs, but in the second a pupillary dilatation occurs, the presence of a lesion of the nerve fibers of the left eye may be assumed. This test is modified in the pseudo-anisocoria test in which the finally resulting pupillary sizes, after occlusion of the right eye, are observed and not the movements of the pupil. After occlusion of the left eye, the size of the pupils are exactly measured and compared with each other. The latter two signs are especially valuable in the diagnosis of retrobulbar lesions. Inability to follow a moving object and absence of optokinetic nystagmus indicate disturbance of macular vision. In the O.E.M. test, an object is brought into the field from without. When the eye turns toward the ob-

ject, it proves that the object has been seen. Systematic application of this O.E.M. test in eight directions gives a fairly good visual field. Dr. Kestenbaum concluded that the strongest attraction on the infant's eye is exercised by a human face entering the visual field.

Management of infantile glaucoma

Dr. David H. Webster reported the operative results in six cases of infantile or congenital glaucoma. All the cases were operated during the first week of life. Three cases in which the tension remained normal following iridencleisis did not develop buphthalmos. One case in which aniridia was an associated anomaly did not do very well following an attempted iridencleisis. In spite of repeated trephinations development of buphthalmos occurred in two cases.

In the course of 35 years, Dr. Webster said that he had seen eight cases. The condition is recognized by the steamy white cornea, 14 to 16 mm. in diameter. The creation of a new filtration channel to compensate for the structural defects in the angle of the anterior chamber is accomplished by iridencleisis.

Retrolental fibroplasia

Dr. Algernon B. Reese stated that for over a hundred years basically related lesions have been reported under various synonyms including tunica vasculosa lentis, congenital fibrous tissue back of the lens, congenital connective tissue in the vitreous with and without detachment of the retina, remains of the hyaloid system, and so forth. Formerly such lesions were rare, and occurred in full-term infants, and were usually unilateral. During the last 10 years there has been an increased incidence of these lesions which have been reported in premature infants and bilaterally.

Dr. Terry has called these more recent cases retrolental fibroplasia. He believes that the condition appeared after birth (not before the fourth month). He considered it a newly acquired disease.

Dr. Reese said that Dr. Payne and he believe that both lesions mentioned are one and the same, basically. He felt that the lesion is congenital, although at times the matrix may be inconspicuous at birth and becomes more pronounced after birth by hyperplasia. He explained the greater incidence on the basis of the fact that more premature children now survive. He called attention to the fact that this eye lesion is frequently associated with hemangiomatous manifestations elsewhere.

Dr. Reese cited the opinion of Dr. Krause that this lesion is characteristically associated with mental retardation, and that these two manifestations are due to a faulty development of the neuroectoderm over that portion where it forms the retina as well as the brain. Dr. Krause called the condition congenital encephalo-ophthalmic dsyplasia. Dr. Reese said that he did not agree with Dr. Krause's concept because:

1. The eye lesion is not characterized by a dysplasia of the retina but by the presence of fibrous tissue in the vitreous. This fibrous tissue may contain any of the derivatives of the mesoderm such as cartilage, smooth muscle, fat, connective tissue, and blood vessels.

2. Remains of the hyaloid artery, or some of this system, is a common finding and would not be expected in retinal dysplasia.

3. Mental retardation due to a brain dysplasia or agenesis does not seem to be an integral part of the lesion. Excluding the cases of hydrocephalus, only 30 percent of these cases show mental retardation. It seems more likely that the mental retardation present in these cases is due to prematurity (82 percent of Dr. Krause's cases were premature), to cerebral anoxia, and to hydrocephalus. Furthermore, autopsy findings presented by Dr. Krause did not seem convincing re-

garding the pathologic evidence of a cerebral agenesis.

Dr. Reese stated that the etiology of this eye lesion is not clear. It seems likely that the same factor producing the prematurity also produces the eye lesion. The mothers of these children give a high incidence of bleeding during pregnancy, and a history of respiratory infection is common. The affected eyes sometimes show evidence of inflammation. This is manifested by residua of iritis or choroiditis, and microscopically by the presence of round cells in some of the cases. There are instances of subclinical maternal infections producing congenital anomalies in the eyes of the offspring. Dr. Reese cited the case of a bilateral retrolental fibroplasia occurring in the offspring of a mother who had rubella in the fourth month of pregnancy.

Discussion. Dr. Kornzweig questioned the possible time of occurrence of the toxic influence. It must occur after full development of the hyaloid system. The hyaloid system reaches the height of its development during the second to third month, then it atrophies. The ciliary processes are formed after the third month and touch the lens after the fourth month. The toxic influence must, therefore occur between the third and fourth month concluded Dr. Kornzweig.

Dr. Sitcheska agreed that these patients have well-developed mentality.

Dr. Mandelbaum asked if it is always possible to see the vascular structure of the tissues or whether the lens is too dense.

Dr. Friedman asked whether X-ray studies show areas of calcification, as in glioma. He remarked that in these cases the pupil does not dilate well and if atropine is used glaucoma may result.

Dr. Reese (in closing) replied: (1) That of 18 patients, 16 were normal mentally. (2) In answer to Dr. Mandelbaum's question, that cataractous changes can occur and prevent the view of the tissues and also a cloudy cornea may prevent it. (3) In answer to Dr. Friedman, that X-ray studies do not show any calcification.

Congenital cataract after maternal rubella

Dr. Charles Perera stated that the occurence of congenital malformations (cataract, cardiac abnormalities, mental retardation, deaf-mutism, and other defects) following maternal rubella was reported from Australia in 1942 by Gregg, and confirmed the following year by Swan and his colleagues. Reese brought this to the attention of American ophthalmologists in 1944. Since then a number of reports have appeared on this subject.

The ocular pathologic changes reported by Swan in three infants dying from congenital defects, by Terry, and by Cordes and Barber in an 8-week-old embryo showed retardation in the development of the involved eyes, necrosis of the nuclear portion of the lens, and degenerative changes in the equatorial lens fibers. These findings are consistent with the clinical observations of microphthalmos, nuclear cataract, and diffuse lens opacification in these children. Microscope preparations of the eyes of a 10-week-old fetus, obtained from a woman who had rubella during the seventh week of pregnancy, show degenerative changes in the fetal lenses in the central and posterior portions.

A patient seen in November, 1946, was the 3-year-old daughter of a woman who had rubella late in the second month of pregnancy. The girl was unable to walk or talk, and had diffusely hazy lenses and a variable esotropia.

Dr. Perera discussed the treatment of congenital cataract with special reference to extraction of the lens, needling, and through-and-through discission of the lens.

This type of cataract may result from the passage of the virus or toxic substances through the placenta into the fetal circulation or through the amniotic fluid. He stressed the need for further investigation of this subject by studies in the field of pathology and by more surveys such as those reported from the Vanderbilt University Hospital, in 1945, by Conte, McCammon, and Christie.

Discussion. Dr. Smith asked whether discission should be performed during the first or second month of life, or be postponed to the 11th to 12th month. Dr. Smith also agreed on the use of a through-and-through discission because of the danger of glaucoma.

Dr. Perera (in closing) replied that in his opinion early operation is advisable before the sixth month, preferably during the second or third month.

Strabismus in childhood

Dr. James W. Smith presented this subject. His paper is published in full on page 85 of this issue of the Journal.

Bernard Kronenberg,
Secretary.

SOCIEDAD OFTALMOLOGICA DE MADRID

February 21, 1947

Profuse hemorrhage in pterygium

Dr. Marin Amat and Dr. Marin Enciso presented the case of a woman, aged 57 years, who was admitted to their service in the ophthamologic clinic of the Provincial Hospital in Madrid. The patient presented a chronic suppurating dacryocystitis and an internal membranous pterygium in both eyes. She was operated on and both lacrimal sacs were removed in one session without anything abnormal occurring either during the operation or after the operation.

A few days afterwards, on December 3, 1946, they removed in one session both pterygia similarly without the least complications. The postoperative course was perfectly normal and on the seventh day the bandage was removed. But during that night the right eye began to bleed and it was necessary to bandage the eye again in order to check the bleeding. The next morning the bandage was removed. On the night of the same day, another hemorrhage occurred in the small operative wound of the pterygium of the right eye, but this hemorrhage was very profuse. It was not possible to check the bleeding with a compression bandage because the latter became immediately saturated with blood. The doctor on duty had to renew the bandage several times and give many coagulating injections of cebion E (vitamine K), coaguleno, and zimema, without being able to stop the bleeding effectively.

The following morning the patient was in shock (cold, with a barely perceptible pulse, with vomiting), necessitating the giving of a subcutaneous injection of 500 cc. of physiologic saline and also a transfusion of 300 cc. of whole blood. By these means the hemorrhage was stopped and did not recur. Thereafter the patient slowly improved and was discharged as cured on December 23rd.

In view of such an important complication we undertook to investigate the etiology, but nothing in the family history or the biologic analysis gave any clear insight into the cause. The only outstanding factor was that the woman was in very poor circumstances and had subsisted for a long time on practically a hunger diet, which indicated that she was in a state of avitaminosis with a consequent lack of vitamin K and a reduction in the production of thrombokinase.

Pseudoglioma of metastatic origin

This was a case of a little girl, aged 26 months, who showed a morbillous exanthem with temperature and sudden appearance. All of the symptoms disappeared the following day. The next day

she awoke with her whole body swollen. There was intense oliguria and an analysis of the urine showed albuminuria, hematuria, and cylindruria. Two days passed without any change in the picture. On the fourth day of the sickness there appeared a whitish spot, ring shaped, which covered a large part of the pupil of the right eye. A similar spot appeared on the left eye the following day. The eyes presented a picture of a bilateral uveitis with an intense ciliary reaction and with hypopyon. On the same day penicillin was administered (27,000 units every three hours) until a total of 1,700,000 units had been given. The general condition became improved. The spot in the left eye disappeared in the first 24 hours and that on the right eye after about 10 days.

When the child was examined on January 17th, there was a slight circumcorneal congestion and dilated pupils without reaction to light but without any inflammatory manifestations at the anterior pole. With the ophthalmoscope could be seen a yellowish white mass in the vitreous body in both eyes which prevented a view of the fundi of the eyes and verified the absence of vision. There was hypotension in the right eye.

Three phases in this clinical history stand out: (1) general symptoms; (2) the false picture of nephritis, which showed the time that intervened between the general infection and the ocular metastasis; (3) the presence of ocular symptoms.

The diagnosis is a pseudoglioma of both eyes of metastatic origin subsequent to a septic process from which the patient had suffered. Prognosis as to vision is unfavorable because one could not hope for any recovery of vision. The chief point to emphasize is the success of penicillin in the treatment of ocular metastasis without which, in this case, probably both eyes, certainly one of them, would have terminated with a panophthalmitis.

FOREIGN BODY IN SCLERA

DR. MARIN AMAT presented a case of a foreign body embedded in the external sheath of the sclera alongside the optic nerve after having crossed the eyeball. It was a case of an accident of occupational origin, relating to a railroad worker who, while working on the track on January 21, 1947, was struck in the right eye by a foreign body. Radiographs of the orbit were immediately taken, one frontal, one lateral, the latter in two exposures (while looking up and while looking down) which were positive and showed the presence of an intraocular foreign body.

Consequently, a search was made by the scleral or posterior route and the proper point of the giant electromagnet was introduced into the operative wound. Notwithstanding repeated trials, removal failed and enucleation of the eye became necessary. A couple of days afterwards the eye was removed. On dissecting it the following details were noted: (1) Total detachment of the retina with abundant yellowish subretinal liquid. (2) Absence of any intraocular foreign body. (3) The presence of a circumscribed hemorrhagic focus in the ciliary region and an extensive zone of whitish infiltration in the process of organization. (4) What had seemed to be foreign bodies in the lens and in the retina were nothing more than a true tattooing by the iron salts. (5) The hard nodule alongside the optic nerve showed on dissection to be a small piece of iron, triangular in shape with a pointed vertex, which was imbedded in the external sheaths of the sclera, in Tenon's space, and encased by reparative tissue arising from the external sheath of the optic nerve and from Tenon's capsule. These explained the various findings which resulted from the path of the foreign body, and also explained the false radiographic localization.

Joseph I. Pascal,
Translator.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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OPHTHALMIC PUBLICITY

At the recent meeting of the American Academy of Ophthalmology and Otolaryngology, there were two important contributions, the public and press reactions to which merit some comment. These two contributions both dealt with procedures which had been highly and luridly publicized in the lay press. Both contributions were largely negative in their conclusions. Through the public relations officer of the Academy, the representatives of the press were authoritatively informed of the negative results. These negative conclusions, the results of long and patient investigation, received, with one or two notable exceptions, little or no comment in any of the newspapers, whereas the gaudy claims of the proponents of these forms of therapy, claims based on personal enthusiasm and unsupported by scientific investigation, had previously been heralded far and wide across the country by the various news agencies.

The first of these contributions related to

the corneal-transplant operation. The careful studies of the five speakers in the symposium showed the operation to be one of limited applicability, of uncertain results, with many contraindications, and was especially contraindicated in patients with vision of 20/100 or better, where there was a greater chance of permanent blindness than of improvement of vision. At best, in the over-all statistics, only approximately one third of the patients undergoing this operation had material improvement of vision. It was quite true, however, that in specially selected cases, notably in keratoconus and slight central corneal scarring without undue vascularization, spectacular visual improvement, not possible by any other means, might be expected in a materially higher percentage of cases.

The second contribution dealt with the results of tissue therapy and the administration of cod-liver oil in patients with pigmentary degeneration of the retina, the so-called Filatov treatment. Here a careful investigation of the results of this treatment in a large number of patients failed to reveal any evidence supporting the wide claims made by the proponents of this form of therapy. A limited number of the patients showed some slight subjective improvement in the usual level, but in no greater number and of no higher degree than had been reported with the other widely different forms of treatment formerly proposed—vitamin therapy, sympathectomy, estrogenin and androgenin treatment, vasodilators, and reduction of the intraocular pressure. Objective examination of these patients, before and after treatment, showed little or no change in the visual fields or light adaptation. The conclusion appeared inescapable that, so far as this careful investigation was concerned, there was no evidence at hand to support the extravagant claims which had been so widely made.

At first glance it appears surprising that the various news agencies, whose function it is to disseminate "news," and the lay press of the country, which should strive to lay pertinent information before the public in readable form, exhibit little or no interest in negative results. On thought, however, the answer appears easy. Negative results are not "news," and the publication of results invalidating already published claims is, at best, only a wet blanket and, at the worst, may precipitate on the heads of the publishers recriminations and even damage suits.

A case in point which well illustrates this is the attitude recently taken by the Curtis Publishing Company. The question of various eye exercises for myopics had been widely publicized, and indeed apparently endorsed by a number of prominent periodicals. The Curtis Publishing Company had taken no part in this publicity, but nevertheless was deeply interested in its possible humanitarian application and its publicity value. Through the agency of the editor-in-chief of one of their major publications, they undertook to finance a thorough investigation of the possible beneficial results of such treatment. As a result of their offer, a joint investigation of this treatment was undertaken by a group of psychologists and optometrists on the one hand, and the team from the Wilmer Institute staff on the other. The Wilmer Institute team acted only as judges of any results observed. The results of this study, published in full in the medical press, were largely negative. These negative results were duly transmitted to the Curtis Publishing Company who, since they had financed the psychology-optometry phase of the investigation, had just right for first publication after the reports had appeared in the medical journals. However, in as much as the results were negative, the Curtis Publishing Company had no interest in publishing them or commenting upon them. They simply charged off their investment. The publication of the results, from their standpoint, might only have touched off a controversy, uninteresting to the great body of their readers, and in which they had no inclination to participate.

Such a specialty as ophthalmology is par-

ticularly susceptible to the ill results of misleading publicity. The blind have an emotional appeal to the seeing world. Any form of treatment which promises to alleviate or cure blindness is immediately of interest to the general public, any claims supporting such treatment find sympathetic ears, and any agency endorsing the proposed form of therapy finds ready supporters. In short such forms of treatment are interesting and appealing "news," which the public is anxious to read and the press, therefore, correspondingly anxious to publish. While, undoubtedly, in many instances the publicizing of these unproven forms of therapy is animated by the most altruistic motives, nevertheless in other instances this does not appear to be true. It must regretfully be admitted that there are a few ophthalmologists who avail themselves of this sentimental appeal for the purpose of self-advertising. Were the news agencies as industrious in circulating the results of investigations which disprove these spectacular forms of treatment, and the lay press as eager to print them as they are to publicize the original claims, it might well have a deterrent effect on the self-advertisers.

Although the reaction of the press to negative results is understandable, the question may well be asked—does it reflect a healthy interest in the public welfare and is it in line with the humanitarian motives which one would assume underlay the dissemination of information relating to these apparent cures? There the answer should be an unequivocal "No."

As was pointed out in the discussion of the paper on pigmentary degeneration of the retina, mankind is afflicted with a host of maladies, often congenital or degenerative, about which the conscientious physician can do little or nothing. These unfortunates are constantly seeking for some relief or cure of these conditions for which they can obtain little alleviation from legitimate doctors. They are ripe fruit, ready for the plucking. As the late Sir William Osler once remarked, "People love to be fooled, and the sons and daughters of Circe are still in our midst." When there is a demand, there is usually a supply. The publicization of unproven and often utterly fallacious remedies is followed by a deluge of inquiries on the doctors and medical centers for information as to their value. There must then ensue a long period of patient investigation to validate or invalidate these claims. If the claims are validated, as is rarely the case, the fundamental investigator receives but scant public recognition—the bulk of the glory goes to the proposer or instigator of the treatment, to the man who thought up the dream. If the claims are invalidated, the investigator gets no thanks for his labors, and may often be the subject of attack in one form or another. At the best the whole incident is quickly forgotten.

The lay press cannot escape its responsibility. If the press is willing to publish the unfounded and unproven claims of enthusiasts and self-advertisers, to give them wide publicity, and often to make them the subject of special articles and Sunday features, it should be equally willing, even anxious, to follow up the subject and give equal publicity to legitimate releases of investigators which disprove the former extravagant claims. If false hopes are aroused in the minds of sufferers from untractable ailments by injudicious publicity, the same agents responsible for the publicity should do what they can to rectify their error. Only thus can their public duty be discharged. The present policy of exploiting sensational claims and soft-pedaling the results of investigations which disprove these claims, is playing into the hands of self-advertisers and, in some cases, of charlatans.

Alan C. Woods.

ECLIPSE RETINITIS

On November 12th there occurred a partial eclipse throughout the greater part of the United States. Along the Eastern Sea-

board the time of its visibility varied between 16 and 34 minutes. In the San Francisco Bay area the duration was two hours and 31 minutes.

During the two weeks following the eclipse the staff of the Division of Ophthalmology of the University of California saw 23 cases of eclipse retinitis. There must have been many more cases observed by other ophthalmologists and many more persons must have had light attacks that cleared quickly and therefore were not seen.

Most of the cases occurred in children between the ages of 11 and 15 years, although there were also some adults. All gave the history of loss of vision following the observance of the eclipse without protective glasses or film. Vision at the time of examination ranged from 15/200 to 20/30. Examination of these patients revealed that many of them had a central scotoma, while in some instances a relative scotoma was present.

On fundus examination the macular area showed an edema which in two of the cases corresponded in shape to the actual eclipse. In one patient the retina had the appearance of a central angiospastic retinopathy. At the end of two weeks, vision had returned to normal in most instances with no appreciable fundus changes. In one boy, aged 13 years, vision has remained at 20/40 and the appearance of the macula in each eye suggests an early hole in the macula. In another patient, a Negress, vision has remained at 20/70 in each eye and the macula has the appearance of an early hole in the macula.

Most of the patients were unaware of the possibility of damage to the eyes from looking at the eclipse without the proper protection. In one instance, a boy, aged 11 years, looked at the eclipse while at school under the direction of the teacher. He was given some sort of dark glasses but apparently did not use them all of the time. Some of the patients had the belief that an ordinary pair of so-called dark glasses was sufficient protection. In any event, it was apparent that the laity has not been sufficiently warned of the dangers of eclipse retinitis.

"Eclipse burns" are not new and have been observed many times. During the last war they were seen a number of times among Navy personnel. It was usually observed following the use of the long glass, a monocular telescope of 20 times magnification. The burns usually resulted from "following an enemy plane into the sun." There was pain at the time of the exposure followed by loss of central vision and subsequent formation of a typical hole in the macula.

The process results from the passage of infrared rays through the layers of the retina to be absorbed by the pigment layer, where they are degraded into heat and may produce a thermal lesion. This is accompanied by swelling and edema of the retina, together with congestion of the underlying choroid, and frequently leaves a permanently pigmented scar. Probably the most extensive work on this subject is that of Verhoeff and Bell* who showed that the effects known as eclipse blindness are wholly thermic and are due to the intense concentration of the solar energy upon the retina by the refractive system of the eye itself.

Clinically the immediate effect in the milder cases is a marked scotoma which does not pass away promptly but leaves more or less "serous cloudiness" of vision that may last a few weeks. In the severer cases the scotoma is commonly central and generally of small extent, in a large percentage of cases corresponding fairly well to the dimensions of the sun's image. Wide variations from this may result due to repeated fixations overlapping. Metamorphopsia sometimes appears. In the milder cases, the scotoma tends to contract with the lapse of time, and normal vision is regained within some weeks; whereas, in the more severe cases the scotoma and loss of vision are per-

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* Verhoeff, F. H. and Bell, Louis. Proc. Amer. Arts and Sci. 51:630-811 (July) 1916.

manent. Experimentally Verhoeff and Bell were able to show that the size of the lesion is 3 mm., corresponding in size to the size of the sun's image on the retina. They also give the critical time for the development of eclipse blindness as one minute or less. Based on the cases seen among Navy personnel, it would seem that the use of the "long glass" apparently very materially shortens the time of exposure necessary to produce eclipse blindness.

Eclipse blindness is discussed in most of the textbooks but in almost none of them is there any description of the proper precautions to be taken to avoid damage to the eyes. Duane in Fuchs's textbook states that eclipse blindness occurs in patients "who watched an eclipse with glasses which were not sufficiently smoked." No mention is made of what constitutes a "sufficiently smoked" glass.

An eclipse of the sun is usually described in the press a number of days in advance so that the appearance of the phenomenon is well known. In view of the experience in San Francisco and other localities it would seem the duty of the ophthalmologists of a community to issue a warning through coöperation of the local county medical society and the press. These warnings could also describe the necessary precautions. It has also been suggested by a member of the staff that the National Society for the Prevention of Blindness or some similar organization might make it its duty to keep posted on the appearance and location of eclipses of the sun. The society could send press releases to the communities involved, describing the dangers and giving the proper precautions to be employed.

Above all it would seem that teachers should be warned of the dangers so that their pupils would not be exposed to the possibility of permanent loss of vision.

It is hoped that this editorial may stimulate some organization to give this problem its attention.

Frederick C. Cordes.

OBITUARY

SELIG HECHT
(1892-1947)

On September 18, 1947, the scientific world sustained an irretrievable loss in the untimely and sudden death of Selig Hecht, a distinguished investigator and teacher, and professor of biophysics in Columbia University. Dr. Hecht's achievements in the



Courtesy of *Newsweek*

Selig Hecht

field of general physiology and, in particular, visual physiology, rightfully gave him the distinction as a world authority on visual function.

Dr. Hecht was born in Glogow, Austria, on February 8, 1892, and was brought to this country by his parents when he was six years of age. He attended public school in New York City and later the Townsend Harris Preparatory School before entering the College of the City of New York where, as a student, he early displayed that rare intellectual curiosity and scientific ability which so characterized his entire career. Before the completion of his college course, he served as research assistant for

the United States Bureau of Fisheries. After receiving his B.S. degree he was appointed for a year as assistant pharmacologist in the Bureau of Chemistry of the United States Department of Agriculture. He then undertook graduate work at the Harvard Zoological Laboratory, receiving his Ph.D. degree in 1917. During his graduate years, he was an Austin teaching fellow at Harvard University. The summer following the receipt of his doctorate he conducted scientific research at the Scripps Oceanographic Institute at La Jolla, California. In the fall of 1917 he went to Omaha, Nebraska, where he served for four years as assistant professor of physiology in the Creighton Medical College. During the summers of these years, he carried on intensive investigations at the Marine Biological Laboratory at Woods Hole, Massachusetts. His researches there were concerned largely with the photosensitivity of the mollusca. These studies laid the basic foundations for his later investigations which dealt primarily with the photochemistry of human vision.

In 1921-22, Dr. Hecht went to England on a National Research fellowship and became an investigator in E. C. C. Baly's Spectroscopy Laboratory at the University of Liverpool. Upon return to this country, he was associated for two years with the late Prof. Lawrence J. Henderson in the laboratory of biochemistry at Harvard University. With the aid of a Rockefeller Foundation fellowship, he again went abroad, spending the year, 1924-25, at the zoological station in Naples, Italy, and the following year in Barcroft's Laboratory in Cambridge, England. In 1926, he was appointed associate professor of biophysics in Columbia University and, in 1928, was promoted to full professorship of biophysics, which position he held until his death.

The broad training in physics, chemistry, and biology that he received in this country and abroad equipped him most admirably for his scientific career. Physics and chemistry were precision tools which he used most effectively in his investigations on the kinetics of retinal photosensory processes. His bibliography, consisting of 116 publications, is concerned largely with the problems of vision in man and in animals. He wrote extensively upon many fundamental aspects of the subject, such as retinal adaptation to changing illumination, visual acuity, color vision, and the like. In recent years he became intensely interested in Planck's quantum theory of light as applied to human vision. In this connection he measured the number of light quanta necessary to produce a minimum stimulation of the human retina. As national Sigma Xi lecturer in 1944, he lectured on this subject in many American universities under the title "Energy and Vision."

During World War II, he was active in many projects concerned with vision as related to the armed forces. He was responsible investigator for various contracts for the armed forces and the O.S.R.D. He was a member of the Army-Navy O.S.R.D. Vision Committee which, after the war, became the Army-Navy National Research Council Vision Committee. Recently he lectured before the National War College in Washington on the subject "Scientific Discoveries and Social and Military Needs."

Dr. Hecht was also made a member of the Emergency Committee of Atomic Scientists, a group of nine scientists headed by Dr. Albert Einstein and formed for the purpose of acquainting the public with the problems of atomic energy. In this connection his recent and timely book *Explaining the Atom* has received high praise as a popular exposition of nuclear energy. In an editorial tribute to Professor Hecht for this book, the *New York Times* said, "We need more research scientists and teachers like him—men who are as brilliant in the laboratory as they are in the classroom or on the printed page, and, above all, men who have so little academic snobbery in them that they consider it a duty, as Clark Maxwell did in his time, to talk of science to the

common people in simple homely figures of speech that they can understand."

Dr. Hecht did possess that rare ability to discuss highly technical data in such fashion as to make the subject intelligible and stimulating to practically any audience. If he was forced to employ equations, he made sure the audience understood what the equations meant. As a lecturer he was dramatic. His subject matter was always presented with excellent logic or, may I say, with logical excellence. To listen to him develop a subject for an hour was indeed an aesthetic pleasure.

Despite Dr. Hecht's devotion to his laboratory and the many problems that constantly bothered his searching mind, he graciously shared his time for the benefit of others. He was a member of the editorial board of the *Columbia Biological Series,* the *Biological Bulletin,* the *Monographs on Experimental Biology,* and the *Journal of the Optical Society of America.* He gave freely of his time to lecture on various biologic subjects at the New School for Social Research in New York City. Recognition of his scientific achievements came to him in many forms. In 1941, he received the Frederick Ives Medal from the Optical Society of America, and, in 1942, the Townsend Harris Medal from the alumni of the College of the City of New York. He was a fellow of the American Association for the Advancement of Science, a member of the National Academy of Sciences, American Society of Zoologists, American Society of Naturalists, American Physiological Society, Optical Society of America, Harvey Society, Phi Beta Kappa, and Sigma Xi.

Although Dr. Hecht possessed a high degree of individualism, he was never a lone worker. He gave a great deal of time and energy to his graduate students, who received excellent training under his scientific leadership. A number of his students have taken prominent academic positions in the field of general physiology. Not only is his passing a tragic loss to the scientific world, but as acting President Fackenthal of Columbia University so aptly expressed it, "He will be missed by many people, in many ways."

Samuel R. Detwiler,
Professor of Anatomy,
Columbia University.

CORRESPONDENCE

The search for aqueous veins

Editor,
American Journal of Ophthalmology:

The following may answer questions raised by some visitors to my aqueous-veins exhibit at the October meeting of the Academy of Ophthalmology, concerning the difficulties connected with the search for aqueous veins.

In 1941, I found them in more than 26 percent of the patients examined with the Bausch and Lomb corneal microscope (American Journal of Ophthalmology, 25:32, 1942). But even with a simple 10-

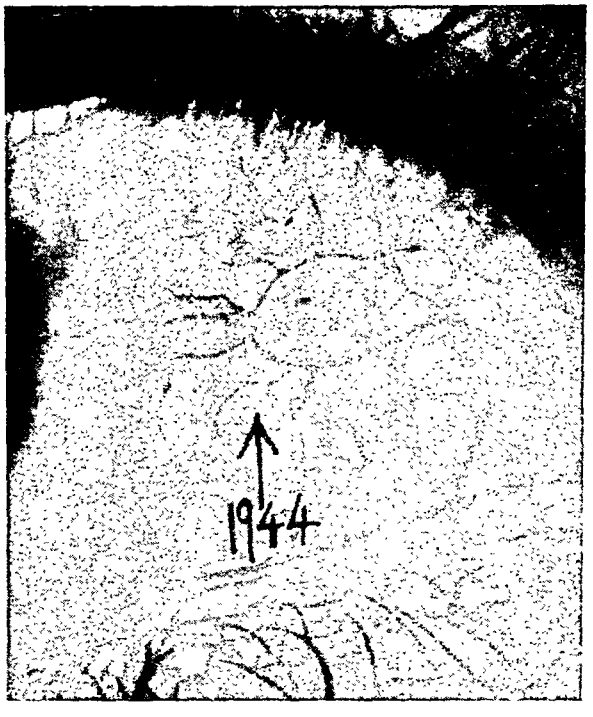


Fig. 1 (Ascher). An aqueous vein and its emptying into a stratified vessel. (5×)

times magnifying loupe, under good flash-light illumination, 14 percent of all normal eyes will show at least one aqueous vein (American Journal of Ophthalmology, 29:1384, 1946).

With 20- to 40-times magnification, and good illumination with not too narrow a

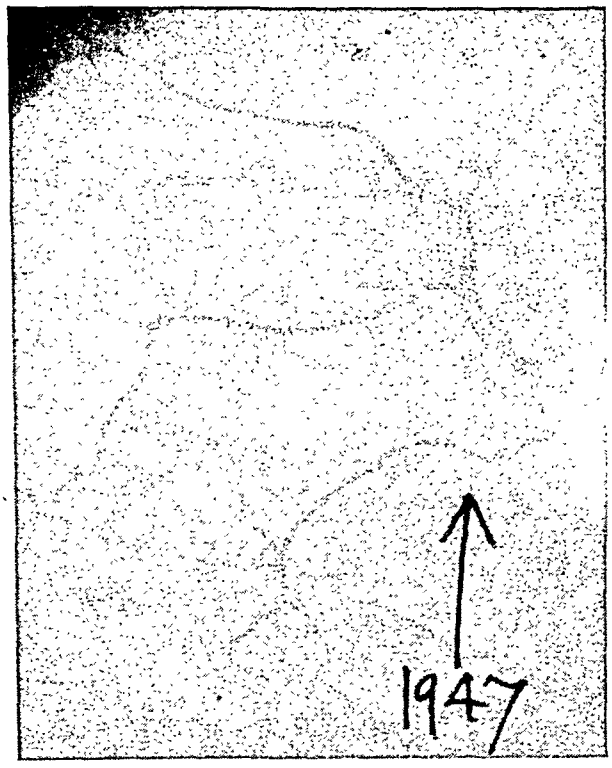


Fig. 2 (Ascher). A picture of the same vein taken 35 months later. (20×)

beam, aqueous veins are found more often. Goldmann (Ophthalmologica, 111:147 1946) saw them in 75 percent of all normal eyes; De Vries (De zichtbare afvoer van het kamerwater, Drukkerij Kinsbergen, Amsterdam, 1947) examined 113 patients and found in all of them at least one aqueous vein; he, however, devoted to the study of one patient—including photography—as much as two hours and confessed that in some cases the search for an aqueous vein was comparable to the search for a needle in a haystack.

While I thought that the majority of aqueous veins were located near the nasal and temporal horizontal meridian, Goldmann found most of them in the temporal lower and nasal lower quadrants and De Vries counted, among 409 aqueous veins, 168 in the nasal lower quadrants.

Here, I should repeat some of the diagnostic characteristics described five years ago (American Journal of Ophthalmology, 25:1183, 1942): The origin is in or near the limbus, often with a U-like or figure-6-like arch, or from the limbal capillaries, or—these are the largest and deepest aqueous veins—from a scleral emissary. The color of the aqueous veins is paler than that of regular veins—sometimes it is as clear as water—and often strata of different shades are seen running parallel to each other along the vessel wall. The width of aqueous veins is approximately between 0.01 and 0.1 mm. and their length varies between fractions of millimeters and one centimeter or slightly more.

Having published numerous drawings of aqueous veins, I think I should add here two photographs showing one aqueous vein and its emptying into a stratified recipient vessel, taken from the same eye of the same patient at an interval of 35 months; both pictures are unretouched and prove the constancy of aqueous veins as anatomic structures.

(Signed) K. W. Ascher,
Cincinnati, Ohio.

Inverse cyclodialysis

Editor,
American Journal of Ophthalmology:

In the July, 1947, issue of the Journal is an article by Dr. Robert N. Shaffer about inverse cyclodialysis. In the same issue Dr. H. Saul Sugar recommends the inverse method as preferable because it tends to reduce trauma.

Blaskovics gives a complete description of the inverse cyclodialysis in his book "Eingriffe am Auge" published in 1938. A horizontal incision, 10-mm. long, is made above the insertion of the superior rectus, 10 mm. from the limbus. For fixation, Blaskovics recommends a suture through the superior rectus or a strabismus hook. The capsule is

opened directly below the insertion of the muscle and the sclera is exposed.

A strictly radial scleral incision is made at the 12-o'clock position, starting below the insertion of the superior rectus extending 4 mm. toward the limbus. The dialysis is performed exactly as described by Shaffer. If one wishes another dialysis, it is performed in the opposite direction, but Blaskovics found keratic precipitates if the dialysis was too extensive. He does not mention any difficulties in reintroducing the spatula. Maybe he was such an excellent surgeon that there was no bevel with his incision.

Since reading Dr. Shaffer's paper, I have used the inverse cyclodialysis in several cases with equally good results. The main improvements in this operation since it was originated by Blaskovics seem to me to be the following:

1. Gonioscopy for the selection of the best operative site.
2. Fixation of the eyeball with a scleral suture if the incision is not done below the superior rectus muscle.
3. Air injection into the anterior chamber to prevent or stop bleeding.
4. Postoperative position of the patient's head.

Dr. Shaffer and Dr. Sugar deserve great credit for their papers which reintroduce and modify the inverse cyclodialysis for American ophthalmologists.

(Signed) Ernest E. Hessing,
Oakland, California.

BOOK REVIEWS

GIFFORD'S TEXTBOOK OF OPHTHALMOLOGY. By Francis H. Adler, M.D., professor of ophthalmology, Universty of Pennsylvania Medical School. 4th edition. Philadelphia and London, W. B. Saunders Company, 1947. 512 pages. Price, $5.50.

This book, termed by the publisher the fourth edition of "Gifford's Textbook of Ophthalmology," has undergone such radical changes in appearance, arrangement, illustrations, and text that it might well have been offered as a completely new volume. The reputation of Dr. Adler is such that one would not have thought it necessary for the publisher to capitalize on the Gifford name while at the same time eliminating most of the personality of the original author. Carful comparison of the present edition with the third edition reveals occasional sentences and paragraphs retained in unchanged form but for the most part the text has been completely rewritten with some material omitted and a considerable amount added. Numerous new illustrations, many of them excellent, have been included.

Dr. Adler's interest in physiology has led to the inclusion of much subject matter not ordinarily found in a textbook of this scope. Considerable detail is presented on the visual pathways and 50 pages are devoted to disturbances in ocular motility. That these are accurate and well presented will be anticipated by any reader familiar with the author's (revisor's) teachings and writings but it may be wondered whether much of this material is not at the level of postgraduate teaching. On the other hand, methods of refraction and surgical procedures have been greatly minimized, as is proper in a textbook prepared ostensibly for undergraduate medical students and general practitioners. The chapters on "Ocular Manifestations of General Disease" and on "Ocular Disorders Due to Diseases of the Central Nervous System" are particularly valuable and appropriate.

Another innovation is the addition of bibliographic references at the end of each chapter. These have been somewhat arbitrarily selected and are far from complete but may suggest additional reading for the more advanced student.

Many of Dr. Gifford's special procedures in therapy, such as delimiting keratotomy and the use of trichloracetic acid in corneal ulcers, are briefly mentioned but not always as originally advocated. For example, in the use of trichloracetic acid the essential thing

is to have no excess of acid on the very fine-tipped applicator (Gifford always removed the excess by wiping on his thumb nail) and not the subsequent irrigation with normal saline as advocated in the present text. The metric system for recording visual acuity has been substituted for the "foot" system, although the latter continues to be the most widely used in this country in spite of all theoretical objections.

There is naturally a legitimate difference of opinion as to what a textbook on ophthalmology intended for use by medical students should contain. The author of any such text is obliged to reach a compromise between completeness and the brevity and concise presentation essential to his purpose. Unfortunately, the medical curriculum is so crowded that in most schools ophthalmology, the "queen of the specialties," is often relegated to an undeservedly inferior position on the part of the administrative authorities and students. The number of hours assigned for didactic and clinical work in this field are wholly inadequate for a highly comprehensive study. Students have neither the time nor the inclination, unless they possess a very unusual interest, to read voluminous treatises on the eye. The particular task of the teacher, then, is to emphasize the recognition of the more important eye diseases and particularly the relation of the eye to general disease. In correlation with this, reference books aimed at this particular educational level are essential.

As a *reference book* for undergraduate medical students and general practitioners this new edition of Gifford's well-known textbook, rewritten by Adler, is excellent and deserves wide use. The format and typography are pleasing and the material is well prepared and authentic. Its greatest value, however, lies for students at the postgraduate level who, beginning a real study of ophthalmology, seek a simplified dissertation on the eye before delving into the more complicated and extensive discussions found in the standard reference books and in the current literature. It would also not be surprising if practicing ophthalmologists found it extremely convenient and useful.

William A. Mann.

A HANDBOOK OF OCULAR THERAPEUTICS. By the late Sanford R. Gifford, M.D. Revised by Derrick Vail, M.D., D.O. (Oxon.). 4th edition. Philadelphia, Lea & Febiger, 1947. 336 pages. 66 illustrations. Price, $5.00.

In the revision of Gifford's masterpiece, Vail has blended with admirable skill the personal approach of the original author with the later advances in ocular therapeutics. Gifford's teaching has been most influential in determining modern therapeutic practice, especially among the younger ophthalmologists, and his handbook has become a recognized classic in its field. As administrator of this heritage, Vail was a natural choice both because of his long intimacy with Gifford and their common background of professional ideals and ophthalmic tradition.

Future editions, while preserving the best of Gifford's contribution, will undoubtedly reveal more of Vail's own personality. Revision involves the triple responsibility of creation, preservation, and destruction. In the present volume, Vail has been probably unduly conservative in adding new material or deleting old. Among the additions are recent studies in chemical burns of the cornea, the newer therapy of seborrheic blepharitis, a discussion of D.F.P. (diisopropyl fluorophosphate), typhoid vaccine for vasodilatation, and the differential treatment of thyrotoxic and thyrotropic exophthamos. Agents whose place in ocular therapeutics is not yet established, such as rutin, the antihistamin drugs, and the newer mydriatics have been judiciously omitted.

Some new ideas that might have been included are glycerine for clearing the cornea in acute glaucoma to permit ophthalmoscopy, the diagnostic patch test for tuberculosis,

BAL (2,3- dimercaptopropanol) for the elimination of arsenic in tryparsamide and other reactions, gelfoam and thrombin for hemostasis, and merthiolate and zephiran as alternative preservatives for ophthalmic solutions. In the discussion of sulfonamides, their mechanism of action is insufficiently detailed, sulfapyridine might well be omitted, and sulfadiazine given much more emphasis. Sulfacetimide is no more than listed. The text reflects the previous need for economy in the use of penicillin, but the present tendency is toward massive concentration in subconjunctival injections and in ophthalmic ointments. The deteriorating action of adrenalin on penicillin is more than counterbalanced by the prolonged localization that its proper use insures.

The book deals brilliantly with office surgery, but neglects attention to some aged but excellent procedures, such as cautery puncture for ectropion, entropion, and lymphangiectases, Agnew's incision for acute dacryocystitis through the cul-de-sac, and Crigler's compression maneuver for congenital impatency of the nasolacrimal duct.

Each edition of Gifford's *Therapeutics* has been a significant improvement over its predecessor, and the present edition meets the challenge worthily. This slim volume, though crammed with information, is written with an effortless style that makes cover to cover reading as enjoyable as the contents are profitable.

James E. Lebensohn.

FUNDAMENTALS OF CLINICAL NEUROLOGY. By H. Houston Merritt, Fred A. Mettler, and Tracy Jackson Putnam. Philadelphia, The Blakiston Company, 1947. 289 pages, 96 figures, index. Price, $6.00.

Ophthalmologists, as a general rule, confess to some weakness in neurology. Most of us are aware of the neurologic conditions that lie within our field, but not many are truly expert in this branch of medicine that is so important to ophthalmology. The authors have given us a much needed tool with which to work. The volume is beautifully illustrated and executed. It covers the entire field of clinical neurology in a most economical yet lucid fashion, and the reputations of the authors vouch for its accuracy. Ophthalmologists will find it most useful in refreshing their recollections of neurologic disorders, and valuable in the interpretation of problems met with in their daily practice.

Derrick Vail.

DISEASES OF CHILDREN'S EYES. By James Hamilton Doggart, M.D., St. Louis, C. V. Mosby Co., 1947. Clothbound, 288 pages, 210 illustrations, including 32 colored plates. Price, $10.00.

In his preface, the author disclaims any special knowledge about this particular phase of ophthalmic practice. He also states that he did not have a large clinic on which to draw for material, but because of his wartime assignment he had become interested in the subject and had thought that collecting in one book the material from previous publications that might be considered particularly applicable might serve a useful purpose. The reviewer thinks that he has done this satisfactorily but that all of the material is available in the best textbooks. It is hard to understand the need for a book devoted exclusively to the eyes of children. However, if one desires a book confined to the problems of this subject, he might add this volume to his library. It is well prepared, of an acceptable size, in good print with good illustrations and a substantial binding, characteristic of the products of this publisher.

Lawrence T. Post.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Haden, Henry C. **The development of the ectodermal framework of the optic nerve, with especial reference to the glial lamina cribrosa.** Am. J. Ophth. 30:1205-1214, Oct., 1947. (15 figures.)

Wilczek, Marian. **The lamina cribrosa and its nature.** Brit. J. Ophth. 30:551-565, Sept., 1947.

Since the work of Fuchs in 1916 there has been little research on the nature of the lamina cribrosa. Fuchs stated that some of the internal fibers of the sclera extend through the nerve fibers across the foramen sclerae and form the sieve that gives this membrane its name. Wilczek made detailed studies by means of serial sections and wax plate reconstructions of the area of the membrane in fetal, post-natal, and adult life. He found that the lamina is composed of neuroglia fibers from the dural and pial coverings of the optic nerve as well as from scleral fibers. It is not an independent structure but is simply the strongest part of the septal system of the nerve. The function of the lamina is essentially the fixation of the nerve in the scleral canal where it is subject to danger of traction. The serial sections proved, in addition, that at the level of the lamina the nerve bundles are subject to the most constriction and hence are most easily damaged by inflammatory processes, edema and intraocular pressure. (14 figures.) Morris Kaplan.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Braley, A. E., and Alexander, R. C. **Virus studies in lymphomatoid diseases of the ocular adnexa.** Am. J. Ophth. 30: 1369-1380, Nov., 1947. (4 figures.)

Brown, A. L., and Nantz, F. A. **Corneal wound healing II: variations in adhesive power of fibrin. In vitro studies** Tr. Am. Ophth. Soc. 44:85-92, 1946.

The authors present experimental evidence of the adhesive power of fibrin in the cycle of corneal healing in the rabbit and dog. By an ingenious method employing standardized corneal strips and various concentrations of fibrin the ten-

sion of the adhesive power of fibrin in experimental wound healing was accurately measured under varying conditions. C. D. F. Jensen.

Carsten, M. E. **A rapid procedure for the embedding of eyes.** Arch. Path. 44: 96-100, July, 1947.

Preparing eyes for microscopic study is a very slow process. Rapid methods of dehydration and embedding cause shrinkage and consequent distortion. Where rapid diagnosis is called for and experimental work is being done a water soluble embedding medium which would not shrink or dehydrate tissues was being sought.

The author describes a method of embedding eyes by means of water-soluble "carbowax" (polyethylene glycol) and "carbowax" ester used in succession. There is no shrinkage, dehydration, or fungus growth associated with the technique. The tissue is well preserved.

By this method sections can be cut as thin as 7 microns, but for easy mounting 10 to 15 microns is preferable.

Francis M. Crage.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Aldrige, W. H., Davson, H., Dunphy, E. B., and Uhde, G. I. **The effects of di-isopropyl fluorophosphate vapor on the eye.** Am. J. Ophth. 30:1405-1412, Nov., 1947. (1 figure.)

Ferraro, A., Roizin, L., and Givner, I. **Ocular changes in rats on diets deficient in amino acids. II. Corneal dystrophy due to valine deficiency.** Arch. Ophth. 38: 342-352, Sept., 1947.

In this preliminary communication, the authors report observations on rats reared on a valine-deficient diet. Changes develop in the cornea, in addition to general changes and structural alterations in other organs, that seem to be the result of edema and progressive degeneration, and gradually lead to keratinization and disorganization of the epithelium of the cornea. These changes in the eye appear to be reversible if treated in time. (6 figures, 11 references.)

R. W. Danielson.

Ferraro, A., and Roizin, L. **Ocular involvement in rats on diets deficient in amino acids. I. Tryptophan.** Arch. Ophth. 38:331-341, Sept., 1947.

During the past four years, the authors have been studying the effects of various diets deficient in amino acid on the growth, development and morphology of various tissues and organs, endocrine glands and nervous system in rats. Ocular involvement occurred with diets deficient in tryptophan and valine. Tryptophan is able to prevent, improve and cure the general clinical, as well as some of the ocular symptoms produced experimentally by tryptophan-deficient diets. These changes are of two types. The earlier changes characterized chiefly by water splitting of the lens fibers and vacuolation were found to be reversible under tryptophan treatment. The more advanced changes which lead to disorganization of the structure of the lens seem to be irreversible. (4 figures, 7 references.)

R. W. Danielson.

Gillette, D. F. **Visual disturbances due to digitalis.** Tr. Am. Ophth. Soc. 44: 156-165, 1946.

The author reviews the literature concerning the types of visual disturbance that can result from mild and more severe forms of digitalis intoxication. He presents three interesting cases of digitalis poisoning, two of which were characterized by central scotomata and diminished visual acuity. Withdrawal of the drug

permitted the relatively prompt return of normal vision. In each case several types and degrees of chromatopsia are described. C. D. F. Jensen.

Matteucci, P. **Sympathetic innervation and neuro-vegetative regulation of the uvea.** Rassegna ital. d'ottal. 16:283-292, July-Aug., 1947.

Animal experimentation leads the author to several conclusions regarding the nerve control of the uvea. Rapid degeneration of the vegetative fibers of the iris after resection of the ciliary nerves indicates that the iris contains no nerve ganglia. The caroted sinus, with its sympathetic, vagal and sensory innervation is an important regulatory center of uveal circulation. Uveal vasomotor fibers do not all stop in the superior cervical ganglion; some follow the pericaroted sympathetic. The influence of the cervical sympathetic upon ocular tension may be a result of its control of capillary tone.
Eugene M. Blake.

Robbie, W. A., Leinfelder, P. J., and Duane, T. D. **Cyanide inhibition of corneal respiration.** Am. J. Ophth. 30:1381-1386, Nov., 1947. (4 figures.)

von Sallmann, L., and Dillon, B. **The effect of di-isopropyl fluorophosphate on the capillaries of the anterior segment of the eye in rabbits.** Am. J. Ophth. 30: 1244-1262, Oct., 1947. (8 figures, 43 references.)

Scuderi, R., and Morone, G. **Action of vestibular stimulation on the pressure in the central retinal artery.** Riv. di oftal. 2:22-36, Jan.-Feb., 1947.

In 25 persons between 14 and 30 years of age, the retinal arterial diastolic pressure was measured before and 15, 30, 45, 50, 90 seconds, 2, 3, 4, 5, and 10 minutes after the caloric and rotary stimulation of the labyrinth. Both the caloric test of Veits and the rotatory test of Barany regularly produced a decrease of the intraärterial pressure, amounting to five grams (Baillart) after the rotatory tests and seven grams after the caloric test, and lasting for two to three minutes. The drop in arterial pressure always occurred in both eyes and was of the same duration as the nystagmus which accompanied the tests. The decrease in arterial pressure in the retinal arteries is not due to a drop in general blood pressure.
K. W. Ascher.

Sloan, L. L., and Gilger, A. P. **Visual effects of tridone.** Am. J. Ophth. 30:1387-1405, Nov., 1947. (25 figures.)

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Borsello, G., and Gomirato, G. The adaptation curve and the visual field behavior to normal and attenuated light in neurasthenic constitutional syndrome. Riv. Oto-neuro-oftal. 21:278-311, Sept.-Dec., 1946.

In 14 neurasthenic patients between 25 and 35 years of age dark adaptation was retarded and reached terminal values inferior to normal. The visual fields in normal light showed a slight concentric contraction for green. In dim light the chromatic field was very much more contracted than in normal subjects. The authors discuss the probable pathogenesis of these changes concluding that they are in part a local result of the general neuro-vegetative-endocrine changes and in part an expression of a miopragic constitution of the retina. (15 figures, bibliography.) Melchiore Lombardo.

Boström, C. G., and Kugelberg, I. **Official color sense control in Sweden.** Arch. Ophth. 38:378-380, Sept., 1947.

This paper describes the development and use of the authors' color sense tests in Sweden. R. W. Danielson.

Clark, W. E. Le Gros. **A possible central mechanism for color vision.** Nature 160:123-124, July 26, 1947.

The author suggests that the correlations in this article (together with those reported in a previous paper) offer further presumptive evidence that the six-layered pattern of the geniculate nucleus (that is, two sets of three layers for the two eyes) may be related to color vision. However, further and more detailed correlations need to be established, and much more experimental evidence is required in order to put this thesis to a crucial test.

Theodore M. Shapira.

Dubois-Poulsen, A., and Rozan, A. **Graphic study of accommodative fatigue.** Ann. D'Ocul. 180:206-237, April, 1947.

Made partly from a toy railroad and track, the apparatus used is a modification of that used by Howe and Berens-Stark. It consists essentially of a continuous cord tracking on several pulleys which is attached to a square vertical frame. To the cord a target and a recording stylus are attached. The examinee by pulling the posterior vertical part of the cord down simultaneously moves the target nearer his eye and the stylus proportionately up.

For 195 office patients records were made for three minute periods with oscillation periods of approximately 45 to 60 seconds, in an illumination of 8 to 14 lux. In 30 percent accommodative fatigue was observed during the test. In 40 to 50 percent the accommodation remained constant, and in 28 percent the accommodation increased during the test. In monocular fixation fairly marked variations were observed between the static and the dynamic near points. This difference was increased by fatigue and was roughly proportionate to the rapidity of contraction of the ciliary muscle. Relatively little variation occurred in the same subject on repeated tests. With binocular vision the curves were essentially similar except that the decrease of the dynamic near point was less accelerated. Accommodative fatigability changed little with age or sex or with quantitative and qualitative variations of illumination within reasonable limits. In hypermetropic and astigmatic subjects accommodative fatigue was greater than in the mypopic. General bodily exhaustion was observed to be a more important factor than muscular fatigue. The results obtained following the instillation of parasympatheticomimetic and sympatheticomimetic drugs, and in hyperemia and increased ocular tension were not conclusive although it is probable that increased accommodative fatigability is frequently an early sign of ocular hypertension. (13 figures, 13 references.)

Chas. A. Bahn.

Gernandt, B., and Granit, R. **Single fiber analysis of inhibition and the polarity of the retinal elements.** J. Neurophysiol. 10:295-302, July, 1947.

This article is not readily abstracted to a form shorter than its summary which appears below. A condensation of this article may be found in Nature 159:806, 1947.

"Single fiber responses have been isolated from the nasal region of the cat's retina with the micro-electrode technique and tested by illumination and polarisation of the retina between fixed electrodes.

The pure on-elements respond to threshold cathodal polarisation with an on-effect. An increase of current strength by some 30 percent elicits a threshold anodal off-effect.

The pure off-elements (inhibited by

light) have opposite polarity. They respond to cathodal polarisation at the threshold with an off-effect, to anodal stimulation of the same strength with an on-effect (not elicitable by light).

The on-off-elements are either "cathodal" or "anodal", depending upon their off/on-ratio determined by illumination at threshold strength. They are held to be combinations of on-paths and off-paths.

The results form the basis of a simple explanation of the nature of inhibition in the retina in terms of the horizontal and amacrine cells." Elek Ludvigh.

Gernandt, B. **Colour sensitivity, contrast and polarity of the retinal elements.** J. Neurophysiol. 10:303-308, July, 1947.

This article is not readily abstracted to a form shorter than its summary which appears below. A condensation of this article may be found in Nature 159:806, 1947.

"The micro-electrode technique and the cat's retina have been used for a first analysis of the spectral sensitivity of well-isolated retinal elements during anodal and cathodal polarisation. It was found that, depending upon the polarity, different spectral regions were enhanced or depressed so that polarisation proved a convenient and very direct method of color analysis.

The on-elements were sensitive to short wave-lengths only, the off-elements to both long and short wave-lengths; the on-off-elements had humps or depressions in various regions. The regions in which enhancements or depressions chiefly occurred were (in the order enumerated) 0.520, 0.600, 0.470, and 0.570μ, the humps in 0.600μ being particularly large.

The on- and off-components of the isolated spike of an on-off-element were often differentially sensitive to "contrasting" regions of the spectrum, suggesting that the two components are running in different but adjacent and well-synchronized fibers."

Elek Ludvigh.

Hartridge, H. **Recent advances in the physiology of vision.** Brit. M. J. pp. 913-916, June 28, 1947.

The author uses retinal micro-stimulation to form geometric images of a diameter equal to one-fifth of a cone unit. A green ray (5,200 A.U.) moved less than one-fourth of a cone unit on repeated tests. Different fixation points were found for the following colors: red, orange, yellow, green, blue green, greenish blue and blue. A white beam remained white wherever it was situated on the retina unless conditioning colored lights were present in the visual field. The white then took on all seven previously mentioned colors. Color mixture experiments showed that the seven colors could be produced when various proportions of the others were mixed. Young's theory of color vision is discussed in the light of the seven color receptors.

From the response curves and tests for hue discrimination, the author concludes there are at least five types of receptors for color in the retina. There is a loss of color vision normally when reducing the visual angle or the illumination is reduced in peripheral vision. Colored objects which subtend small angles often become altered and appear to be of another color. The author concludes that there are at least seven receptors for color in the human retina. (11 figures.)

H. C. Weinberg.

Kinsey, V. E. **Transfer of ascorbic acid and related compounds across the blood-aqueous barrier.** Am. J. Ophth. 30:1262-1266, Oct., 1947. (5 figures, 4 references.)

Mann, Ida. **Contact lenses.** Brit. J. Ophth. 31:565-568, Sept., 1947.

To the newly formed Contact Lens Society, Mann delivered this presidential address as a plea for the accumulation of more data and the planning of further experiments. The problem of contact lenses is unusual in that animal experimentation is almost impossible because visual acuity and subjective tolerance are not measurable. The problems of prisms, of cylinders and of bifocals still demand much work.

The most pressing problem is that of tolerance. Mann sent a questionnaire to 100 patients for whom she had fitted lenses without subsequent control of data. Of 61 who had myopia 11 had an error of 5.00 diopters or less, and the others up to 22 diopters. Ten patients who were given one lens only for monocular aphakia did not wear it. Of 11 who had conical cornea 9 wore the lens all day, and none was a complete failure. The patients were all asked if, knowing what they know now, they would go in for contact lenses again. Sixty-four replied unhesitatingly yes and 19 gave an equally emphatic no. Seventeen said if they could be made more comfortable they would say yes. Must the lenses be worn every day for good tolerance? Fifty-five wore their lenses every day, 47 had enough tolerance for a full day's work and 31 wore them more than 12 hours every day. On the other hand 9 wore them only occasionally with excellent tolerance so that daily wear was not considered necessary. Tolerance could not be associated with any special condition of the eyes, except that in conical cornea contact glasses were almost always successful and in monocular aphakia always useless.

To the questions concerning solutions, 49 answered that they insert their lenses dry, 22 patients used normal saline and 9 used tap water. Obviously much has to be learned about solutions and much has to be done for the whole problem of contact lenses. Morris Kaplan.

Mann, I., and Sharpley, F. **The normal visual (rod) field of the dark-adapted eye.** J. Physiol. 106:301-304, July, 1947.

The rod visual field of the completely dark-adapted eye was mapped out within 90° limits from the fixation point for 33 normal individuals. The mean angular radius of the plotted fields for 80 subjects (including 47 previously tested) is given by age groups, and a tendency for the field to contract with advancing age is observed. The possible reasons for this contraction with age are discussed.

Theodore M. Shapira.

Matteucci, P., and Carucci, E. **Mydriasis and acute intraocular hypertension.** Ann. d'ocul. 180:360-365, June, 1947.

In rabbits, mydriasis is not primarily produced by acute ocular tension. Pupillary dilatation is basically caused by a reflex parasympathetic photomotor paresis or by hyperfunction of the sympathetic control. In a first group of rabbits, ligature of vorticose veins was performed at once; in a second group retrobulbar injection of nicotine preceded the ligation of the vorticose veins. In a third group the ciliary nerves were resected, then the vorticose veins were ligated. After the vorticose vein ligation the tension rose from 20 to 50 mm. Hg during the first day and by the fifth day decreased to approximately 15. The pupil size remained at 4 mm. practically constantly. There was also no parallelism between the ocular tension and the pupillary size in the other two groups. (4 figures, 15 references.) Chas. A. Bahn.

Pascal, J. I. **A radical innovation in contact lenses.** Arch. Ophth. 38:381-382, Sept., 1947.

After discussing the history of attempts to make contact lenses comfortable, Pascal says that an experimental study as to what kind of curve would best fit the great majority of eyes brought to light the almost unexpected emergence of the cone. It was found that if the scleral section was made conical, and the angle of the cone was so chosen that it rested tangentially against the eyeball a minimum of pressure was exerted. Instead of a large bearing surface between lens and sclera, it was found that sometimes a narrow tangential band one to three mm. wide set inside the edge of the lens gave more comfort than any other surface.

R. W. Danielson.

Pascal, J. I. **The power or powers of a lens.** Brit. J. Ophth. 31:570-572, Sept., 1947.

The method of calculating reduced surface power of the crystalline lens is simplified by what is called the "dam" formula: $D = aM$. In this formula a is the difference between the two indices and M is the curvature in metrecs which is obtained by dividing the radius in mm. into 1000. Morris Kaplan.

Rezende, Cyro de. **Mirror writing.** Arq. brasil. de oftal. 10:20-31, 1947.

The author quotes a number of previous writers on the subject, and then records and illustrates a personal case, in a boy of eight years. Other conditions were normal. The vision of the right eye was 0.2 that of the left eye 1.0, and the refraction was apparently normal. The mirror writing involved words and drawings, but not numbers. (References; an excellent full-page illustration of the peculiarity discussed.) W. H. Crisp.

Rose, H. W., and Schmidt, I. **Factors affecting dark adaptation.** J. Aviation Med. 18:218-230, June, 1947.

A survey of the literature on factors affecting dark adaptation is reported. Experimental data are presented that show that caffeine-metrazol (caffeine .05 gm., metrazol .1 gm.), mild muscular exercise, strychnine nitrate .005 gm., ultrasonic vibrations of 24,000 c.p.s., .003 gm. fervitin, .05 gm. ephedrine hydrochloride, .05 gm. octin D, stimulation of taste with saccharin, or the administration of 266,000 I. U. of vitamin A in emulsion or oil daily for sixteen days, do not significantly affect the dark adaptation of normal subjects. Elek Ludvigh.

Sebas, S. R. **Optical correction of astigmatism.** Rev. brasil de oftal. 6:17-24, Sept., 1947.

The author's routine method includes the clock dial, the ophthalmometer, skiascopy, and the use of test lenses as described by Donders ninety years ago. Cases of "spasm of accommodation," he would refer to the neurologist before undertaking the measurement of refraction. He has apparently little respect for the use of cyclopegics in the measurement of astigmatism. W. H. Crisp.

Temple Smith, E. **Thoughts on refraction.** M. J. Australia 2:69-71, July 19, 1947.

Cycloplegics should never be used as a routine measure, but only when indicated. In children atropine is indicated because of the amazing faculty the child has for suppressing hypermetropia and in young adults cycloplegics should be used when ciliary spasm is suspected. A subjective examination is necessary in presbyopic adults to check the retinoscopy. An examination in cycloplegia necessitates two or three visits with loss of time, and causes annoyance to the business man. Mydriasis is obtained by using a mixture of cocaine, adrenalin, and neo-synephrine.

Complete dilatation of the pupil, in the presence of small errors, causes confusion by giving conflicting retinoscopic reflexes, but should be used to examine the extreme periphery of the retina.

H. C. Weinberg.

Veasey, C. A., Jr. **The dissatisfied refraction patient.** Am. J. Ophth. 30:1286-1293, October, 1947.

5

DIAGNOSIS AND THERAPY

Adrogué, E., and Wolf, J. A. **Gonioscopic examination; its technique with Goldman's contact glass.** Arch. chilenos de oftal. 3:305-312, Nov.-Dec., 1946.

The authors remark that so recent a work as that of Berens and Zuckermann on diagnostic examination of the eye does not mention Goldman's procedure. The various details of the technique for examination according to Goldman are carefully explained, under the headings of previous adjustment of the lamp, placing of the contact glass, and the actual examination, as well as interpretation of the image in optical sections. In conclusion the authors discuss the principal difficulties which may occur during the gonioscopic examination; including irritability of the eye calling for repeated anesthetization, occasional inversion of the eyelids causing appearance of the lashes in the gonioscopic image, absence of the necessary layer of liquid between cornea and the gonioscopic lens, excessive obliquity of the source of illumination, and the development of corneal edema. (2 figures, references.) W. H. Crisp.

Bellows, J. G., and Farmer, C. J. **Streptomycin in ophthalmology.** Am. J. Ophth. 30:1215-1220, Oct., 1947. (3 figures, 9 references.)

Calogero, V. N. **Rubrophen treatment of ocular tuberculosis.** Riv. di oftal. 2:58-69, Jan.-Feb., 1947.

Rubrophen, a triphenylmethane derivative, was introduced into therapy by Sailer, in 1937. For extrapulmonary tuberculosis, it is used either in comprettes containing 0.15 gram, or intravenously in doses of 0.30 gram with the addition of 0.08 gram of sodium bisulfite. Five percent ointment can be administered in a lanolin base. The therapetutic dose of 0.30 is 1/150 of the fatal dose of 50 grams for a patient who weighs 70 kilograms. In five patients suffering from anterior segment tuberculosis and observed for many years the application of the rubrophen, oral and parenteral, proved beneficial. (Bibliography.) K. W. Ascher.

Chamlin, Max. **Technical methods for the 1/2,000 field.** Am. J. Ophth. 30:1414-1423, Nov., 1947. (3 figures.)

ten Doesschate, J. **Perimetric charts in equivalent projection allowing a planimetric determination of the extension of the visual field.** Ophthalmologica 113:257-270, May, 1947.

As stated in the title, the purpose of this study was to design perimetric charts that would lend themselves to planimetric measurement. To meet this requirement the perimetric findings which are spatial values obtained on the inside of a sphere have to be transferred to or projected onto a plane surface in such a way that all areas enclosed by a closed line on the sphere are directly proportional to the corresponding areas on the surface of projection (the principle of equivalent projection). Since none of the existing perimetric charts meets this requirement, the author by applying spherical trigonometry, devised one in which the relationship between perimetric angle (or

angle of eccentricity) and radial distance on the chart is as follows:

perimetric angle in degrees	linear (radial) distance in units of lengths
10	4.9
20	9.8
30	14.6
40	19.4
50	23.9
60	28.3
70	32.4
80	36.4
90	40.0
100	43.3
110	46.3

Such a chart is suitable for planimetry but not free of distortion. The result of the planimetric measurement, that is a figure expressing area, is useful for statistical purposes, but does not express the practical usefulness of the visual field. A round concentric field of a certain area is doubtlessly more useful than a hemianopic field of the same area.

The author has also designed a chart in which the area of the field is a measure of the number of functioning receptor units. Such a chart, however, is clinically impractical. Peter C. Kronfeld.

Guy, L. **Dangerous explosion of transilluminator.** Arch. Ophth. 38:382-383, Sept., 1947.

The author reports that his Lancaster transilluminator exploded when turned on. The tip hit the wall with sufficient force to break the plaster. Fortunately, the instrument had not yet been inserted behind the eyeball. R. W. Danielson.

Halbron, P., and Aitoff, H. **Local use of penicillin in external gonococcic affections of the eye.** Rev. brasil de oftal. 6:25-29, Sept., 1947.

The authors describe seven cases in which penicillin was used locally, either in collyrium or in ointment. The collyrium contains a concentration of 5,000 Oxford units per cubic centimeter. The ointment contains 1,000 Oxford units per gram. Both preparations, kept in the refrigerator, remained effective for a week. Local treatment with penicillin of gonococcic ophthalmia represents a real advance over previous forms of therapy.
W. H. Crisp.

Ingalls, R. G. **Current status of penicillin in ocular infections.** Am. Practitioner 1:680-683, Aug., 1947.

Only those diseases caused by bacteria sensitive to penicillin are cured by the drug. As larger doses are being used, more bacteria that are sensitive are being found. Failure with bacteria usually sensitive may be due to resistance built up from inadequate doses, or to the need for high initial dosage. In the treatment of intraocular infections one should not await the laboratory findings, but should begin immediately with penicillin and sulfonamide therapy. Infected traumatic wounds of the anterior segment may be treated with penicillin solution. In vitreous infection, intravitreal injections of purified penicillin should be used. (References.) Bennett W. Muir.

Johnson, M. H. **Method for restoration of human orbits following necroscopy enucleation.** Am. J. Ophth. 30:1298, Oct., 1947.

Magitot, A. **Tissue therapy.** Ann. d'ocul. 180:376-378, June, 1947.

Is tissue therapy worthwhile? Based upon a résumé of the literature, the pros and cons are summarized as described by Filatov and Verbitska. The treatment consists essentially of intramuscular in-

jections of cod liver oil prepared in a specific manner and of subconjunctival and subcutaneous tissue implantations. For the subconjunctival implantations placenta is used but the subcutaneous injections consist of a varied assortment of biologic entities ranging from aloes to ovaries. In the treatment of pigmentary retinal degeneration and many other ocular affections ranging from trachmatous pannus to sclero-choroidal myopia, its usefulness is somewhat problematic. The essential factor in the treatment is apparently a new type of "Biologic Activator" which seems to be a sonorous but somewhat meaningless term. Improvements are recorded in such small units that only God and the authors can measure the progress. Chas. A. Bahn.

Sorsby, Arnold. **Penicillin in ophthalmia neonatorum.** Brit. M. J. pp. 913-916, June 28, 1947.

Penicillin was used in the treatment of ophthalmia neonatorum by a variety of methods. In thirty cases local instillation of drops containing 2500 units per ml. at five-minute intervals gave good results. In fifty-two cases these drops were given at one-minute intervals and the eyes became clear within an average time of 33 hours. Twenty-seven patients recovered within 48 hours when drops containing 10,000 units per ml. were used. In fifty-one cases the use of penicillin in an oily or solid vehicle at less frequent intervals was unsatisfactory.

Four systemic injections of 200,000 units at intervals of three hours combined with local medication was followed by recovery within 46 hours in 84 percent of patients. In infection with diphtheroid organisms or inclusion bodies treatment was not limited to penicillin. In no case has penicillin treatment failed to remove all anxiety within a few hours. (11 tables.)

H. C. Weinberg.

Sorsby, A., and Ungar, J. **Distribution of penicillin in the eye after subconjunctival injection.** Brit. J. Ophth. 31:517-528, Sept., 1947.

Comparisons of intraocular concentrations of penicillin after various routes of application were made. Subconjunctival injections with and without adrenalin were compared with instillations of highly concentrated ointment and with intravenous injections. By far the most satisfactory therapeutic concentration was obtained by the injection of the drug in 50,000 unit doses dissolved in 0.5 cc. of 1 to 1,000 adrenalin solution beneath the conjunctiva in cocaine anesthesia every six hours. The concentration reached in all the eye tissues was several times greater in the 50,000-unit dose than with a 20,000-unit dose and was maintained considerably longer. When injections are made with adrenalin fairly substantial levels of penicillin are still present in the fellow eye at the end of 4 to 6 hours. The ointment used contained 50,000 units per gram and the intravenous injections were of 25,000 units. In both these routes, the concentrations were considerably less in all tissues than with the subconjunctival injection with adrenalin. (14 tables.)

Morris Kaplan.

6

OCULAR MOTILITY

Adler, F. H., and Jackson, F. E. **Correlations between sensory and motor disturbances in convergent squint.** Arch. Ophth. 38:289-300, Sept., 1947.

The important factor in the production of convergent comitant squint is the primary force which turns the eyes in, i.e. the excessive convergence innervation. In only one group is one thoroughly cognizant of the manner in which an abnormal convergence stimulus is produced and how it causes squint. This is the group in

which the convergence is due to excessive hypermetropia. It is the purpose of this paper to consider the senory relationships found in all types of convergent squint and to determine the correlations between the sensory abnormalities and the motor disabilities in the hope that some light may be thrown on the source of this excessive convergence. One hundred and seventy-five private patients form the basis of this study. In this statistical analysis, the most striking feature is the relationship between the type of correspondence and the angle of squint. Persons with squints of low angle have predominantly normal correspondence, whereas persons with squints of 15 to 20 degrees and over usually have anomalous correspondence. The squints of low angle fall largely into the accommodative group; the squints of large angle belong predominantly in the class for which no causal factor is known. Age of incidence, duration of squint and presence or absence of amblyopia have little to do with determining the type of correspondence. It is possible that the cause of the squint of undetermined origin is anomalous correspondence itself. (4 references.)

R. W. Danielson

Azzolini, U. **Two cases of Tuerk-Stillings' syndrome, one of them of the inverted type with preserved abduction and missing adduction.** Riv. di oftal. 2:12-21, Jan.-Feb., 1947.

The syndrome of Tuerk, called syndrome of Stilling by French authors, consists of unilateral absence of abduction, while adduction of the same eye is restricted and accompanied by enophthalmos and narrowing of the lid fissure. Discussing the numerous explanations proposed in the literature, Azzolini prefers the assumption of multiple anomalous muscle insertions for his cases. (12 photographs, bibliography.) K. W. Ascher.

Burian, H. M. **Sensorial retinal relationship in concomitant strabismus.** Arch. Ophth. 37:504-533, April, 1947.

This is a continuation of a paper on the same subject. The clinical picture of anomalous retinal correspondence and its interpretation is discussed with the presentation of illustrative case reports. Not all patients with concomitant strabismus develop anomalous correspondence. The first prerequisite is a certain amount of binocular cooperation.

The principles of treatment of anomalous correspondence are outlined. Under this heading are discussed occlusion, surgery to restore normal position, prisms, and orthoptics. In discussing surgery, the author states that every child with strabismus should have his eyes straightened before entering school or shortly thereafter. (To be concluded.)

John C. Long.

Coachman, E. H. **A new syndrome, the association of latent vertical phoria with endocrine dysfunction.** South. M. J. 40: 656-665, Aug., 1947.

A series of cases is presented in which the patients were made more comfortable after refraction when special stress was put upon vertical imbalances. These defects are brought out or made more evident by total occlusion of one or the other eye for 48 hours and measured with the usual Maddox rod.

The author has noted an association of symptoms, namely scanty eyebrows in the outer third, subnormal temperature, low blood pressure and slow pulse, such as are commonly found in decreased activity of the thyroid. There is a generalized edema especially of the lids and face, and along the medial aspect of the lower part of the tibia.

The patients commonly complain of periodic headaches which are usually unilateral and occur around or between the

eyes and radiate to the occiput, down the neck and into the scapular areas. The headaches are apt to follow movies, sewing, reading, card playing or driving, and may even be present upon awakening. Sensitivity to changes in position or motion is prominent. Children are poor readers, or skip lines entirely. Wearers of dark glasses are apt to have vertical imbalances, and when corrected by proper prisms are made comfortable with clear glasses. A. G. Wilde.

Neely, J. C. **The Treatment of traumatic diplopia.** Brit. J. Ophth. 31:581-642, Oct., 1947.

This dissertation is in its essentials an apologia for active and more radical treatment of the diplopia which has been shown to be a not infrequent result of an injury to the head or face. The author discusses diagnosis and treatment and documents his opinion by liberal quotations from the records of 55 patients, members of the Royal Air Force personnel. The illustrations include reproductions of photographs, X-ray films and Hess charts. Diplopia is usually caused by a paresis and not a paralysis of an extraocular muscle and the vertically acting muscles are most often involved. In the majority of cases the "closed" head injury and not the penetrating wound is the cause of diplopia. Injuries to the orbit tend to be overlooked owing to the severity of other injuries, yet the restoration of the normal anatomy of the parts is of immediate importance. Well planned eye muscle surgery aided by orthoptic exercises is the best means of restoring binocular single vision. Once the vertical deviation has been reduced by operation to manageable proportions, the binocular reflexes strengthened by orthoptic training will enable the patient to maintain fusion within the range of normal ocular movement. If the deviation is considerable it is best to carry out the correction in stages rather than risk overcorrection and another relative paresis which may prove more troublesome to patient and surgeon than the first. O. H. Ellis.

Wright, E. S. **Bilateral ophthalmoplegia in acute anterior poliomyelitis.** Am. J. Ophth. 30:1294-1298, Oct., 1947. (1 figure, 16 references.)

7

CONJUNCTIVA, CORNEA, SCLERA

Attanasio, V. **Epidemic keratoconjunctivitis.** Boll. d'ocul. 25:481-500, Oct.-Dec., 1946.

Five cases of keratoconjunctivitis that occurred in patients whose ages ranged between 16 and 34 years are reported in detail. The disease was monocular and characterized by initial swelling and redness of the caruncle and the plica which was followed by the appearance of follicles on the fornix and palpebral conjunctiva. The pre-auricular glands were swollen. Photophobia and profuse tearing were among the common symptoms. Corneal lesions lasted a few months and left more or less defective vision. The usual course of the disease ranged from two to four weeks. The etiology and the treatment are discussed. The instillation of lemon juice combined with sulfamide therapy shortened the course. (4 figures, bibliography.) Melchiore Lombardo.

Bartolozzi, R., and Leoz de la Fuente, G. **Fatty degeneration of the cornea.** Arch. Soc. oft. hisp.-amer. 7:558-564, June, 1947.

The authors describe three cases of this rare affection, of which only 15 cases have been reported. A woman 40 years old, had a primary corneal peripheral lipodystrophy. A man, 24 years of age, sustained a burn of the right cornea in infancy, and

this eye was much more extensively involved than the left. The third patient had congenital aniridia, coronary cataracts and a peripheral bilateral lipodystrophy. Visual acuity was severely impaired in all three patients. None of them had a demonstrable disturbance of the cholesterol metabolism. Their ingestion of fat was limited by economic conditions. The lipodystrophy was therefore attributed to a disturbance in the local oxidation which transformed invisible cholesterol into a visible form. The literature is reviewed, and it is noted that therapy is ineffective. (7 illustrations.) Ray K. Daily.

Castelli, A. **Keratoplastic surgery.** Rassegna ital. d'ottal. 16:253-269, July-Aug., 1947.

The author performed 12 transplantations of corneal grafts, of which 11 healed with clear transplant Six of the patients had keratoconus, 2 congenital familial degeneration of the cornea, and 4 had corneal complications of trachoma.

The technic was essentially that used in the United States. The author uses a 5-mm. trephine and advises the operation particularly for keratoconus and for corneal scars that are not total or vascularized. Eugene M. Blake.

Chace, R. R., and Locatacher-Kohorazo, D. **Keratoconjunctivitis due to a diphtheria-like organism.** Arch. Ophth. 37: 497-503, April, 1947.

A woman, 26 years of age, had a bilateral keratoconjunctivitis for approximately seven years. The tissue of the mucocutaneous juncture of the lids was replaced by a scar and trichiasis was severe. There was roughening and redness of the conjunctiva of the fornices with papillary hypertrophy. The corneas showed a thin vascularized membrane with some staining with fluorescein. The patient was somewhat undernourished. Very detailed studies by culture and animal inoculation identified the causative organism as one of the Corynebacterium xerose group. Treatment has consisted in the removal of the cilia, sulfathiazole ointment and penicillin ointment. In spite of clinical improvement, the organism still appears in heavy growths in culture.

John C. Long.

Chavarria Iriarte, F. A. **Progressive, circular, bilateral fibro-vascular degeneration of the cornea.** Arch. Soc. oft. hisp.-amer. 7:565-571, June, 1947.

The patient, a woman 61 years old, suffered from recurrent corneal marginal ulcers for a number of years. During this period of observation she developed a progressive bilateral circular pannus, which in some areas assumed the aspect of degenerative keratitis, with a slight corneal depression. A small zone of deep grayish infiltration in the cornea, without blood vessels, which extended beyond the vascularized area was biomicroscopically demonstrable. The differential diagnosis of corneal pannus is discussed. The etiology of the degenerative lesion in this case remains unknown. (3 illustrations.)

Ray K. Daily.

Chuliá, Vicente. **Five cases of Groenouw's corneal dystrophy in one family.** Arch. Soc. oft. hisp.-amer. 7:572-577, June, 1947.

Groenouw's nodular corneal dystrophy occurred in the eyes of a man, 60 years old, and in the eyes of his mother, of her brother and of this brother's two sons. A slight increase in the blood calcium was found. No new data are presented. (3 illustrations.) Ray K. Daily.

Colombo, Giuseppe. **Four cases of keratitis superficialis vesiculosa disseminata, three of them associated with formation of corneal filaments.** Riv. di oftal. 2:1-11, Jan.-Feb., 1947.

Keratitis filamentosa is not a disease entity; filaments may appear on the corneal surface whenever vesicles of the epithelium are formed as a result of trauma, inflammation or, degeneration. Vesicles of the corneal epithelium are broken and rolled by the lid movements to form the characteristic threads. Neurotrophic factors may be involved. (1 drawing.) K. W. Ascher.

Franklin, H. C. **Prophylaxis against ophthalmia neonatorum.** J.A.M.A. 134: 1230-1235, Aug. 9, 1947.

Since Credé of Leipzig instituted the 2-percent silver nitrate prophylaxis of ophthalmia of the new born, that method has become mandatory in most countries although the concentration was reduced to one half because the original is uniformly irritating. Even this can cause a chemical conjunctivitis when undissolved crystals get into the eyes, or when the solution has become concentrated by evaporation.

Solutions of silver nitrate decompose slowly and the liberation of a small amount of nitric acid augments the irritating effect.

Ophthalmia neonatorum was once regarded as uniformly gonorrheal in origin but the term is now applied to any inflammatory process that appears within two weeks after birth. The staphylococcus, a diphtheroid bacillus, and pneumococcus may be the etiologic agent and the latter can be as destructive of the cornea as the gonococcus.

Believing that penicillin possesses the virtues but not the vices of the older agent, the author used it for a four month period. The crystalline sodium salt was employed in a concentration of 2,500 units per cc. in isotonic sodium chloride. The solution was not kept longer than one week, and when not in use was refrigerated below 59°F. Within one hour after delivery, secretions were removed from the lids, the conjunctival sac was washed with 2 to 3 cc. of isotonic sodium chloride, and one drop of the penicillin solution was instilled. This procedure was carried out in the nursery for three days.

It was found that the irritation of the eyes was much less after penicillin than after silver, and the prophylactic action of the former is just as effective.

A. G. Wilde.

Gallego Asorey. **Keratomalacia.** Arch. Soc. oft. hisp.-amer. 7:469-476, May, 1947.

A typical case of keratomalacia is reported in a child two years old in whom nutritional deficiencies were found to be the cause. Twenty days after he was first seen the child died of a pulmonary disease. J. Wesley McKinney.

Gonçalves, Danilo. **Corneal ulcer in chickenpox.** Rev. brasil. de oftal. 6:31-36, Sept., 1947.

The condition was seen 21 times in ten months. Such ulcers may have serious consequences as to vision. Prophylaxis by disinfection of the eyes and the nasopharynx is recommended. No case of associated depigmentation of the iris (false vitiligo) was seen. W. H. Crisp.

Kilgore, G. L. **The value of corneal peeling or corneal resection in ophthalmology.** Tr. Am. Ophth. Soc. 44:100-112, 1946.

The author presents his method of corneal peeling or corneal resection. He first injects physiological solution along the line of initial incision to avoid danger of damage to the posterior corneal lamellae. Resection is of particular value where the scar is limited to the anterior half of the cornea. Visual results then compare favorably with those of keratoplasty. Aphakia is not a contraindication. Indica-

tions and contraindications are systematically listed. Keratoplasty can be performed if corneal resection fails. Several cases of successful corneal resection are described in detail. C. D. F. Jensen.

Laval, J., and Schneider, J. **Modified Snellen suture for prolapsed chemosed conjunctiva.** Arch. Ophth. 38: 375-377, Sept., 1947.

The authors describe a case in which a new operative procedure, a modification of the Snellen suture for ectropion was used successfully in the treatmentof prolapsed chemosed conjunctiva of the lower eyelids. This procedure has the twofold purpose of restoring the prolapsed conjunctiva and of reforming the inferior fornix. (2 references.)

R. W. Danielson.

Leoz de la Fuente, G. **Superficial filamentous keratitis and lattice-shaped keratitis profunda.** Arch. Soc. oft. hisp-amer. 7:553-557, June, 1947.

Leoz de la Fuente reports an unusual combination of an acute filamentous keratitis with a keratitis profunda in interlacing straiae as described by Haab and Dimmer, in an obese woman, 59 years old, with hypertension. That the cause was an infection is concluded from the prompt recovery in eleven days when 20-percent sulfathiazole solution was instilled after failure to improve with heat, dionin, and yellow oxide of mercury. The literature is reviewed. No new viewpoints are presented. (2 illustrations.)

Ray K. Daily.

McKinney, J. W. **Indication for corneal transplantation.** South. Surg. 13:622-625, Sept., 1947.

Corneal transplantation is indicated where the superficial ulcers or burns have not affected the deep corneal stroma, deep ulcers or opacities involving the central portion of the cornea only, mild interstitial keratitis and keratoconus. It is not indicated in extensive ulcers, burns and deep infiltrating diseases, severe interstitial keratitis, trachoma with pannus, adherent leucoma, glaucoma, aphakia and the dystrophies. Irwin E. Gaynon.

McLaughlin, R. S. **Chemical burns of the human cornea.** Am. J. Surg. 74:373-377, Sept., 1947.

The urgent immediate treatment of a chemical burn of the eye consists of immediate and copious irrigation of the eye with tap water. This should be done at the site of the accident. No neutralizing substances are used. The patient is then brought to the dispensary where the eye is anesthetized with 0.5-percent pontocaine solution, stained, particles removed, and the eye irrigated for fifteen minutes with normal saline. The eye is stained again with fluorescein. If it stains, the eye is again irrigated for 15 minutes. If the cornea still stains, the involved epithelium is removed by denudation using a round tooth pick swab, moistened with 4-percent cocaine hydrochloride.

Irwin E. Gaynon.

Newell, F. W. **Stimulation of corneal epithelization with topical application of erythrocytes.** Am. J. Ophth. 30:1238-1243, Oct., 1947. (22 references.)

Petragnani, P. V. **Reiter's disease.** Riv. di Oftal. 2:51-57. Jan.-Feb., 1947.

Petragnani describes the case of a man, 30 years of age, who had Reiter's disease twice in two years. Cultures taken from urethra, blood and conjunctiva did not reveal any causative organism. Recovery occurred in eight days after local antiseptic and stringent treatment supported by three intramuscular injections of sulfoidol. In another case, local treatment and sulfonamids and salycilates were of

no avail. Finally after three weeks recovery occurred after intramuscular administration of sulfoidol.

K. W. Ascher.

Reese, A. B. **Pigmentation of the palpebral conjunctiva resulting from mascara.** Am. J. Ophth. 30:1352-1355, Nov., 1947. (5 figures.)

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Bitran, David. **Recovery from sympathetic ophthalmia.** Arch. chilenos de oftal. 3:318-322, Nov.-Dec., 1946.

A healthy man of 32 years sustained a penetrating corneoscleral injury, with hernia of the iris and ciliary body. Prophylactic injection of 80,000 units of penicillin did not prevent the development of sympathetic ophthalmia in the second eye, which continued to get worse even after enucleation of the injured eye. In the course of 48 days, however, the sympathetic involvement completely recovered under further use of penicillin and intensive use of sulfadiazine. The sympathetic nature of the inflammation was confirmed by a histologic study of the enucleated eye. (3 figures.)

W. H. Crisp.

Esterman, Benjamin. **Choroideremia.** Arch. Ophth. 37:716-721, June, 1947.

Choroideremia is always bilateral, occurs almost invariably in males, is usually associated with night blindness and sharply contracted visual fields, but often with relatively unimpaired central vision, and in the majority of instances occurs in persons with myopia of moderate degree. The lesion has often remained stationary.

A case of choroideremia was observed in a white man aged 29 years whose chief complaint was night blindness. Corrected visual acuity of the right eye was 20/200 and the left 20/30. Fields were reduced to a radius of five degrees in each eye. There was only a small island of choroid in each eye. The differential diagnosis between this condition and retinitis pigmentosa, gyrate atrophy, choroidal sclerosis and massive retinal gliosis is discussed. (1 colored plate.)

John C. Long.

Poniedel, C. **Calcium deposits in the iris.** Brit. M. J. 2:691-692, Nov. 1, 1947.

Calcium deposits in the iris were an interesting and perhaps important finding in a patient who became severely ill in October, 1944. Soon afterward his vision became blurred and examination revealed a chalky deposit in the anterior chamber and retina of the right eye. More than one year later fine deposits of calcium were found in the iris. The clinical studies, which included chemical examination of the patient's blood, made it seem probable that the primary disturbance was a chronic renal disease with secondary increase of calcium in the blood and not a primary hyperparathyroidism. It was interesting to note deposits in the iris and the observance of renal calculi.

F. H. Haessler.

Schaegel, T. F. Jr. **Bilateral granulomatous uveitis from the use of horse serum in rabbits.** Am. J. Ophth. 30:1225-1237, Oct., 1947. (5 figures, 4 tables, 17 references.)

Sorsby, A., and Reed, H. **Local penicillin therapy of hypopyon formation with special reference to the use of subconjunctival injection.** Brit. J. Ophth. 31:528-551, Sept., 1947.

The treatment of 66 cases of hypopyon associated with infected corneal ulcer, iritis, glaucoma and with herpetic or neuropathic corneal lesions is presented in detail. It consisted of repeated subconjunctival injections of 50,000 units of

penicillin usually dissolved in adrenalin and novocaine solution combined with instillations of penicillin ointments and drops and with general sulphonamide therapy. The use of subconjunctival penicillin was superior to all other treatment in eyes with bacterial infection. It had little effect on the herpetic or neuropathic lesions and in the hypopyon associated with simple iritis atropine instillation alone was sufficient.

The penicillin was injected every 6 hours for 12 injections. After that an ointment of penicillin, 100,000 units to the gram, was instilled every four hours day and night until recovery.

Morris Kaplan.

9

GLAUCOMA AND OCULAR TENSION

Barkan, Otto. **Cyclodialysis, multiple or single, with air injection—an operative technique for chronic glaucoma.** California Med. 67:78-83, Aug., 1947.

The author's operation is designed to create a larger dialysis with less trauma than is possible with the ordinary technique, and, secondly, to control hemorrhage. The resulting cleft is larger and permanent. The technique is described in detail. His injection of air into the chamber has been seen to stop an iris hemorrhage. An injection, if too great, can cause a rise of intraocular tension by blocking the outflow in the angle and by producing a seclusion of the pupil. Saline solution is made to replace some of the air. Extreme miosis is a preoperative essential. Maximal miosis should be maintained postoperatively to prevent closure of the cleft and the channel outlet. He further advises permanent daily use of a miotic to assure maintenance of the opening and channel.

Francis M. Crage.

Bloomfield, S. **Lability test for chronic simple glaucoma.** Arch. Ophth. 38:368-374, Sept., 1947.

The need for a more reliable provocative test for simple glaucoma led the author to design his lability test which is based on the fact that the induction of a transient vascular congestion in the eye would tend to produce a significant elevation in tension that would be most pronounced if the normal controlling mechanisms were pathologically defective.

Basically, the lability test consists in the simultaneous application of the cold pressor test of Hines and Brown and the jugular compression test described by Schoenberg. First the tension of each eye is measured. The patient then places one open hand up to the wrist in ice water. Simultaneously, a blood pressure cuff previously placed loosely about the neck is inflated to a pressure of 50 to 60 mm. Hg. At the end of exactly one minute, the ocular tension is again recorded, with the hand still in ice water and the cervical pressure undiminished. Then the hand is withdrawn, the pressure cuff is removed, and the test is over unless a repetition is desired for purposes of accuracy. A study of its results when applied to a series of eyes with chronic simple glaucoma and to another group without that condition indicates that it is a highly reliable test. (3 figures, 3 references.)

R. W. Danielson.

Díaz Dominguez, Diego. **The etiopathogenesis of glaucoma,** Arch. Soc. oft. hisp.-amer. 7:477-507, May, 1947.

This article deals exclusively with primary chronic glaucoma. There is no experimental work which can elucidate its pathogenesis because glaucoma is fundamentally a human disease. The author identifies glaucoma with ocular hypertension and does not believe in the existence of glaucoma without hypertension. Cases of glaucoma without hypertension have been reported but in his opinion the

hypertension was not discovered because the patient's tension was not taken often enough to get a true measurement. He believes that glaucoma develops because an initial neurovegetative dystonia causes a circulatory disturbance. The result of the persistent circulatory disturbance is a venous stasis that leads to increased capillary permeability and production of exudates which block the drainage outlets. The author presents an extensive review of theories of the development of hypertension in glaucoma and especially the role played by the aqueous humor. (Bibliography.) J. Wesley McKinney.

Gát, L. **The effectiveness of a modified cyclodialysis.** Ophthalmologica 114:106-118, Aug., 1947.

This is a report from the University Eye Clinic of Debrecen (Hungary) where, during the last 25 years, glaucoma surgery has consisted chiefly of iridectomies and cyclodialyses. Blaskovics' "inverted" technique has been modified as follows. The scleral incision is made anterior to the lateral instead of the superior rectus muscle. Most of the upper-temporal quadrant of the ciliary body is dialysed. During the dialysis the globe is fixated and the bleeding tendency reduced by placing a muscle clamp tightly on the tendon of the lateral rectus. The statistically presented results are difficult to evaluate because the absolute number of operations is small, the period of postoperative observation is short, and the criteria of failure or success are not clearly stated.

The author believes that the cyclodialysis is the most promising operation for glaucoma. Its advantages are the ease of performance, the applicability to all forms of glaucoma, the feasibility of repeated cyclodialyses on the same eye, the inherent freedom from serious operative complications.

Cyclodialysis also has disadvantages. The intraocular pressure remains high during the first two or three days after the operation. The acute and some of the chronic glaucomas, therefore, require a posterior sclerotomy combined with the cyclodialysis. Severe hemorrhages may occur (incidence not given). If the absorption is slow, the essayist aspirates the chamber contents on the fourth or fifth day. The central visual acuity may be temporarily impaired by the residues of the hemorrhage or by a refractive change in the direction of greater myopia. Retinal detachment has been reported but has not occurred in the author's series.

The author believes to have shown that cyclodialysis has lived up to the prediction of its originator Heine: "Optimal effects are achieved with the smallest and least dangerous operation."

Since completing this report the author has moved the site of the operation again. The scleral incision is now made in front of the inferior rectus and the inferotemporal quadrant is dialyzed. "The results have been encouraging."

Peter C. Kronfeld.

Grant, H. W. **The diagnosis of early glaucoma.** Am. J. Ophth. 30:1276-1285, Oct., 1947. (9 figures, 1 table, 18 references.)

Gros, B. H. **Glaucoma in young persons.** Ann. d'ocul. 180:366-375, June, 1947.

In all glaucoma three factors are important: the constitutional, the environmental, and the age-time factor. The author relates the progress of 17 cases of glaucoma, mostly in young persons. These illustrate the important effects of ocular and extraocular vascular permeability in the aggravation of glaucoma. In the aged this vascular degeneration is an arteriosclerotic process, but in the young

it is a neurovegetative disequilibrium involving especially the hypothalmus. Syphilis and other diseases as well as the excessive use of stimulants, alcohol, tobacco, and especially caffein may further accelerate this constitutional degenerative tendency. Records of prolonged uncontrolled destructive emotions and the shocks and frustrations of life, singly and in combination, run through the glaucomatous histories of these 17 persons of different ages. Chas. A. Bahn.

Holst, J. C. **A statistical study of glaucoma.** Am. J. Ophth. 30:1267-1275, Oct., 1947. (2 tables.)

Kronfeld, P. C. **Contribution to the chemistry of the aqueous humor in the glaucomas.** Tr. Am. Ophth. Soc. 44:134-142, 1946.

The author presents interesting statistical studies of the protein and ascorbic acid content of the aqueous humor of normal eyes and of eyes with glaucoma of the wide-angle type. He correlates these findings with the ascorbic acid content of the blood. There is a close parallelism between the ascorbic acid content of the blood and of the aqueous and no apparent relationship between the permeability of the blood-aqueous barrier and the ascorbic acid level in the aqueous. He concludes that in the normal eye as well as in the eye affected with deep-chamber glaucoma the ascorbic acid level of the aqueous is dependent upon the blood-ascorbic acid level. C. D. F. Jensen.

Magitot, A. **The intracranial origin of glaucomatous optic atrophy.** Ann. d'ocul. 180:321-341, June, 1947.

Glaucoma and ocular hypertension are not synonymous. The field changes in primary glaucoma are reasonably explained only by postulating extraocular vascular lesions in the optic nerve and hypothalmus that are either spastic or otherwise obliterative. These lesions reduce the blood supply to specific sections of the retina until anemia temporarily or permanently prevents their function. The upper nasal quadrant is first involved in 60 percent and the lower nasal field in 20 percent. Glaucomatous field changes center around the disc and not the macula which is involved much later, if ever. The foundation of functional and structural changes that occur in glaucoma is to be found in the arrangement of the several sectors in the retina, disc, optic nerve and the chiasm as well as in their vascular supply. The vessels of the optic nerve, like those of the retina, branch dichotomously and are terminal vessels with practically no anastomoses. Hence there is no more collateral circulation in spastic or other obliterative lesions of the optic nerve than in the retina. The binasal hemianopic fields which are frequent in advanced glaucoma also occur in chiasmal lesions, especially in those of vascular origin. The mydriasis which usually accompanies glaucomas cannot be produced by fluid vitreous injections that increase the intraocular tension. The pupillary changes in glaucoma are essentially bilateral, even though but one eye is involved. Similar changes may be induced with electric shock or cardiazol treatment. These basically affect the vascularity of the hypothalamus. The hypothalamic center of Karpus and Kreidl which is apparently primarily involved affects pupillary dilatation and is very near the other autonomic centers, which are involved in lacrimation, accommodation, and indirectly in intraocular tension and glaucoma. This autonomic regulation involves not only the quantity and quality of nervous impulses but also vascularity and permeability.

It is difficult to dissociate hypothalamic and pituitary function. The relative fre-

quency of glaucoma in patients with definite evidences of pituitary disfunction has long been known. Only recently are the association of bodily neurovascular spastic and other obliterative lesions in integrated patterns being recognized. Irrespective of their bodily locations, angioneurotic edema in the skin and the chronic glaucoma of epidemic dropsy in India, have in common a dominant neurovascular factor in which apparently hypothalamic dysfunction is involved. The accepted field changes in primary glaucoma are evidence that the atrophy is descending, not ascending. This means that paracentral, peripheral and central loss of vision is not primarily intraocular, but due to vascular lesions in the optic nerve and hypothalamus. (8 figures, 61 references.) Chas. A. Bahn.

Marr, W. G. **The clinical use of diisopropyl fluorophosphate (D.F.P.) in chronic glaucoma.** Am. J. Ophth. 30:1423-1426, Nov., 1947.

Sabata, J. **A case of inborn glaucoma observed during seven years.** Lekarske listy 2:477-479, Oct. 15, 1947.

A girl of healthy parents had bilateral congenital glaucoma which was followed by great growth of the eyeballs, subluxation of the lenses and spherophakia. The child, now eight years of age, began to grow strikingly in height at the age of six years and now she displays other symptoms of Marfan's syndrome.

F. H. Haessler.

10

CRYSTALLINE LENS

Arjona, J. **Two thousand cataract operations.** Arch. soc. oft. hisp.-amer., 7:429-444, May, 1947.

This is a brief analysis of 2,000 cataract extractions performed by the author. Tabulated data are presented. His observations are also given on the behavior of certain types of cataracts with particular characteristics such as: juvenile, morgagnian, myopic, diabetic and those complicated by iridocyclitis.

J. Wesley McKinney.

Atkinson, W. S. and von Sallman, Ludwig. **Mercury in the lens.** Tr. Am. Ophth. Soc. 44:65-70, 1946.

A rose-brown, homogenous reflex was visible on the lens in a patient with chronic mercurialism. The clinical observations were supplemented with histological and histochemical studies on fixed specimens of the eyes removed at autopsy. Four control lenses were also studied histologically and histochemically. The microscopic appearance of elongated and amorphous deposits of black or dark brown pigment articles arranged with their long axes parallel to the surface of the lens is described. The control lenses did not contain such deposits. Spectrographic examination revealed that mercury existed among the trace elements in a value slightly less than five gammas. The chemical nature of the deposits was further confirmed with microchemical tests. Bellows suggests the distribution of the mercury in the lens may be explained, as in the case of copper, by the migration produced by the electric current within the eyeball. C. D. F. Jensen.

Barkan, Hans. **An evaluation of methods and results of cataract operations as performed in private and clinic practice at Stanford Hospital.** Tr. Am. Ophth. Soc. 44:71-79, 1946.

The author presents a survey of 771 cataract operations performed at Stanford Hospital during the past five years. The extracapsular method was used in 584 or 76 percent of these operations and the intracapsular in 187 or 23 percent. A vision of 20/30 or better was obtained in 83

percent of the intracapsular operations and in only 69 percent of the extracapsular. Sixty-two (10 percent) of the latter required discission. Retinal detachment followed eight and infection five extracapsular extractions and did not occur after the intracapsular procedure. There was vitreous loss in 5 of the 187 intracapsular operations and in 6 of 584 extracapsular. Barkan emphasizes the need of statistical reports of completely unselected material. Cases with poor prognosis are segregated from the body of the statistics. C. D. F. Jensen.

Buschke, Wilhelm. **Acute reversible cataract in chicken due to various nitrocompounds.** Am. J. Ophth. 30:1356-1368, Nov., 1947. (2 figures.)

Duehr, P. A., and Hogenson, C. D. **Treatment of subchoroidal hemorrhage by posterior sclerotomy.** Arch. Ophth. 38: 365-367, Sept., 1947.

Diagnosis of the expulsive type of subchoroidal hemorrhage is not difficult. The sudden severe pain, pallor, clammy perspiration and nausea associated with a rapidly hardening eyeball are characteristic. This occurred in a patient while the sutures were being tied after cataract extraction. The authors performed a sclerotomy and the knife was thrust into the wound to release the blood. This was repeated at least six times. The eye healed with normal tension and visual acuity of 2/100. R. W. Danielson.

Falcão, Pedro. **Utilization of oral suction apparatus in cataract operation.** Arq. brasil. de oftal. 9:131-138, 1946. Appears in English translation, Am. J. Ophth. 30: 1428, Nov., 1947.

Falcão, Pedro. **Technique of cataract operation with the oral-suction cupping apparatus.** Am. J. Ophth. 30:1428-1442, Nov., 1947. (2 figures.)

Hoskins, L. C. **Penicillin therapy of experimental infections of the lens and vitreous with Clostridium welchii.** Arch. Ophth. 38:301-309, Sept., 1947.

In view of the failure of penicillin iontophoresis to check infection of the lens with Clostridium welchii, the present study was undertaken with direct injection of penicillin into the lens and the vitreous. Direct injection of penicillin into the lens and vitreous of rabbits controlled infections with Clostridium welchii when the therapy was instituted within three hours after the inoculation. Less favorable results were obtained when the interval between the infection and the treatment was increased to six hours. The beneficial effect in the three hour series was obtained with moderate damage to the structures of the eye. (15 references.) R. W. Danielson.

Kettesy, A. **Restoration of the chamber after intra-capsular extraction.** Brit. J. Ophth. 31:572-575, Sept., 1947.

Delayed restoration of the anterior chamber is more frequent after intracapsular extraction than after extracapsular but it is less significant because it cannot be ascribed to particles of capsule or cortex left in the wound. The easily verified and remediable causes are: delayed healing, reopening of the wound, and choridal detachment.

Occasionally the anterior chamber does not form at all and this very serious sign seems not to be appreciated.

It can occur after a perfectly normal operation with a perfectly healed wound. On the twelfth or fourteenth day the cornea becomes hazy, the tension rapidly rises and the eye becomes blind. In 20 years in which he performed 250 extractions annually, Kettesy lost two eyes from this occurrence, and chance affected a cure in a third and gave a possible explanation. Both eyes of the patient were

operated on by uneventful intracapsular procedures. On the twelfth day the tension rose and despite medical treatment, both eyes seemed lost. Cyclodialysis was attempted and by accident the spatula injured the hyaloid membrane of the vitreous. The latter immediately streamed forth, pushed back the iris and filled the anterior chamber. The procedure was repeated on the second eye with the same result. Satisfactory healing was uneventful. The cause of the rise in tension is purely mechanical. The flat iris becomes plastered against the cornea and kept there by the inelastic hyaloid membrane. The aqueous is absorbed by the vitreous and this increases the pressure so that the iris is pressed more firmly against the cornea.

Morris Kaplan.

Leoz, G. **Cataract extraction in high myopia.** Arch. Soc. oft. hisp.-amer. 7: 445-458, May, 1947.

When a cataract develops in a patient with a high degree of myopia the cataract is usually found to be one of the most complicated. Generally, there is damage in the retina, choroid and vitreous humor which makes the success of the operation very doubtful. The author recommends that whenever it is possible it is much better to perform this kind of cataract operation in two stages; a total iridectomy, followed by extracapsular extraction a month later.

J. Wesley McKinney.

Parry, T. G. W. **Post-operative security in cataract cases.** Brit. J. Ophth. 31:569-570, Sept., 1947.

To obviate expected difficulties in post-operative care of an 80-year-old somewhat unreliable patient a complete conjunctival flap was tied with a purse string suture so as to cover the entire cornea after an ordinary intracapsular extraction. The eye was bandaged and the patient walked back to bed and remained ambulatory. The suture started to give on the third day and the whole cornea was clear on the fourteenth day. The procedure seemed so satisfactory that it was repeated on 11 more patients with very good results. All patients were ambulatory after 24 hours and all healed uneventfully.

Morris Kaplan.

deRoetth, A. **Influence of the suture on complications following cataract operation.** Arch. of Ophth. 38:315-330, Sept., 1947.

Use of deep sutures in cataract operations is a great step forward in eliminating certain complications. The preplaced appositional corneo-scleral suture, combined with a conjunctival flap covering the wound, is considered the best method. A modification of the McLean suture is described which eliminates the difficulty of making the incision in the presence of a prepared conjunctival flap. One or two sutures can be used. A series of 150 unselected cases of cataract extraction with use of the Verhoeff suture method A, and a second series of 150 cases of extractions with use of the new suture are compared as to post-operative complications, degree of astigmatism and final visual results. It was found that the new suture was superior to the Kalt-Verhoeff suture in the rapid and solid closing of the wound, thus keeping low the incidence of shallow and flat chambers, wound rupture and postoperative prolapse of the iris and vitreous. (38 references.)

R. W. Danielson.

Samuels, Bernard: **Cataract complicating glaucoma.** Tr. Am. Ophth. Soc. 44: 51-60, 1946.

The author presents the sixth and last part of a survey undertaken to record all microscopic changes that can take place in the lens as a result of lesions in other

structures of the globe. He describes 31 cases of cataract that were believed to have been caused primarily by glaucoma and includes interesting observations on the pathological changes that take place in the retina, iris, and ciliary body. He is unable to shed light on the high incidence of extensive retinal hemorrhage in no less than half of the cases of primary glaucoma. He leaves the question unsettled as to whether glaucoma had led to an impediment in the venous outflow or whether an impediment in the latter led to glaucoma. He points out that malignant glaucoma, particularly when the lens is tilted into the wound, is usually caused by a subchoroidal hemorrhage. In two cases in this series postoperative malignant glaucoma was evidently caused by nonexpulsive subchoroidal hemorrhage. Two other cases of malignant postoperative glaucoma without detachment of the choroid are believed to be definitely the result of a swollen and hardened vitreous body. An extensive cyclodialysis frequently favors the more rapid development of the cataract and may lead to an insidious iritis which is hard to counteract because atropine must be used cautiously. After trephining the ciliary processes are often fixed to the scar and extensive hemorrhage is apt to follow the section which may lead to membrane formation and possibly to sympathetic ophthalmia. (10 figures) C. D. F. Jensen.

Seidenari, R. **The vortex and the posterior epithelium in cataract.** Rassegna ital. d'ottal. 16:293-311, July-Aug., 1947.

The author discusses the question of the growth of the anterior epithelium around the equator and into the posterior surface of the lens. He reports 10 cases, giving the clinical histories and a description of the microscopic changes. Especial attention is given to the general aspect and width of the posterior epithelium, the form, size and aspect of the nuclei, and the number of layers of cells. The epithelial cells passed over the equator in 82 percent of 50 cases. In the nine lenses in which this was not so five had mature or hypermature cataract and four immature. No definite conclusions can be drawn except that the overgrowth of epithelium is not characteristic of any type or age of cataract but it is most marked in complicated cataract. (4 figures.) Eugene M. Blake.

11

RETINA AND VITREOUS

Dollfus, M. A., Thiebaut, F., Daum, S., and Wolinetz, E. **Tuberous sclerosis of Bourneville.** Presse Méd. p. 380, June 4, 1947.

The authors report the case of a boy of 18 years with the characteristic tetrad of symptoms that consists of skin lesions, phakomatosis retinae, epileptic crises, and mental retardation. The skin lesions were nevi, vitiligo, and adenoma sebaceum. The epileptic attacks first appeared at the age of 15 years. The mental retardation had resulted in a mental age of 8 to 10 years and there was a simultaneous somatic retardation.

The patient had a visual acuity of 10/10 in each eye but fundus examination revealed prepapillary tumors and multiple pseudo-colobomatous atrophic areas. The lesions did not change during the three months that the patient was observed.

Phillips Thygeson.

Espildora Luque, C., and Schweitzer, A. **The ocular fundus in 78 autopsied cardiovascular patients.** Arch. chilenos de oftal. 3:297-304, Nov.-Dec., 1946.

The ophthalmoscopic examination was negative in 18 percent of the cases. In cases where the age was less than 40 years, the ocular background was negative in 32 percent; of those above 40 years

the negative finding was in 12 percent. In both groups of patients the normality of the eyeground coincided with severe lesions of the cardiovascular-renal apparatus; the renal lesion predominating in the young, and aortic, myocardiac, cerebral, or occasional renal lesions in those of greater age. In young cardiovasculars the ophthalmoscopic lesions were generally more discrete. An exception to this was in malignant angio-nephrosclerosis, which was always accompanied by frank and serious changes of the ocular background. W. H. Crisp.

Fritz, M. H., Fennessy, T. M., and Cabrera, H. **Operative technique of vitreous replacement.** Am. J. Ophth. 30:1221-1224, Oct., 1947. (2 figures, 5 references.)

Greear, J. N. **Interpretation of ophthalmoscopic findings in arterial hypertension.** Am. Practitioner 1:640-642, Aug., 1947.

The author gives a brief historical discussion of the topic and recommends the classification of retinal lesions in hypertension advocated by the Americal Ophthalmological Society.

In pathological studies the author found that cottonwool patches were the result of localized areas of serous exudate in the deeper layers of the retina, or cytoid bodies in the nerve-fiber layer. The macular star figure was composed of collections of lipoidal histiocytes usually in the outer plexiform layer. The flame-shaped hemorrhages involved the nerve fiber layer, the more punctate and round hemorrhages the deeper layers. There is a short discussion of the ophthalmoscopic findings in the various types of hypertension. (References.) Bennett W. Muir.

Hallum, A. V. **Changes in retinal arterioles associated with the hypertensions of pregnancy.** Arch. Ophth. 37:472-490, April, 1947.

This is a detailed study of the fundus changes in hypertensions of pregnancy including a review of the literature. At least 10 percent of pregnant women show some degree of late toxemia. It is stated that an examination of the eyegrounds by one experienced in their interpretation gives the most essential information concerning the management and course of the various toxemias of pregnancy. The obstetrician should do his own ophthalmoscopy, because he will often gain valuable information without extra expense and delay to the patient.

Acute hypertensive true toxemia of pregnancy is characterized by localized and generalized spastic constriction of the arterioles, the degree of which has been found to parallel closely the severity of the toxemia. The degree of spasm of the retinal arterioles indicates the degree of angiospasm in other parts of the body. The eyegrounds should be examined routinely during the early months of pregnancy to determine the status of the arterioles. Later in pregnancy, if hypertension develops, the frequent inspection of the arterioles may help determine the treatment to follow. John C. Long.

Koch, F. L. P., and Strong, P. S. **Lipemia retinalis: report of a case.** Tr. Am. Ophth. Soc. 44:187-194, 1946.

The authors report a case of lipemia retinalis in a diabetic subject. It is the sixty-sixth case of lipemia retinalis to be reported three of which unquestionably occurred in patients without diabetes. Photographs of the eyegrounds and of the serum show the contrast between the conditions present at the peak of the episode and on the twenty-first hospital day.

C. D. F. Jensen.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. Frederick G. Adolph Bardenheier, St. Louis, Missouri, died September 26, 1947, aged 65 years.

Dr. Edward T. Hornback, Hannibal, Missouri, died July 15, 1947, aged 83 years.

Dr. Bertil Thomelius Larson, Pontiac, Michigan, died July 20, 1947, aged 54 years.

Dr. Charles Porter Small, Chicago, Illinois, died September 25, 1947, aged 83 years.

ANNOUNCEMENTS

FLORIDA MIDWINTER SEMINAR

This year the University of Florida Midwinter Seminar in Otolaryngology and Ophthalmology will be held at the Flamingo Hotel in Miami Beach, from January 12th to 17th. The lectures in otolaryngology will be presented on the first three days and those in ophthalmology, the last three days. The registration fee is $25.

Among the outstanding ophthalmologists who will lecture are Dr. S. Judd Beach, Portland, Maine; Dr. William L. Benedict, Rochester, Minnesota; Dr. Daniel B. Kirby, New York; Dr. Peter C. Kronfeld, Chicago; and Dr. Dohrmann K. Pischel, San Francisco.

GEORGE WASHINGTON UNIVERSITY COURSE

From January 26th to 30th, The George Washington University School of Medicine, 1335 H Street, N.W., Washington 5, D.C., will conduct an intensive postgraduate course in ophthalmology.

Fundamental and practical instruction in ophthalmic problems will be presented. Among the topics to be considered are the following: anatomy of the eye, orbit, and optic pathways; congenital defects of the eye; examination of the eye; mydriatic and miotic agents; ocular findings in intracranial disease; the neuro-ophthalmologic examination; psychosomatic disorders; ocular findings in systemic diseases; preoperative and postoperative care for eye surgery; management of cataracts; diagnosis and surgical management of ocular deviations; tumors of the ocular bulb and adnexa; penetrating injuries of the eye; nonperforating eye injuries; localization and treatment of foreign bodies in the eye and orbit; lacrimal apparatus; uveitis; glaucoma; pediatric, geriatric, and tropical ophthalmology.

Among the distinguished ophthalmologists who will take part are: Dr. F. Bruce Fralick, University of Michigan; Dr. Murray F. McCaslin, University of Pittsburgh; Dr. Phillip Robb McDonald, University of Pennsylvania; Dr. Charles A. Perera, Columbia University; Dr. Raymond Pfeiffer, Columbia University; Dr. James S. Shipman, University of Pennsylvania; Dr. Isaac Samuel Tassman, University of Pennsylvania; Dr. Charles Dwight Townes, University of Louisville; Dr. Frank B. Walsh, Johns Hopkins University; Dr. Alan Woods, Johns Hopkins University.

Dr. Ernest A. W. Sheppard, professor of ophthalmology, is the faculty member in charge. The fee for the one-week course will be $50.

OREGON TO HAVE COURSE

The ninth annual spring postgraduate course in ophthalmology and otolaryngology will be held in Portland from March 21st to 26th. Another fine program has been arranged by the Oregon Academy and the University of Oregon Medical School. Dr. A. D. Ruedemann, Wayne University, Detroit, and Dr. C. Allen Dickey, University of California, San Francisco, will be among the guest speakers. There will be lectures, clinical demonstrations, and ward rounds.

Preliminary programs will be ready about February 1st. A program and further information may be obtained from Dr. Harold M. U'ren, secretary, 1735 North Wheeler Avenue, Portland 12, Oregon. In order to make the course more practical and personal, registration will be limited to 125.

A.O.S. TRANSACTIONS AVAILABLE

The American Ophthalmological Society offers back copies of its *Transactions* from its founding through 1939, with the exception of the following numbers that are not available: vol. 1, 1865, 1867, 1868; vol. 6, part 3, 1893; vol. 8, part 2, 1898; vol. 16, 1918; vol. 33, 1935; vol. 34, 1936; vol. 35, 1937. These volumes have been carefully stored and are in good condition.

Volumes 1 through 15 (years 1866 through 1917), vol. 21 (1923) and vol. 26 (1928) are unbound at $3 each. The other volumes are in the standard green binding at $5 each.

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MISCELLANEOUS

CHICAGO REFRESHER COURSE

The Chicago Ophthalmological Society held a one-week refresher course from December 8th to 13th. The subjects covered were office procedure, ocular motility, gonioscopy, glaucoma, ocular pathology, ophthalmoscopy, neuro-ophthalmology, perimetry, slitlamp biomicroscopy, refraction, and medical ophthalmology.

Staffs of the four Chicago medical schools and of Cook County Hospital served as instructors.

Eye hospital dedicated

The Thigpen-Cater Eye Hospital, commemorating Dr. Charles A. Thigpen and Dr. Job T. Cater, was dedicated on November 2, 1947, at Birmingham, Alabama. Dr. Alston Callahan, professor of ophthalmology, The Medical College of Alabama, has been named director of the Hospital.

Rivista di Oftalmologia

Florentine ophthalmology, more or less stagnant since the transfer of the "Bollettino d'Oculistica" to Rome and as a result of the recent war, is undergoing a reawakening. Prof. Biagio Alajmo, director of the Institute of Clinical Ophthalmology of the University of Florence, has founded a new monthly ophthalmologic journal, the "Rivista di Oftalmologia," which appeared in January, 1946, published by L. Salpietra, Florence, Italy.

The editor of the "Rivista" is ably assisted by a group of well-known Italian ophthalmologists—V. Accardi, A. Bencini, G. B. Bietti, F. Caramazza, D. Cattaneo, V. Cavara, A. Contino, Q. Di Marzio, E. Federici, R. Gallenga, L. Guglianetti, G. Lo Cascio, L. Maggiore, V. Rossi, A. Santonastaso, S. Sgrosso, A. Rubino, M. Simonelli, and U. Azzolini. The "Rivista" includes in its pages original papers, reviews, therapeutic notes, and abstracts from Italian and foreign journals.

Volume I, which the writer of this note (Charles A. Perera), has had the pleasure of reading, contains excellent papers by many prominent Italian oculists. If this volume is a portend of the future, it is safe to say that the "Rivista di Oftalmologia" will make an enviable reputation in Italian ophthalmologic literature. American ophthalmologists greet this newcomer with best wishes for its continued success.

Eye-Bank Fellowships

The Eye-Bank for Sight Restoration, Inc., has granted fellowships for research in ophthalmology to the medical schools of Harvard and Yale universities. Dr. Thomas Duane has been chosen to work at the Howe Laboratory, Harvard University Medical School, investigating the metabolism of the cornea. Dr. David Freeman, who will work at Yale University School of Medicine, will carry on experiments in tissue transplantation.

Riggs Optical Company moves

The Chicago city and general offices of the Riggs Optical Company are now located at 18 South Michigan Avenue, Chicago, where the company occupies the 4th and 5th floors.

Societies

N.S.P.B. annual meeting

The National Society for the Prevention of Blindness held its 33rd annual meeting on December 12th, in the Russell Sage Foundation Building, 130 East 22nd Street, New York.

The principal speaker was Dr. C. E. A. Winslow, editor of the *American Journal of Public Health.* Dr. Winslow's subject was "Prevention of Blindness in the Public Health Program."

Activities of the National Society for the Prevention of Blindness during the past year were reviewed by Dr. Franklin M. Foote, executive director. Mason H. Bigelow, president of the society, presided.

Reading meetings

At the 70th (Academy) meeting of the Reading (Pennsylvania) Eye, Ear, Nose, and Throat Society, the following members reported: Dr. Paul C. Craig, Dr. William J. Hertz, Dr. Isaac B. High, Dr. James E. Landis, Dr. John J. Penta, Dr. Samuel A. Phillips, Dr. Robert E. Shoemaker, and Dr. John M. Wotring.

The 71st meeting of the society was held jointly with the Berks County Medical Society. The speakers were Dr. Samuel A. Phillips of Allentown, Dr. Arthur A. Bobb of Reading, and Dr. William T. Hunt of Philadelphia.

Milwaukee program

On the scientific program of the November 25, 1947, meeting of the Milwaukee Oto-Ophthalmic Society were the following speakers: Dr. George Roncke, who discussed "Intraocular Tumors"; Dr. Wendell Jones, "Injection Therapy of Oesophageal Varices"; Dr. Charles Finn, "Case Simulating Acoustic Neuroma"; Dr. Howard B. Morter, "Otogenic Intracranial Infection"; Dr. Milton Loring, "Exophthalmos: A Case Presentation"; Dr. Claire M. Flanagan, "A Problem in Diagnosis of Laryngeal Carcinoma."

Personals

Gives Schoenberg Lecture

Dr. Peter C. Kronfeld, Chicago, delivered the first Mark J. Schoenberg Memorial Lecture on December 1, 1947, at the New York Academy of Medicine. The subject of the lecture was "The Canal of Schlemm."

Has new address

Prof. Ida Mann has resigned her appointment at Oxford University and has returned to London where her address is 87 Harley Street, London W. 1.

Receives Mackenzie medal

Mr. Eugene Wolff, F.R.C.S., London, was presented with the William Mackenzie Memorial Medal in Glasgow on October 24, 1947.

Speaks on corneal transplantation

Dr. A. E. Maumenee recently discussed "Corneal Transplantation" for the members of the department of ophthalmology, Medical College of Alabama, at the Thigpen-Cater Eye Hospital.

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 31 FEBRUARY, 1948 NUMBER 2

OCULAR LESIONS FOLLOWING THE ATOMIC BOMBING OF HIROSHIMA AND NAGASAKI*

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INTRODUCTION

It seems necessary for me to relate briefly in chronological order the fortuitous series of events leading to my participation in the medical investigations at the atomic bomb areas in order to give the reader insight into the situation that confronted us and the difficulties we encountered in making a clinical study of the survivors. The atomic bomb had struck Hiroshima on August 6, 1945, and Nagasaki on August 9, 1945, three days later.

On September 7th, I was called to an interview held in Yokohama with Brig. Gen. T. F. Farrell, Col. A. W. Oughterson, Col. Stafford L. Warren and Dr. Masao Tsuzuki of Tokyo Imperial University. Dr. Tsuzuki had made an expedition to Hiroshima with some other Japanese several days before, but no American expeditions had been made until that time.

Farrell and Warren represented the Atomic Bomb Investigation Committee of the Manhattan Project. Oughterson, who was at that time deputy chief surgeon, General Headquarters, was to represent the Supreme Command. The Manhattan-Project group, of course, were interested in furthering technical studies carried over from the long train of laborious scientific experimentation and complicated industrial administrations that were partially consummated *in the first test explosion of the atomic* bomb conducted in New Mexico in July, 1945. Their survey was to comprise not only medical research but multitudes of technical observations in the realm of nuclear physics. Colonel Oughterson's task, more specialized, was to make a survey of the overall casualty picture and to organize and formulate a program for adequate study of the casualties. "They say this explosion gives off the light of ten-thousand suns!" he said to me. "If this be true there should be something for you to do."

Our party consisting of three medical officers and 16 others flew to Hiroshima on September 8th, and made the first official entry into the city of Hiroshima on the morning of September 9th. We visited the Red Cross Hospital in charge of Dr. Ken Takenchi and learned that at that time there were approximately 2,000 atomic bomb casualties in 80 hospitals in Hiroshima and surrounding area. Since most of these hospitals were very small and widely scattered over the countryside with no centralized registration, we could see an almost unsurmountable obstacle to organized study of cases. We learned that the death rate was 100 per day among those survivors and felt that any studies made would have to be instituted quickly.

Ujina Hospital was selected for the center of operations because it was located two kilometers from the center of the explosion and because it had the largest number of

* This work was performed as part of the medical researches undertaken by the Manhattan Project, under the guidance and supervision of Dr. Stafford L. Warren, then of the University of Rochester. The aid of Mrs. H. C. Wilder of the Army Institute of Pathology in interpreting the microscopic sections is also greatly appreciated.

patients and the most capable medical organization. Only 30 of the 300 doctors in Hiroshima were alive and able to work at that time. Fairly comprehensive blood studies had been made at Ujina by Dr. Nakao, but the rarity of English-speaking Japanese and our inability to use the records were very discouraging.

There were 220 patients in the hospital at that time for our study. Although all these patients were casualties of the atomic bombing in a sense, they included many types and categories that could furnish us only a small amount of useful information. Some of the patients were debilitated old people, some suffering only from malnutrition; others had thermal burns of the ordinary type sustained in the conflagration of their homes. Although it was our mission to gather statistics on the overall casualty picture including all types, our interest was unavoidably centered about the peculiar form of reaction to irradiation. Japanese records even when translated were often disappointing. Chaotic conditions were reflected in the confusing records kept of the patients. Great numbers of patients were moribund on admission. Lack of housing facilities, medical equipment and personnel, and time interfered with complete and adequate case studies. At one time there were 500 seriously ill patients cared for on the lawn in front of the Red Cross Hospital. This point was a center to which wounded were brought because special fire-fighting facilities had been set up there to keep the fire from that area.

Some of our patients were found in Ono Military Hospital, an old, made-over tuberculosis sanatorium, south of Hiroshima. Two weeks later a landslide brought on by a typhoon destroyed the entire hospital and killed nearly all the persons in it. We went through a small hospital situated in a school house containing several hundred casualties. The place was in charge of a lay nurse's assistant. She told us the doctor came every three days to attend the patients. Dozens of dead were lying among the living. Innumerable flies covered raw, granulating wounds.

At the end of the second day I had examined approximately 300 patients. I had found the usual traumatic lesions one sees in wartime but none of the corneal or lenticular syndromes I had expected to find. There were few ophthalmias among the sick and those found were of the nonspecific kind due to infection. Knowing the high degree of radioresistance of the tissues of the posterior segment I had paid little attention to ophthalmoscopic studies. Becoming interested in the blood studies and peculiar clinical picture of the late "aplastic" anemia, I felt that ophthalmology was to play a very small part in the pattern of radiation sickness or "atomic-bomb disease" as it was being called.

On the third day I was examining two moribund Japanese soldiers with bloody diarrhea, bleeding from the gums, covered from head to foot with petechiae. Their white counts were 2,000 and 900. I examined their eyegrounds. Both had extensive hemorrhagic and exudative lesions of the retina. It seemed entirely consistent with the rest of the picture. The observation seemed a minor confirmation of the findings of the clinicians and hematologists.

As I looked at these patients, I was struck by the remarkable similarity of the shape and form of the lesions in the two cases. Here were hundreds of cases of aplastic anemia! Why not make a study of them? There had never before been and perhaps never again would be such a collection of cases! Correlation of these ophthalmoscopic findings with those of the hematologists and clinicians made it evident that these characteristic fundus lesions were one of the most reliable criteria of radiation sickness. Thus we had acquired a very useful method of separating the radiation casualties from the others.

We had completed our initial survey and felt the need of equipment and personnel for a detailed and comprehensive study. We left Hiroshima on September 14th. Our expedi-

tion to Nagasaki began on September 20th when we flew to Omura. There we found the medical facilities much better than at Hiroshima. The geographic nature of the site of the explosion had resulted in far less destruction of life and property among the Japanese, leaving many able medical men to aid us in our work and to collaborate with us. There were also good buildings in which to work and a relative plenty of equipment and auxiliary personnel to help us. The large naval hospitals located in the vicinity provided excellent places in which to work. The Japanese did everything possible to aid us in carrying out our mission. It was here that a large part of the work herein described was done.

A number of English-speaking Japanese medical students from Kyushu Imperial University in Fukuoka were assigned to us as interpreters. Their work was of obviously great value in translating and interpreting the great number of case histories. At the bedside they were of greatest aid in questioning the patients and translating their answers. It was at Shinkozen Hospital in Nagasaki that my work began to assume organized form. I could see the outline of the task that lay before me. I compiled a check list of all the essential elements of my case histories and tabulated my cases in order not to forget any important data. A Japanese ophthalmologist by the name of Ikui, assistant professor of ophthalmology at Kyushu Imperial University, had been studying the cases there before I came. Through interpreters we had many discussions over the lesions. His studies were very thorough.

On the 26th of September our whole party moved its center of operations from the Shinkozen hospital in Nagasaki to the Omura Naval Hospital, 20 miles away, in which facilities for laboratory work and autopsies were excellent. In subsequent investigations extending over several months, the Omura Naval Hospital was the center, and all patients in surrounding areas were evacuated there for study and treatment. This large hospital was of excellent construction and well provided for in the way of equipment, including the comfort of linen, cooking facilities, and clean water supply. There were five wards of about 50 beds each. The patients were nearly all irradiation cases.

From a practical standpoint my work was immensely easier there due to better frame of mind of the patients and the fact that they were in hospitals beds instead of on straw mats on the floor as all the preceding cases had been. The routine of putting on and taking off a pair of army combat boots a dozen times a day and being compelled to crawl from patient to patient on my knees, examining eyegrounds in awkward positions, had become very annoying. Capable nurses were on hand to instill mydriatics to a whole ward of patients at a time. The patients soon became very much accustomed to the homatropine and seemed to enjoy having their eyes looked at, particularly those who suffered some loss of vision because of their lesions.

By means of army transportation I was able to travel around the area, visiting a number of the small hospitals, gathering case histories and doing ophthalmoscopic examinations. In this respect I had a great advantage over Japanese workers who, because of the unavailability of transportation, were compelled to remain in one hospital for their study.

I remember a visit to one hospital far up on the hillside very near the hypocenter of the explosion that will leave forever in my mind a picture of the stark misery of those wretched people. Only a jeep could have made the trip. In some places the pathway was no wider than a foot path and the wheels seemed to grasp for a footing on the sharply inclined mountainside. A stone building from which the windows, sash and all, had been blown out and from which the roof had been broken and partially blown away was the "hospital." About 20 patients were lying about on the floor upon loose straw so wet

that water came over the tops of my shoes as I stooped to examine the patients. Some were covered with loose nets but most of them were unprotected from the hordes of flies that came to feed upon their open wounds. A small Japanese man introduced himself as the doctor in attendance. He asked us in a weak though earnest voice if there were any way to help his patients, any medicines the Americans could offer. His hair was sparse and his skin pale. [K rations were brought in next day and the patients evacuated to better quarters.]

By the first of October the number of new cases of irradiation sickness coming to the hospitals was practically nil and it could be seen that further studies would have to be limited to repeated reëxaminations of the cases already under observation. On October 6, 1945, I returned to Tokyo to resume my duties with the 42nd General Hospital.

Review of the literature

From a medical standpoint the casualty picture of the survivors of the atom bombs is unique in the history of man. Experimental studies have been made in great numbers on animals by various investigators.[9,10] Medical literature is replete with reports of injuries and even death due to improper or excessive use of irradiation, but never before this time has the world seen death of human beings in large numbers from total body exposure to penetrating rays.

Concerning aplastic anemia and agranulocytosis, one finds isolated case reports of individual cases described more or less in detail,[1,7] often with special reference to the etiology (usually idiosyncrasy to some drug). Studies of the effects of whole-body irradiation even in animals have never included examination of the eyegrounds as far as the author has been able to determine.[10] Such studies have been focused on the gastro-intestinal tract and the hematopoietic system.[11,12]

Benkwith[2] describes a case which he saw in Nagasaki exhibiting epilation of the hair, and petechial hemorrhages of the skin and mucous membranes. The blood studies showed anemia and leukopenia. A beautiful colored illustration shows the hemorrhagic lesion of the retina. The reader is strongly urged to study this illustration—it is very characteristic.

Schlaegel[6] in his recent article gives a beautiful detailed account of the microscopic pathology of eyes taken at autopsy of fatal cases. The article has a comprehensive bibliography. A singularly distressing fact that has been apparent to more than one of us is that the fundamental, early research on biologic effects of irradiation was made with primitive equipment and the protocols often are not clear as to the physical properties of the energy with which the effects were brought about.[5,9] The remarkable advances made in nuclear physics are such as to make much of this early experimental work nonspecific and of little value as interpreted today.

Clinical studies

At the time of our visit to the atomic-bomb areas at Hiroshima and Nagasaki, it was anticipated that some pathologic changes would be found in the eyes of those survivors who were near the site of the explosion. It was known that a large amount of light was produced by the explosion, and it could be assumed that some detectable damage to the tissues of the eye could have resulted. To the date of the completion of this study, October 6, 1945, no primary damage to the ocular structures has been observed that could be interpreted as the result of irradiation of any sort. The president of the Nagasaki Medical College, Dr. Yamane, who himself died two weeks after the explosion from irradiation sickness, is said to have treated a number of cases of purulent conjunctivitis occurring 3 or 4 days after the blast and lasting about a week. These cases all resolved and the disease did not involve the cornea or leave any permanent sequelae. No bacteria were found in the discharge in

studies made by the Japanese at that time.[8]

No evidence of such a disease was found by us 4 to 6 weeks later, and no patient questioned by us gave a history of such a disease. A number of patients with flash burns of the face who must have been facing the exploding bomb were examined carefully with the pupil dilated using the ophthalmoscope and focal illumination. No opacities could be seen in the lens and no pathologic changes were noted in the cornea or conjunctiva. In fact, the flash burns seemed to spare the eyelids in many cases as if the tight closure of the eyes had occurred quickly enough to hide that area of skin. Some patients were seen who had lost their lashes but epilation of eyebrows was rare.

Lesions resulting from the explosion of the atomic bomb may be divided into three categories:

1. Mechanical injury from the blast.
2. Thermal injury from long-wave energy.
3. Radiational injury from gamma rays and neutrons emitted at the time of detonation.

Mechanical injury from blast

Those lesions resulting from mechanical injury differed in no way from those produced by other explosive agents, such as bullets and shells. Among those noted were penetrating injuries of the globe, leukoma of the cornea, traumatic cataract, various lid deformities including ectropion, symblepharon, ankyloblepharon, detachment of the retina, and various syndromes involving fracture of the skull and walls of the bony orbit. Many ambulatory casualties were seen on the streets wearing eye patches.

Thermal injury from long-wave energy

Effects of the enormous thermal energy released by the explosion were evidenced in the frequency of pigmented flash burns. These were of a copper color and involved only the side facing the explosion. The burned areas had straight-line borders resembling a shadow cast over the upper trunk. There were large numbers of patients exhibiting extensive facial burns of the ordinary type with much dense cicatrix. These burns in some instances had involved the conjunctiva and cornea to such an extent that the red, inflamed, lacrimating eyeball had only slight movement and seemed set in a dense mass of contracting scar.

Radiational injury

It is not in the province of this paper to describe in detail the general picture of the effects of the whole-body irradiation or "radiation sickness" as it has been called. However, a brief outline of these phenomena may help to orient the reader in interpreting the more specific findings of the ocular examinations. From 3 to 5 days after the explosion, many survivors who had been near the hypocenter became acutely ill and completely prostrate with bloody diarrhea. These individuals died within 2 or 3 days, long before our investigation began. Those may be called "acute roentgen deaths." They did not become subjects of our investigation. Accounts of the course of their illness were obtained from the Japanese local medical authorities.[3,10] It is assumed that they all received dosages of irradiation sufficient to cause necrosis of the mucosa of a large part of the gastro-intestinal tract.

Beginning about two weeks after the explosion, a strange, new syndrome appeared. Individuals who had previously been well and apparently free from all injury from the explosion fell ill in large numbers. They manifested extreme weakness, pallor, and loss of hair. Innumerable petechial hemorrhages appeared in the skin and there was ulceration and bleeding from oral mucosa. They became febrile and succumbed in large numbers to invasive pulmonary and pharyngeal infection. Examination of the blood revealed extremely low red-cell and hemoglobin values, low white blood count, particularly the granulocytes, and an extremely prolonged bleeding time with no

clot formation. The condition progressed to death. Such cases appeared in large numbers from the beginning of the third week until the end of the sixth week and brought much speculation from the Japanese as to the probable etiology. At the time of our arrival in Hiroshima, near the end of the fourth week, the death rate in that area was given as 100 per day.

The Japanese were doing numerous autopsy studies on the cases at the time of our arrival and had already demonstrated the lesions of the bone marrow, the lymphoid atrophy, the aplastic blood picture, and the diffuse manifestations of hemorrhagic diathesis.

Many of the patients from Hiroshima were evacuated to Fukuoka, Kyushu, for study and treatment in Kyushu Imperial University. Dr. Toichiro Sawada and Dr. H. Mizusima of the medical faculty there showed us the clinical records of many of these cases, the completeness and detail of which reflected their keen awareness of the situation. Dr. Kosaku Ono of the Pathological Institute has preserved beautiful specimens of autopsy material, particularly of the gastro-intestinal tract. It was in this institution that Ikui[3] made his ophthalmoscopic studies.

The physical state leading to and forming the basis of the ocular lesions I am about to describe is briefly and concisely set forth in the following quotation from Warren:[12]

"The hematopoietic system (marrow and lymph nodes) is so badly damaged by the penetrating gamma and neutron radiation as to appear aplastic on histologic examination. This damage is reflected later in leukopenia, progressive anemia, development of petechiae, prolonged bleeding time with absence of clotting with probably some actual capillary injury to all the vessels in the body. . . ."

Ocular lesions associated with irradiation

Ocular lesions associated with or secondary to irradiation were limited to the retina, as far as clinical features were concerned, and were found in 46 cases. Unfortunately accurate count was not made of all patients examined. A reasonable estimate, however, is about 400, of whom approximately 50 were from the Hiroshima area and 350 from the Nagasaki area. Even if these figures were actually known it would be difficult to compute the real incidence of the ocular lesions, since in some instances examination with the facilities available at the time left some doubt as to whether radiation reaction was actually present or not. It was felt that in many cases the ophthalmoscopic examination was useful in establishing a diagnosis of postradiation state in otherwise doubtful cases. I believe it can be stated without reservation that retinal lesions were found in 50 percent of those showing obviously demonstrable signs of whole-body irradiation, that is, epilation, leukopenia, and petechiae of the skin.

The relationship of the blood changes to the retinal lesions is emphasized in the analysis of the data obtained in the clinical examinations (table 3). Of the patients showing these retinal lesions 75 percent had one or more other clinical symptoms of irradiation at the time the study was made. Of 37 cases in which leukocyte counts were available, 28, or 75.7 percent gave figures at some time of 4,000 or below. There were 23 patients under 25 years of age and 23 patients over 25 years of age. Of the four clinical signs found to be typical of irradiation damage—petechiae, gingivitis, angina, and epilation—the group of under 25 had an average of 1.52 while the group of over 25 had an average of 1.22, a difference of about 20 percent. This may indicate a relationship of age to sensitivity to gamma irradiation. However, no correlation whatsoever could be found between the age and the degree or intensity of ocular involvement.

All of the patients in this study were within two kilometers (1.2 miles) of the hypocenter of the explosion. Of all 41 cases, where the information could be obtained,

only 8 (19.5 percent) were outside of a building at the time of the blast. In these cases it must be assumed that some intervening absorptive material, that is concrete, must have protected the majority from gamma-ray dosages that would certainly otherwise have caused them to die before our investigation began.[12] Because of this unknown amount of shielding in any given case, it appears that a correlation of the distances from the explosion with the quality and intensity of the pathologic effects is difficult to compute in spite of the fact that doses received through the air by persons at equal distances were probably the same.

TABLE 1

RELATION OF WHITE BLOOD COUNT TO DISTANCE FROM EXPLOSION

Type Lesion	Number Cases	Average W.B.C.	Average Distance
Exudate alone	10	4,666	1.15 Km.
Hemorrhage alone	14	3,458	1.08
Exudate plus hemorrhage	22	3,156	0.99

The data in Tables 1 and 2 show, however, a definite tendency for the white count to vary directly with the distance from center, and it is felt that if the many extraneous factors such as density of clothing, posture at the time of the blast, intercurrent physical disease, and nonradiational injury could have been properly evaluated the relationship could have been demonstrated more clearly.

Although the factor of sex in the development of the reaction did not seem to be prominent in the cases examined, it may be seen from Table 3 that the average white-cell count was significantly lower for the females than for the males. There is little or no relation between the sex and the ocular lesions found, qualitatively or quantitatively.

It is evident then that, in the case of any given individual at the time of our investigation, we knew only that he had received a dose of irradiation that was either sublethal for him or lethal with a longer latent period than other cases had shown. As noted in some of the case histories, serial leukocyte counts made by the Japanese before our arrival indicated that the depth of the leukocyte depression probably took place around the first week in September in the cases alive and available for our clinical appraisal at the time this survey was made.

TABLE 2

RELATION OF WHITE BLOOD COUNT TO DISTANCE FROM EXPLOSION

Distance Meters	Number of Cases	Counts Available	Average W.B.C.
0–500	10	10	2,470
500–1000	15	9	3,344
1000–1500	12	11	3,081
1500–2000	8	4	8,950

TYPES OF HEMORRHAGES OBSERVED

The lesions observed in this disease appeared in the retina and were limited to that structure and the nerve-fiber layer as it overlay the nerve head. The hemorrhages were of four types. In order of frequency of occurrence these are: flame hemorrhage, preretinal hemorrhage, "Roth"-type hemorrhage, and vitreous hemorrhage.

Flame hemorrhage is, of course, situated in the nerve-fiber layer of the retina. It is due to the rupture of capillaries in that layer and the infiltration of cellular blood elements between the nerve fibers. These lesions were very numerous, being seen in 25 (54.3 percent) of the cases. They were nearly always situated, as were all other fundus lesions described in this study, close to the nerve head, being rarely seen further than three disc diameters away. Some of the flame hemorrhages were very dense and had

TABLE 3

INCIDENCE OF SEX AND RELATION TO WHITE BLOOD COUNT

Sex	Number	Number Counts	Average W.B.C.
Male	20	16	4,262
Female	26	21	2,976

a deep maroon color, while others were a very pale red and only slightly darker than the uninvolved retinal tissue and underlying choroid. The pallor of these hemorrhages was a striking manifestation of the depletion of circulating hemoglobin. The term "flame hemorrhage" is used in this study to refer only to those lesions in which the reflexes from the internal limiting membrane revealed no change in level as they passed over the lesion. The location in the nerve-fiber layer was often strikingly demonstrated by the extension of the lesion continuously onto the disc itself. Some of these took the form of narrow, splinter shapes often being situated parallel to and very close to a large vessel.

TABLE 4

TYPES AND INCIDENCE OF RETINAL LESIONS

Lesion	Number of Cases	Percent of Total*
Exudate	30	65.2%
Flame hemorrhage	25	54.3%
Preretinal hemorrhage	11	23.9%
"Roth"-type hemorrhage	4	8.6%
Vitreous hemorrhage	2	4.3%

* These percentages do not total 100 because each eye often had more than one type of lesion.

Preretinal hemorrhage occurred in 11 (23.9 percent) of the cases. These seemed to be a gross development of the flame hemorrhage in which the blood had leaked into the subhyaloid space producing an elevated, rounded hematoma immediately adjacent to but not invading the vitreous. These lesions were often quite large and had straight-line, horizontal upper borders due to stratification of the elements of the blood. The surface of the hematoma was smooth and convex as determined by the character of the reflex from it. The surface of these blood masses was granular. The distinguishing ophthalmoscopic features of these lesions were their uniformity of color, their large size, their extremely sharp margins, and the tendency to form horizontal, straight-edged upper margins. The serum of the blood could be dimly seen above the straight edge and was usually clear enough so that underlying retinal vessels could be seen.

"Roth"-type hemorrhage. A unique type of hemorrhage observed in this study resembled nothing so much as a Roth spot except that it was larger. These lesions were noted especially in 4 (8.6 percent) of the cases. They were larger than most flame hemorrhages and were almost invariably seen overlying a large artery, a branch of the first order. The portion of the lesion toward the disc was smoothly and sharply outlined while that away from the disc was brushlike. The color was a deep maroon and the lesion showed elevation of the retinal surface. Somewhere on the lesion, usually on the distal portion, was an irregular, round, white area about one fourth of the diameter of the lesion itself. The pathogenesis of these spots could be made out from a study of the hemorrhage forming in association with the exudates (vide infra).

Vitreous hemorrhage was noted in two cases (4.3 percent). There was an infiltration of the vitreous body itself by blood which had burst through the hyaloid. The view of the fundus was always more or less obscured in this type of hemorrhage.

Exudation into the retina was a most common finding in these cases (30 or 65.2 percent). It took the form of round, snow-white, slightly elevated lesions obscuring the retinal vessels. They were usually about one-fourth disc diameter in size. These spots were always within three disc diameters of the disc and were sometimes extremely numerous, 40 or 50 being seen in a single eyeground. The spots were scattered in random fashion over the polar zone of the retina without any reference to blood vessels.

In some of the cases, however, it was noted that occasionally a lesion situated near an artery would show a fine fringe of hemorrhage about its borders, particularly its peripheral or distal border. Some were seen

in which this hemorrhage became large and came to surround the exudate. This led me to believe that such a hemorrhage about an exudate could develop into a hemorrhage of the so-called "Roth" type described above.

The morphologic variations noted in these exudates were rather marked. The most common type was, as described, round and smoothly elevated with a feathered margin indicating that it was an involvement of the nerve-fiber zone. Elongated forms were also seen and a peculiar zig-zag formation in which the extension in length was in a direction perpendicular to the direction of the nerve fibers composing the lesions. Also in these the area of exudation would not everywhere be equidistant from the disc, producing a "Z" shaped figure (fig. 1). In some cases this development became so marked that these exudates formed one or more rings or wreaths partially surrounding the disc.

Subsequent observation of the lesions showed their borders to become sharper as they absorbed in contrast to the hemorrhages in which the borders became more indefinite as absorption progressed. A late residue of an old exudate is a small waxy, yellowish, sharply outlined plaque associated with several much smaller satellite spots. In some instances rather large sharply outlined grayish speckled areas were seen surrounding a large artery. These could very well represent residual atrophy from absorption of one of the larger hemorrhages.

No changes were observed in the optic discs nor were any pathologic changes noted in the vessels themselves. Generalized retinal edema was a very common accompaniment of hemorrhages and exudates so that if edema was present a search for a local pathologic condition was more intensively pursued.

Microscopic findings

Microscopic examination of the eyeballs removed at autopsies done in Hiroshima and Nagasaki has been carried out by Mrs.

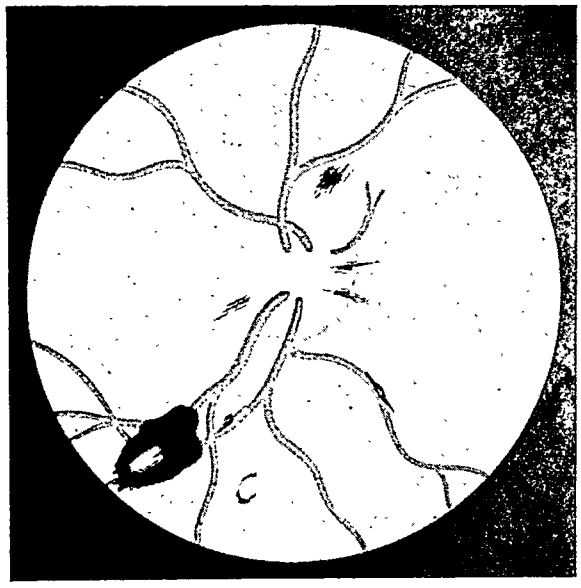


Fig. 1 (Flick). Composite drawing representing the different morphologic types of fundus lesions seen. The hemorrhages are in black and the exudates in white.

H. C. Wilder of the Army Institute of Pathology, Washington, D.C., and also by Dr. T. F. Schlaegel, Jr., of the Indiana University School of Medicine, with both of whom I have conferred personally at length on the findings. It is an unfortunate fact that none of the cases appearing in my report furnished any material for microscopic study and in none of the autopsy specimens examined critically had a clinical examination of the eyegrounds been made.

Of 18 eyes examined by Wilder, 15 showed degenerative changes in the lens; one eye showed a conjunctival hemorrhage; one eye, a retinal hemorrhage; one eye, swollen areas in the nerve-fiber layer resembling cytoid bodies; and 17 eyes showed septic choroiditis. These eyes had been removed 24 to 33 days after the explosion and none had been examined ophthalmoscopically.

Since studies by the Japanese showed that the peak of the leukocyte depression occurred about the end of the fourth week, it is entirely possible that eyes removed in the third and fourth week after the explosion would not reflect the pronounced blood changes that they would have showed

if the individual had survived another 2 or 3 weeks. This explains the absence of hemorrhage in the retina on microscopic examination and also the packing of the choroidal vessels with inflammatory cells.

Regarding the lens changes, there is little to be said at this time. I examined dozens of eyes with the pupil dilated but saw no lens opacities. At no time was my view of the fundus hampered by opacities of the media that I could localize in the lens. I have been extremely interested myself in the swollen areas in the nerve-fiber layer. (This condition is shown in figures 4, 5, and 6.)

These lesions were lenticular in shape, protruding slightly into the vitreous chamber and depressing the inner nuclear layer. The lesion itself is somewhat granular and the nerve fibers become blurred in outline as they pass through the lesion. The color of the stain is grayish pink and the center of the lesion has an amorphous appearance. These lesions could be the areas of edema seen with the ophthalmoscope as white exudates.

Schlaegel in his recent report[6] found no microscopic evidence of the retinal lesions

TABLE 5

TABULATION OF HISTORICAL DATA

No.	Name	Age and Sex	Dist. Km.	Date Onset	Manifestations*	W.B.C. Date	Location When Bombed	Eye Lesions
1	Ogawa	22 ♀	1.0	9-5	1-2-3-4-5-6	3,200	inside	Macular hemorrhage, exudative plaque
2	Hirota	19 ♀	1.0	8-19	1	3,300	inside	Detached retina, membrane behind lens
3	Matuda	18 ♀	1.0	9-8	1-2-3-4-5-6	2,300	inside	Preretinal hemorrhage, Roth spots, flame hemorrhage.
4	Yoshino	64 ♂	0.1	8-29	—	1,100	inside	Flame hemorrhage, plaques
5	Miyasaki	25 ♀	1.5	9-5	3-5-7	3,200	inside	Preretinal hemorrhage
6	Matsubayashi	49 ♂	2.0	9-14	1	7,800	inside	Soft, white exudate
7	Tasaki	16 ♀	0.0	9-5	1-3-4-5-7	2,400	in concrete house	Exudate, preretinal hemorrhage
8	Tawara	20 ♀	0.0	8-26	1-4	3,100	in concrete house	Exudate, preretinal hemorrhage
9	Ito	24 ♀	0.6	9-7	3-4	1,500	outside	Flame hemorrhage, Preretinal hemorrhage, exudate
10	Hashimoto	14 ♀	1.0	9-10	1-2-3-4-6-7	4,000	inside	Vitreous hemorrhage, preretinal hemorrhage, flame hemorrhage.
11	Hashimoto	50 ♂	0.5	9-11	6	2,400	outside	Flame hemorrhage.
12	Narita	32 ♀	2.0	8-14	6	—	inside	Exudate, flame hemorrhage.
13	Kurokawa	31 ♀	1.0	8-18	—	6,100	outside	Exudate
14	Yokoyama	59 ♀	1.0	8-9	4-7	3,600	wood house	Exudate
15	Momoki	14 ♀	0.2	9-11	7	1,200	wood house	Hemorrhage, exudate
16	Kitagawa	67 ♂	2.0	8-9	—	13,800	outside	Hemorrhage, exudate
17	Kataoka	25 ♀	1.5	8-11	3-5-6	—	outside	Exudate
18	Iwanaga	18 ♀	1.7	8-25	2-3-5	—	wood house	Hemorrhage, large
19	Tsujimaru	38 ♀	1.6	8-23	3-5	—	doorway toward blast	Flame hemorrhage
20	Sugino	56 ♀	0.8	8-24	4-6-7	—	wood house	Exudate, flame hemorrhage
21	Kawano	23 ♀	1.0	8-17	3-4-6-7	—	wood house	Exudate
22	Nanri	20 ♀	1.0	9-5	3-4-6-7	— 500	in house	Exudate
23	Fujihara	24 ♂	0.5	8-9	5-7	6,000	in house	Exudate
24	Kaneshiro	34 ♂	1.2	—	—	—	in house	Exudate, hemorrhage
25	Ota	67 ♂	0.8	8-9	4	—	in house	Hemorrhage, exudate
26	Nakamura	18 ♂	0.8	8-29	6	—	in house	Retinal edema
27	Hirana	51 ♂	1.7	8-17	—	—	in house	Absorbing hemorrhage, exudate
28	Inaba	22 ♂	1.2	9-13	3-6-7	3,000 (9-26)	in house	Exudate, flame hemorrhage
29	Takemoto	43 ♀	1.2	8-19	6-7	800 (8-23) 4,300 (9-12)	outside	Vitreous hemorrhage, exudates
30	Furuta	18 ♀	1.2	8-15	3-6	3,000 (9-26)	inside	Exudate, flame hemorrhage
31	Ando	18 ♂	0.8	8-28	—	2,600 (9-26)	inside	Roth spot
32	Niigaki	25 ♀	1.2	9-20	1-3	2,500 (9-20)	in house	Exudate, flame and preretinal hemorrhage
33	Okamura	30 ♀	0.5	9-9	1-6	2,400 (9-20)	in house	Flame hemorrhage
34	Hirayama	30 ♀	—	—	—	3,600 (9-25)	—	Exudate, preretinal and flame hemorrhages
35	Morinoki	59 ♂	1.2	8-25	1-3-4-7	7,200 (9-1)	outside	Exudate, hemorrhages
36	Kagiya	23 ♂	2.0	—	5	7,200 (9-21)	inside wood house	Hemorrhage
37	Azuma	31 ♂	2.0	8-29	1-2-3-4-6-7	7,000 (9-26)	inside	Preretinal and flame hemorrhages
38	Kuromiya	34 ♀	1.5	8-9	6	2,000 (9-3)	inside	Exudate, hemorrhages
39	Matsuo	49 ♂	1.2	8-23	2-3-6	600 (9-21)	outside	Exudate, flame hemorrhage, Roth spots
40	Ishita	42 ♂	1.2	8-19	1-3-4-6	4,800 (9-28)	inside	Exudate
41	Unknown	24 ♂	0.5	9-6	1-2	2,000	—	Hemorrhage, exudate
42	Unknown	25 ♂	0.0	9-1	3	900	inside	Massive hemorrhage, exudate
43	Yoshida	26 ♂	1.0	8-24	1-2-3-6-7	2,200 (9-6)	—	Flame hemorrhage
44	Matsumoto	45 ♀	1.5	9-9	1-2-3-5-6-7	2,500 (9-9)	—	Exudate
45	Iwatsu	7 ♀	1.0	9-10	2	2,800 (9-10)	—	Exudate flame hemorrhage
46	Imafuku	31 ♂	0.5	9-13	1-2-5-7	3,800 (9-30)	inside	Flame hemorrhage

* 1—weakness; 2—petechiae; 3—gingivitis; 4—headache; 5—angina; 6—epilation; 7—fever.

seen clinically. He, too, found the septic choroiditis and evidences of lens degeneration. His paper, which is a remarkable contribution from a documentary standpoint, contains an interesting table showing the increased thickness of the lens capsule in these eyes.

Case histories

The reports submitted in this account represent free translations of histories taken through interpreters. It was felt that a good deal of the realism of the stories told of individual experiences was lost through imperfect and sometimes impossible rendition of the Japanese idiom. The interpreter's lack of knowledge of English frequently resulted in misunderstanding.

Case 1

History. Ogawa, a Nagasaki woman, aged 22 years. This patient was in the Mitsubishi weapons factory one Km. from the center of the explosion inside a concrete building. She was dressed in a blue, one-piece suit with long trousers and Japanese sandals. She suffered no burns or wounds. One hour after the explosion she vomited. Nausea continued for two or three days with loss of appetite.

Beginning on August 13th, she had diarrhea for five days but there was no blood in the stool. Her hair began to fall on the 26th of August and she became bald. From September 1st to 7th she suffered from bleeding of the gums and tonsillitis with high fever. During that time she also had severe nose bleeds.

Since September 15th (now October 6th) she had had poor vision in the right eye. She menstruated five days before the explosion. She began to bleed again on the 25th and had been bleeding continuously at the time these studies were made.

On September 24th, the leukocyte count was 8,600, and the sedimentation rate was 50 mm. for the first hour and 64 mm. in two hours.

Eye examination. On September 21st, the eyegrounds were examined at Shinkozen Hospital and the following descriptive note written:

"Examination of the fundus of the right eye (fig. 3) reveals an appreciable amount of retinal edema generally, particularly pronounced in the macular region. The veins and arteries are full and of good color. There are no pathologic changes in the optic discs. In the foveal region is a deep-red, preretinal hemorrhage one-fourth disc diameter in size and laterally oval in shape. The lesion shows marked bulging into the vitreous and the borders are very sharply defined. Above this is a very much larger, although similar lesion, about three disc diameters in size. This lesion is elevated and

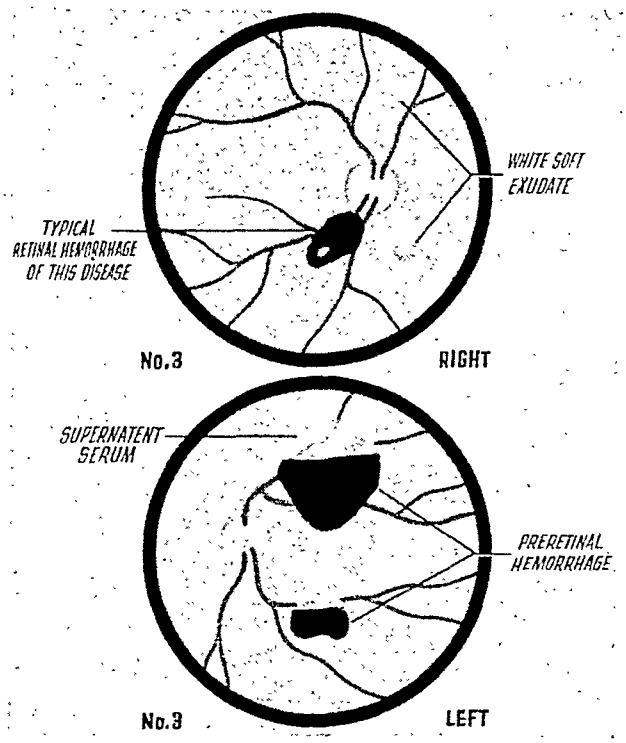


Fig. 2 (Flick). Both eyegrounds of Case 3, showing large lesions.

the lower margin is very sharp. The upper margin is horizontally straight. The lesion is situated 1 to 2 disc diameters from the papilla.

"Scattered about in the intervening retina are numerous small flame-shaped hemorrhages and several white, fluffy, elevated exudates, particularly on the nasal side. The left fundus shows no hemorrhage but numerous exudates of the soft white type."

On October 5th, 15 days later, the following note was made on reëxamination of the eye grounds: "The large preretinal hemorrhage above the macula is 2½ disc diameters in size and shows little evidence of absorption. The hemorrhage in the macula shows some evidence of absorption and has a whitish spot in the center. One small fresh exudate is present with no hemorrhage around it."

Case 2

Hirota, a Nagasaki woman, aged 19 years, had been ill since August 19th. Her only symptoms were severe weakness and poor vision in the left eye. The leukocyte count on admission was 3,300. She had been one Km. (0.6 miles) from the center of the explosion. The right eye was normal in every respect. The left eye, with pupil dilated, showed blood behind the lens with oblique illumination. The fundus could be dimly seen, and it seemed likely that there was detachment of the lower portion of the retina.

Case 3

History. Matuda, a Nagasaki woman, aged 19

years, was one Km. (0.6 miles) from the center of the explosion, inside, at the time of explosion. She became ill on September 8th and developed sore throat, fever, petechiae of the skin, and extreme weakness.

Eye examination. "The right fundus (fig. 2) showed numerous massive hemorrhagic extravasations. Below and temporal to the disc is a very large preretinal hemorrhage that has burst forth from the nerve-fiber layer and protrudes into the vitreous. The lower portion of this lesion is of a yellowish color similar to the so-called 'Roth spot' seen in sepsis. Many small, whitish, elevated, fluffy exudates are seen scattered over the intervening retina. The disc is normal. The large hemorrhage seems to cover the inferior temporal artery and vein near the disc. The left fundus (fig. 2) shows two large preretinal hemorrhages, a very large one above the disc and a smaller one below. These lesions are, respectively, 4 and 3 disc diameters in size. The upper one has an irregular lower border and a flat upper border indicating the level of the settled red cells. The surrounding retina is extremely edematous and the supernatant fluid is slightly cloudy. Numerous small white fluffy exudates are seen scattered about."

CASE 4

Yoshino, a Nagasaki man, aged 64 years, had been ill since August 29th with weakness. He had been only 100 meters (0.06 miles) from the explosion, inside a house. His leukocytes numbered 1,100. Only the right eye (fig. 3) could be examined.

"There are no changes in the optic disc. A small area 1½ disc diameters in size surrounds the inferior temporal vein and consists of a speckled, whitish gray area, as if moth-eaten. The borders are sharp and there is no elevation. There is such a spot also located above the disc in relation to the superior temporal artery and vein. Near the lower spot is a very superficial nerve-fiber layer hemorrhage. One small preretinal hemorrhage is seen just above the disc."

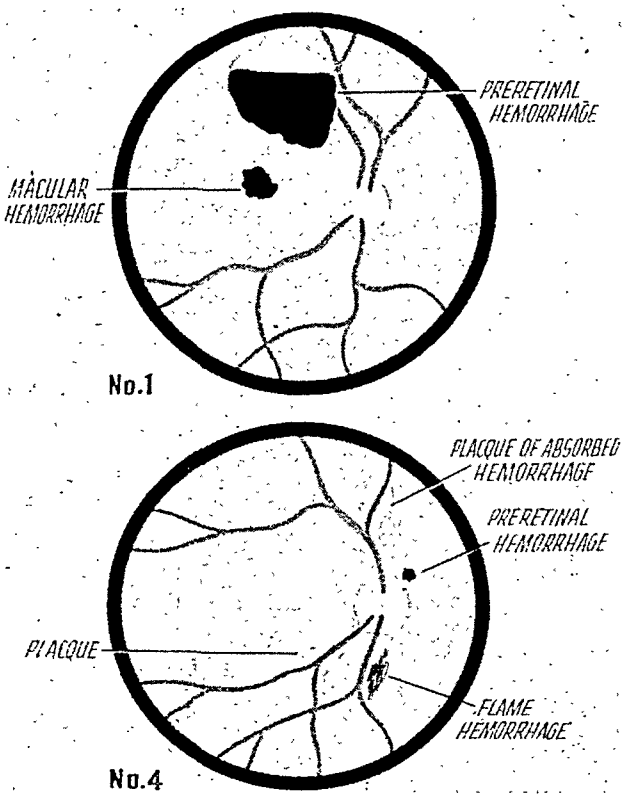


Fig. 3 (Flick). Right eyeground of Case 1, showing macular hemorrhage. Right fundus of Case 4 shows plaques of absorbed hemorrhage.

CASE 5

Miyasaki, a Nagasaki woman, aged 25 years, began her illness on September 5th. The white-cell count was 3,200. There was a moderately large globular hemorrhage of the lower portion of the right fundus.

CASE 6

Matsubayashi, a Nagasaki man, aged 49 years, had been ill since September 14th with ill-defined symptoms. The white-cell count was 7,800. The eyegrounds showed numerous white, soft exudates but no hemorrhage.

CASE 7

Tasaki, a Nagasaki woman, aged 16 years, was at the center of the explosion inside a concrete house. She had been ill since September 5th with extreme weakness. The white-cell count was 2,400. The eyegrounds showed globular hemorrhages and white, soft exudates. The doctors who had treated numbers of the cases said she would surely die.

CASE 8

Tawara, a Nagasaki man, aged 20 years, was also at the center of the explosion inside a concrete house. He became ill on August 26th with extreme prostration and weakness. His white-cell count was 3,100. The eyegrounds showed several large subhyaloid hemorrhages and some white, soft exudates.

CASE 9

Ito, a Nagasaki woman, aged 24 years, had been ill since September 7th. This patient had been 600 meters (one mile) from the center of the explosion, outside. This patient was in extremis. The white-cell count was 1,500. The eyegrounds showed large, globular preretinal hemorrhages, many flame hemorrhages and small, soft, white exudates.

CASE 10

Hashimoto, a Nagasaki woman, aged 14 years, gave no history. The vitreous of the left eye was almost entirely obscured by dense hemorrhage, the lower portion only being visible with the ophthalmoscope. In the right eye were seen a large peripapillary hemorrhage as well as flame hemor-



Fig. 4 (Flick). Lesion of nerve-fiber layer close to nervehead, showing swelling and displacement of outer retinal layers.

rhages and vitreous hemorrhages. There were many white, soft exudates but no papilledema. The leukocyte count was 4,000.

CASE 11

Hashimoto, a Nagasaki man, aged 50 years, was entirely epilated. He had been 500 meters (0.3 miles) from the center of the explosion. There was one small flame hemorrhage temporal to the right disc but no exudates. Leukocyte count was 2,400.

CASE 12

Narita, a Nagasaki woman, aged 32 years had been two Km. (1.2 miles) from the center of the explosion, indoors. There was complete epilation. She had had diarrhea for two days and had been ill since August 14th. There were numerous small white exudates and one small splinter hemorrhage.

CASE 13

Kurokawa, a Nagasaki woman, aged 31 years, had been one Km. (0.6 miles) from the center of the explosion, outdoors. She had become ill on August 18th. The white cells numbered 6,100. There was one small exudate in the left lower fundus.

CASE 14

Yokoyama, a Nagasaki woman, aged 59 years, had, at the time of the explosion, been in a wooden house one Km. (0.6 miles) from the center of the explosion. She became ill on August 9th, the day of the explosion, probably due to the fact that she suffered many primary injuries. The white-cell count was 3,600. There was one small exudate in the right upper temporal region near the disc.

CASE 15

Momoki, a Nagasaki girl, aged 14 years, became ill on September 11th, with nosebleeds and fever. She had been only 200 meters (0.12 miles) from the center of the explosion inside a wooden house. The white cells numbered 1,200. There were great numbers of small exudates scattered about the posterior pole of both eyes. There was also much general retinal edema. One flame hemorrhage extended onto the disc in the left eye.

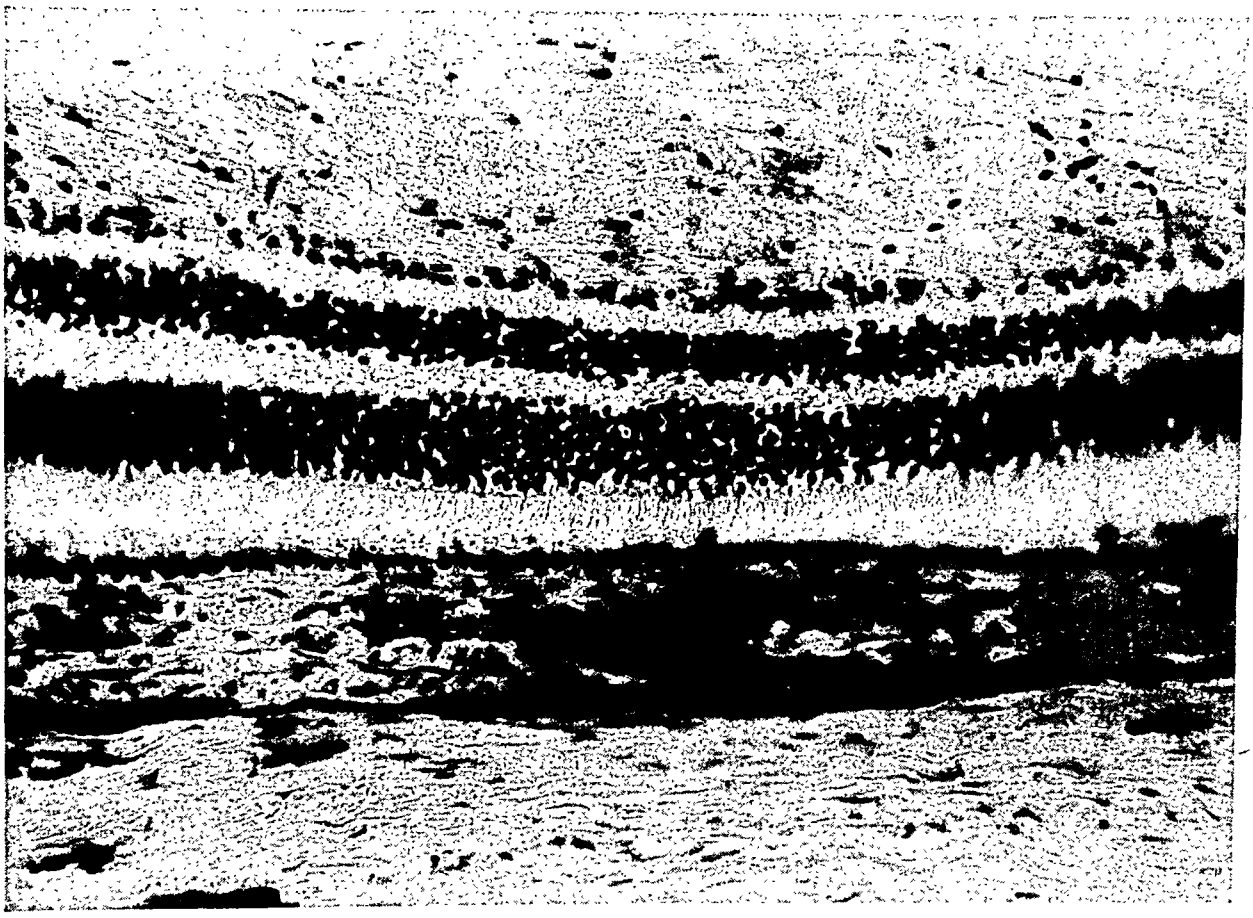


Fig. 5 (Flick). Higher-power view of same lesion as in Figure 4. The granular appearance and loss of fibrillar structure in the nerve-fiber layer in this lesion can be seen.

CASE 16

Kitagawa, a Nagasaki man, aged 67 years, had been outdoors two Km. (1.2 miles) from the center. He had been continuously ill since the explosion with febrile illness. There were no other manifestations of radiation injury. The white count was 13,800. There was a small, white exudate near the left disc, and splinter hemorrhages surrounded the right inferior temporal vein.

CASE 17

Kataoka, a Nagasaki woman, aged 25 years had been 1,500 meters from the center of the explosion, outside. She became ill on August 11th. There was generalized flash burn over neck, arms, and legs. No other evidences of radiation injury were present except the marked oral sepsis with gingivitis and hemorrhagic ulceration of the throat. The eyegrounds showed many white exudates.

CASE 18

Iwanaga, a young Nagasaki woman, aged 18 years, was inside a wooden building at the time of the blast, 1,700 meters away (1.02 miles). She lost her hair on August 25th and became quite ill on September 1st, with gingivitis, sore throat, purpuric spots on the skin, and bloody sputum. The eyegrounds showed one large typical hemorrhage.

CASE 19

Tsujimaru, a Nagasaki woman, aged 38 years was standing in the open doorway toward the blast at the time of the explosion. This was approximately 1,600 meters (one mile) from the center. Two weeks later she began to suffer from bleeding gums and pharyngitis. The left fundus showed one flame hemorrhage.

CASE 20

Sugino, a Nagasaki woman, aged 56 years, was standing in a wooden house near Urakami station, Nagasaki, 800 meters from the center (0.48 miles). There were no burns or wounds. Beginning two weeks after the explosion she became ill with headache, fever, and prostration. Many small hemorrhages of the flame type and many small exudates were found in the eyegrounds.

CASE 21

Kawano, a Nagasaki woman, aged 23 years, had been standing in a wooden house 1 Km. (0.6 miles) from the center. She gave a history of having soreness of the gums and headache for an indefinite period of time. The hair began to fall on August

17th. From August 10th to 17th, she had a temperature of 39° to 40°C. There was a small wound of the left hand and some bruises but no burns. The last menstrual period was July 1st. Examination with the ophthalmoscope revealed one small exudate in one retina, no hemorrhages.

CASE 22

Nanri, a young Nagasaki woman, aged 20 years, was sitting indoors working as a secretary in the Mitsubishi arms factory one Km. (0.6 miles) from the center. She began to notice a dizziness on September 5th. She also began to notice at that time a soreness of the gums which lasted about eight days. She had a headache and fever up to 40°C. On September 9th she began to have diarrhea with 2 to 3 soft, reddish stools per day. On September 5th: white-cell count, 500; red-cell count, 3.4 million; September 10th: white-cell count, 3,200; September 22nd: white-cell count, 4,800. The left eyeground showed one small exudate.

CASE 23

Fujihara, a Nagasaki man, aged 24 years, was a medical student at the Nagasaki Medical College located 500 meters from the center. He was inside a heavy concrete building. On August 29th, he developed a temperature up to 39°C., with angina of the throat which was diagnosed as diphtheria but persisted until September 14th. During this time the white cells numbered 12,000; at the time of this study they numbered 6,000. He also suffered a compound fracture of the left femur and lacerations of the arms, head, neck, breast, and left side of the abdomen. Eyegrounds showed two small, thin exudates but no hemorrhages. (Practically all persons in the medical-school area died.)

CASE 24

Kaneshiro, a Nagasaki man, aged 34 years, was at Ohashi, 1.2 Km. from the center. He was standing outside. There was deafness of the right ear without pain or tinnitus. Numerous minor burns were present. There were several small exudates and splinter hemorrhages in the eyegrounds.

CASE 25

Ota, a Nagasaki man, aged 67 years, was 800 meters (0.48 miles) from the center of the explosion inside the arms factory at Urakami. He was standing up outside. The eyegrounds revealed many small exudates and splinter hemorrhages.

CASE 26

Nakamura, a Nagasaki youth, aged 18 years, was also in the arms factory, standing up, 800 meters (0.48 miles) from the center. He began to lose his hair on August 29th. There was marked diffuse retinal edema but no local or focal lesions were seen.

CASE 27

Hirana, a Nagasaki man, aged 51 years, was

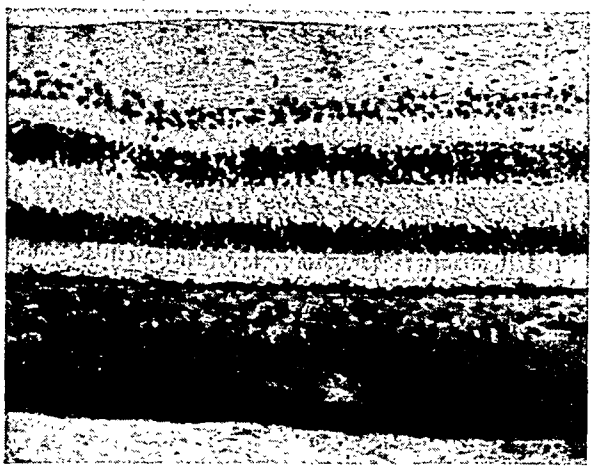


Fig. 6 (Flick). Another lesion in the same section. Note the excellent structural preservation of the retinal elements.

1,700 meters (1.02 miles) from the center, standing outside but protected by a brick wall 4 meters away. From August 20th to 30th he had diarrhea of 1 to 2 stools a day. An absorbing hemorrhage was seen in the right eye. The left eye showed a typical "Roth-type" hemorrhage with white distal portion.

CASE 28

Inaba, a Nagasaki man, aged 22 years, was at the arms factory at the time of the explosion. He was admitted to the hospital on the day of the explosion but his present illness did not begin until August 19th when his hair began to fall. He was bald for about one month when his hair began to grow back. In the meantime he had sore gums, pharyngitis, and diarrhea with black stools. The eyegrounds showed many exudates in the right fundus, nasal to the disc. There were no hemorrhages. The left fundus showed changes similar to those in the right, but there were some absorbing hemorrhages in the left.

CASE 29

Takemoto, a Nagasaki woman, aged 43 years, was at Ohashi near the arms factory. Epilation began on August 16th. She had a severe "cold" with fever up to 40°C. On August 23rd, white-cell count, 800; red-cell count: 4.04 million; Hemoglobin, 55 percent; color index, 0.68. On September 12th, white-cell count, 4,300. The left fundus showed numerous absorbing hemorrhages of the lower portion.

CASE 30

Furuta, a young Nagasaki woman, aged 18 years, was in Ohashi in a wooden house. She states that at the time of the explosion she was blinded and could not see for three days. From August 15th to 18th she had fever up to 40°C. At this time the cuts she had began to be infected. Fever recurred, September 4th to 14th, up to 40°C., and there was soreness of the gums and tonsillitis.

She also complained of nausea, increased salivation, and pain in the abdomen. There were three small exudates in the upper nasal fundus of the right eye. The left eye showed small exudates with some subsiding retinal edema.

CASE 31

Ando, a Nagasaki youth, aged 18 years, was in a wooden house. There was inability to open the mouth for a long time (tetanus?). There was diarrhea for two days without blood on August 28th and 29th. There was some infection of the right wrist reaching its height about September 1st. Examination of the eyegrounds revealed one small hemorrhage of the "Roth" type.

CASE 32

Niigaki, a Nagasaki woman, aged 25 years, was near the Mitsubishi arms factory and was injured by falling building material. She was three months' pregnant and abortion occurred on September 1st. She developed pallor and gingival bleeding on September 20th that lasted five days. On September 24th, the sedimentation rate was 140 for one hour, and 168 for two hours. The leukocyte count was 2,500. There were many flame and preretinal hemorrhages, and exudates in both eyes.

CASE 33

Okamura, a Nagasaki woman, aged 30 years, was located 500 meters (0.3 miles) from the center, inside a wooden house. On September 9th her hair began to fall out. On September 20th the white cells numbered 2,400. She had missed one menstrual period. The eyegrounds showed one flame hemorrhage.

CASE 34

Hirayama, a Nagasaki woman, aged 30 years, gave no history. There were preretinal and flame hemorrhages in the eyegrounds, as well as some exudates of the usual type.

CASE 35

Morinoki, a Nagasaki man, aged 59 years, had been 400 meters west of the Ohashi arms factory or about 1,200 meters (0.72 miles) from the center of the explosion. He was standing outside. Beginning on August 25th, there was increasing weakness, swelling, tenderness and bleeding of the gums, and fever up to 41°C. He complained of pain in the chest and some ringing in the ears. On admission to the hospital it was found he had sloughing of the anterior portion of the soft palate which seemed to result from the extension of the gingival ulceration. Ophthalmoscopic examination revealed several soft exudates and splinter hemorrhages extending to the disc. Reexamination eight days later revealed one small exudate temporal to the left disc. The hemorrhages were seen to be absorbing.

CASE 36

Kagiya, a Nagasaki man, aged 23 years, was two Km. (1.2 miles) from the center of the explosion. He had diarrhea and sore throat with nose bleeds on September 8th. A few splinter hemorrhages, found in the eyegrounds, had completely disappeared in eight days.

CASE 37

Azuma, a Nagasaki man, aged 31 years, was sitting inside the arms factory 800 meters from the explosion (0.48 miles). He began to notice dizziness and weakness on September 17th and noticed that his skin was covered with petechiae. There were also painful soreness of the gums, headache, and falling of the hair which started on August 19th. There was fever up to 40°C. and tonsillitis. The eyegrounds showed many flame and preretinal hemorrhages and also exudates. On reëxamination eight days later, hemorrhages were recorded as very numerous in both fundi. These were of the flame and preretinal type. There were a few exudates. A few typical "Roth-type" lesions were seen, related to the left inferior temporal artery. There was one exudate just temporal to the right disc. Two preretinal hemorrhages, related to the superior and inferior temporal arteries of the right fundus, were seen.

CASE 38

Kuromiya, a woman, aged 34 years, was inside a wooden house 1.5 Km. away from the center at the time of the explosion. The hair began to fall on August 22nd. The patient states she had bloody diarrhea for several days after the explosion. She had not menstruated since the explosion. On September 3rd, the white cells numbered 2,000, and the sedimentation rate was 130 for the first hour and 160 for two hours. Both eyegrounds showed exudates and hemorrhages. Reëxamination eight days later showed one exudate nasal to the left disc. There was an area of absorbed hemorrhage around the proximal part of the superior nasal artery. This had the appearance of the typical "Roth-type" hemorrhage of this disease. There were no lesions seen in the right eye.

CASE 39

Matsuo, a Nagasaki man, aged 49 years, had been at Ohashi factory 1 to 2 Km. (0.6 to 1.2 miles) from the center and had been standing outside. The hair began to fall on August 23rd. Sore throat with fever up to 39°C. came the first week in September. He also had petechial eruption in the skin and sore, painful gums. His record showed:

	Sept. 6	Sept. 8	Sept. 10	Sept. 13	Sept. 15	Sept. 20	Sept. 24
R.B.C.	3.7	3.3	2.7	2.2	2.2	2.6	3.0
W.B.C.	600	500	700	1,100	3,400	3,600	3,000
H.B.G.	65%	60.9%	50%	55%	48%	50%	58%
C. Ind.	0.89	0.91	0.9	1.2	1.0	0.96	0.96
Bl. T.	3½	12	12	10	7	6	5
Cl. T.	3.16	3.16	3.16	3.15	3.14	3.14	5

On September 27th the examination revealed many exudates and hemorrhages of all kinds. On October 5th, there were numerous exudates with sharp borders indicating absorption but no hemorrhages were seen. In the right eye, there was a lesion of the upper temporal region and, in the left eye, one below the disc.

CASE 40

Ishita, a Nagasaki man, aged 42 years had been at the Ohashi factory inside a wooden house at the time of the explosion. On August 19th he had weakness, sore gums, and falling of the hair. He was hard of hearing in the left ear. Many exudates were seen in both fundi. Reëxamination eight days later showed the exudates to be smaller, whiter, more waxy and they seemed to be broken up into numbers of smaller deposits.

CASE 41

This Hiroshima man, aged 24 years, had been 500 meters (0.3 miles) from the center of the explosion of the bomb that had fallen on Hiroshima. He was examined on September 10th and had had purpuric anemia for five days at that time. His leukocyte count at that time was 2,000. The eyegrounds showed massive retinal hemorrhage around the discs in both eyes. There were subhyaloid and nerve-fiber hemorrhages and "Roth" spots in the right eye. The hemorrhages had sharp margins indicating their preretinal location. There were many edema exudates and some swelling of the macula but no changes in the discs.

CASE 42

This Hiroshima man, aged 25 years, was at the center of the explosion. He had been ill 10 days by September 10th. The leukocyte count was 900. The eyegrounds showed large edema exudates near the discs with globular subhyaloid hemorrhages. It was the hemorrhages in this case that first suggested to me their similarity to Roth spots. There was a macular hemorrhage in one eye.

CASE 43

Yoshida, a Hiroshima man, aged 26 years was seen in Fukuoka where he had been evacuated from Hiroshima after the bombing. Patients from both areas were being studied together at the Imperial Kyushu University Hospitals. He suffered from sore gums, petechiae, and fever which had its onset about August 24th. His record showed:

Date	White-Cell Count
September 9th	2,300
September 22nd	2,700
September 29th	3,100
September 30th	6,800

The eyegrounds showed flame hemorrhages.

CASE 44

Matsumoto, a Hiroshima woman, aged 45 years, was 1.5 Km. (0.9 miles) from the center of the explosion. She had petechiae, loss of hair, sore throat, and gingivitis with fever. These entries showed:

Date	White-Cell Count
September 9th	2,500
September 22nd	2,700
September 27th	3,600
September 30th	3,800

The eyegrounds showed many exudates but no hemorrhages.

CASE 45

Iwatsu, a Nagasaki girl, aged seven years, was one Km. from the center of the explosion. She developed petechiae and epistaxis.

Date	Red Cells	White Cells	Hemoglobin
September 10th	2.3	2,800	45%
September 13th	2.1	1,200	54%
September 17th	1.5	1,200	46%

There were exudates and flame hemorrhages in the eyegrounds.

CASE 46

Imafuku, a Nagasaki man, aged 31 years, was a student in the Nagasaki Medical College, one Km. (0.6 miles) from the center. The onset of the illness was September 13th, when he developed petechiae, fever, and angina with marked painful involvement of the tongue. He was examined at Kyushu Imperial University. There was no epilation.

Date	Red Cells	White Cells	Hemoglobin
September 13th	3.6	5,500	——
September 18th	——	——	51%
September 30th	1.74	3,800	——

The retina showed flame hemorrhages.

CONCLUSION

The transient nature of the condition and the chronologically short period over which the studies were made tend to relegate to the order of indulgent speculation any definite conclusions as to the pathogenesis of these lesions. As a result of repeated examinations of the same individuals and of repeated examinations of the same lesions it seemed likely that the exudative lesions represented the milder involvement. This is borne out statistically in Table 1. It seems that those individuals showing both hemorrhage and exudation were on the average closer to the site of the explosion and had lower white-cell counts than did those with either hemorrhage or exudation alone. The witnessing of a transition from the fluffy

exudate to the "Roth"-type hemorrhage and preretinal hemorrhage was rather impressive. It would seem logical to conclude that local areas of the retina could become swollen by transudation of serum through the walls of hyperpermeable capillaries in the presence of anemia, oligocythemia, and consequent lowered oxygen tension in the blood. If this process were to become so intense as to cause tissue breakdown in the lesion itself as a result of stasis and anoxemia, the extravasation of whole blood elements could occur superimposing itself on the original lesion, coming to surround it as "the hemorrhage with the white center."

The location of these lesions near large vessels is explained by the increased intravascular pressure in vessels of larger size. Once engendered by complete vascular rhexis the bleeding is not halted or modified by the clotting mechanism since practically none exists. The tendency of the preretinal blood to settle in layers is no different from its behavior in the sedimentation test tube. The spotty localization of the retinal lesions is probably based on slight local anatomicophysiologic differences in the circulation in the fine branches of the terminal retinal vessels.

It seems safe to conclude that the ocular lesions here described are directly related to the deficiency in blood elements and in no way directly related to the action of radiant energy on the eye. The lesions were observed to disappear in those individuals recovering from the hematopoietic depression with no residual damage to the eye. It is felt that this healing occurred in all patients who survived the irradiation and that no permanent residual damage of permanent nature resulted from the retinal lesions. As to the vexatious question of radiation damage to the lens, time alone will tell.

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THE ROLE OF THE DIENCEPHALON IN REGULATING OCULAR TENSION*

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This study is a part of an investigation of factors which influence ocular tension. In a previous publication[1] the normal range of ocular tension and rigidity was ascertained in rabbits with a Schiøtz tonometer. Average values and standard deviations were established. The purpose of this presentation is to determine the role played by the cerebral cortex and the diencephalon on ocular tension in rabbits and dogs.

Certain hypnotic drugs are assumed to have a more or less selective action on various regions of the brain. These drugs were used by other investigators to evaluate functional differences. Pick and his co-workers[2-5] determined that paraldehyde and chloral hydrate depress mostly the cerebral cortex; whereas, barbiturates act mainly upon hypothalamic centers. These observations inspired several investigations which in a sense tended to confirm Pick's findings. Barbiturates were found to be antagonistic to the analeptic effects of picrotoxin, ephedrine, and benzedrine which act on the brain stem.[6-8] Masserman's[9] work indicated that sodium amytal, a barbiturate, diminished or abolished in cats the sympathetic and emotional mimetic reactions of the hypothalamus to faradic stimulation. On the other hand, excitation of the cerebral cortex exerted no influence on the responses of the skeletal neuromuscular mechanism. Bender and O'Brien[10] found that barbiturates either decreased or altered nystagmus due to disease of the brain stem.

On the basis of these reports, paraldehyde and pentobarbital sodium (nembutal) were employed in the following experiments to differentiate the functional activity of the cerebral cortex from that of the diencephalon in relation to ocular tension. Additional data on the subject were supplied by Lowenstein and Schoenberg[11, 12] who demonstrated in their pupillographic studies the possible presence of a central sympathetic factor which is assumed to play a role in the production of primary simple glaucoma. The diencephalon includes the thalamus, the hypothalamus, and the hypophysis, the mammillary, and the pineal bodies, the trigonum habenulae, and the posterior commissure.

MATERIALS AND METHODS

Rabbits of 1 to 2 years of age and adult dogs were used. The ocular tension was determined tonometrically. In one phase of the investigation, paraldehyde was given orally (1.5 cc. per Kg. body weight) and diluted with water in proportion of 1 to 8. Pentobarbital sodium was injected intravenously (0.45 cc. per Kg. body weight). The concentration of both narcotics was sufficient to induce a moderately deep narcosis for a few hours. In another phase of the investigation, the effect of hypotonic solution was studied on narcotized animals. Immediately prior to injection of pentobarbital sodium or paraldehyde, 40 cc. of distilled water per Kg. of body weight was administered to the rabbits by mouth. The ocular tension was determined before and during narcosis at intervals of 2 to 20 minutes for two hours. The 5.5- and the 10-gm. weights were used. Care was exercised during narcosis to avoid extraneous pressure on rabbits' eyes. Narcosis was induced and the ocular tension was determined on 10 to 20 different occasions on each of the animals.

Eight normal rabbits and three dogs were employed in the experiments. In addition, three rabbits with abnormal changes were

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studied. Two of the abnormal animals had congenital hydrophthalmos. In the third animal, a secondary glaucoma was induced in the left eye with colloidal iron.

The eyes of the abnormal animals showed the following changes: In the experimentally induced glaucoma six weeks after introduction of colloidal iron, the cornea contained several superficial blood vessels, the iris was atrophied, there were several minor lens opacities, the left anterior chamber was deeper than the right, and there was a ring of white tissue, 1.5-mm. wide, inside the corneal limbus. Five months after induction of glaucoma, the left papilla was dark gray with a peripheral dark-red zone and the excavation was about two diopters.

In one of the animals with a congenital disorder, there was an increase in connective tissue between the eyeballs and the upper lids of both eyes. The corneas were cloudy and the corneal diameters were approximately 18 mm. Both anterior chambers were deep. The fundus of the right eye had a large papilla with slight peripapillary atrophy but with normal medullated fibers and without excavation. In the left eye, the papilla was larger, gray-red, with peripapillary atrophy and missing medullated fibers.

In the second rabbit both corneas were cloudy with a pannus glaucomatosus. The parenchyma showed Fuchs's "Aufhellungsstreifen." The corneal diameters were 17 mm. The irides in both eyes contained many large blood vessels. The right fundus showed a red reflex, the left was indistinct and peripapillary atrophy was present.

Results

The results of the experiments are outlined in the accompanying charts in which are shown the degree and the rate of change of tension. The curves represent average measurements of changes in tension as they were determined with the 5.5-gm. weight. Standard deviations for the above measurements were equal to ±2.5 mm. Hg; whereas, under normal conditions for a two-hour period, the deviations are ±1.5 mm. Results with the 10-gm. weight showed no variations indicating that, at least tonometrically, there was no difference in ocular rigidity in the normal and in the glaucomatous eyes (figs. 1, 2, and 3).

The ocular tension in normal and glaucomatous animals under paraldehyde showed no significant changes (fig. 1). Upon injection of pentobarbital sodium, the normal

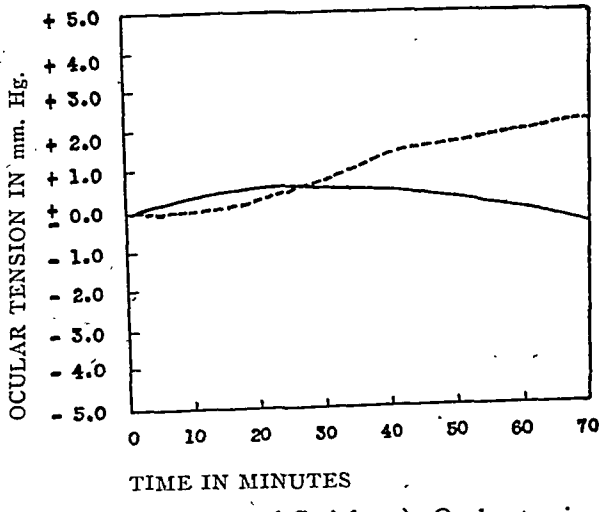


Fig. 1 (Schmerl and Steinberg). Ocular tension in normal rabbits (unbroken line represents 14 experiments) and glaucomatous animals (broken line—10 experiments) under the influence of paraldehyde. There are no significant changes in either group of animals.

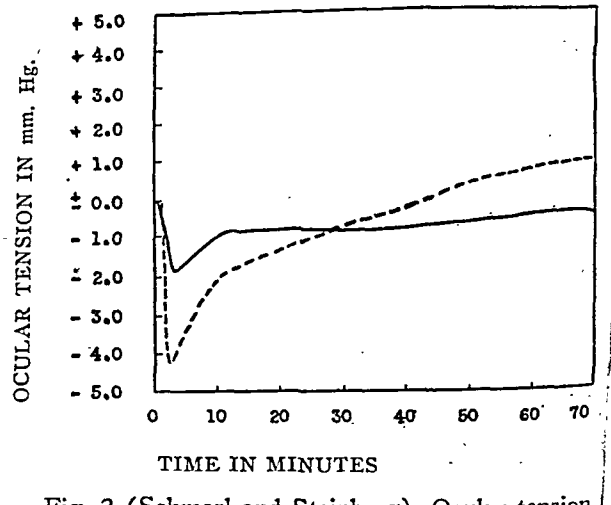


Fig. 2 (Schmerl and Steinberg). Ocular tension in normal (unbroken line—18 experiments) and glaucomatous animals (broken line—14 experiments) after injection of pentobarbital sodium. There is an immediate decrease in tension which shortly returns to normal.

and the glaucomatous animals showed an initial immediate decrease in tension which was followed by a return to normal (fig. 2).

Hypotonic solution (distilled water) was administered to normal and glaucomatous rabbits. The ocular tension showed a rapid and pronounced increase in the normal animals. The subsequent fall in tension occurred almost as rapidly. In the glaucomatous group of animals, the rise in tension was slower and less pronounced (fig. 3).

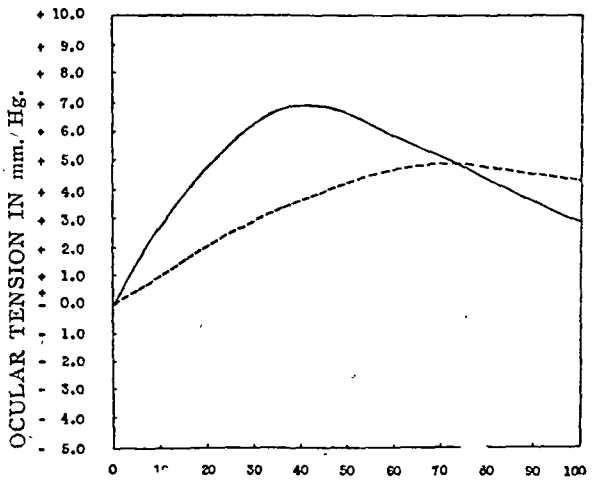


Fig. 3 (Schmerl and Steinberg). Distilled water was given orally to normal and glaucomatous rabbits and ocular tension determined in normal animals (unbroken line—16 experiments) and in glaucomatous animals (broken line—14 experiments). Note the rapidity of increase and decrease of ocular tension.

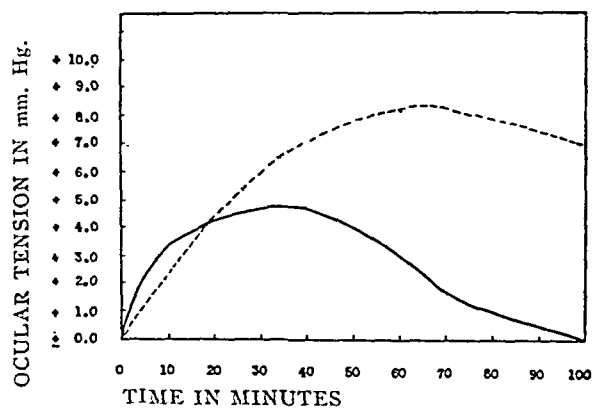


Fig. 4 (Schmerl and Steinberg). Ocular tension in normal (unbroken line—14 experiments) and glaucomatous animals (broken line—10 experiments) after introduction of distilled water and paraldehyde. The rise in ocular tension in the latter animals is rapid and pronounced. Compare with Figure 3. There is no significant change in the normal animals.

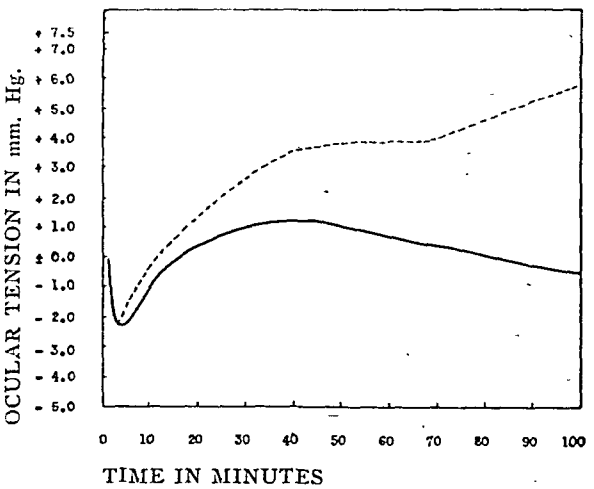


Fig. 5 (Schmerl and Steinberg). Ocular tension in normal (unbroken line—20 experiments) and in glaucomatous animals (broken line—14 experiments) with distilled water and pentobarbital sodium. The hypnotic inhibited the rise in tension in the normal and delayed it in the glaucomatous animals.

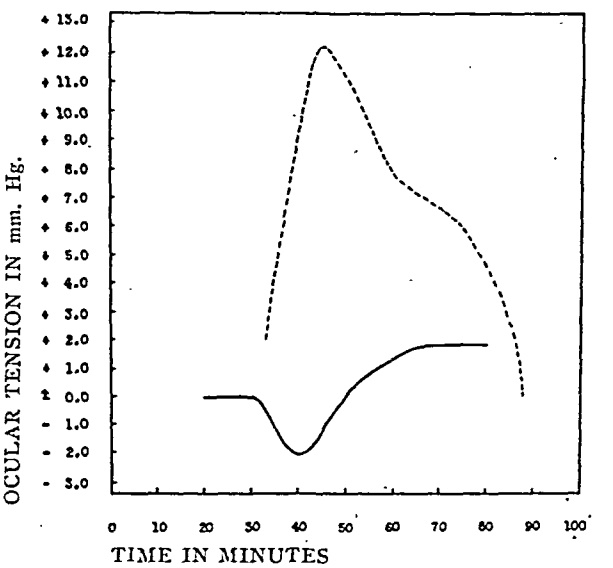


Fig. 6 (Schmerl and Steinberg). Ocular tension in a normal dog. Broken line represents tension following administration of paraldehyde and distilled water. Unbroken line represents tension following administration of pentobarbital sodium and distilled water.

Introduction of distilled water and paraldehyde into normal animals failed to change significantly the rise of the ocular tension

(fig. 4). On the other hand, in glaucomatous animals under similar conditions there occurred a considerably more rapid and pronounced rise in tension (fig. 4). The increase in tension was greater than obtained with hypotonic water alone (fig. 3).

Injection of pentobarbital sodium in animals to which distilled water had been administered showed no significant change in the ocular tension (fig. 5). Apparently pentobarbital sodium inhibited the rapid rise which occurred with distilled water alone (fig. 3). On the other hand, in glaucomatous animals after an initial delay, the tension became elevated to a degree equal to that without a hypnotic (fig. 3).

Introduction of pentobarbital sodium and of paraldehyde with distilled water in normal dogs paralleled the findings obtained in rabbits (fig. 6).

Summary and Conclusions

Paraldehyde, a hypnotic affecting primarily the cerebral cortex, produced no changes in the ocular tension of normal and glaucomatous animals. Paraldehyde also failed to inhibit the rise of tension in normal animals which were given distilled water. In glaucomatous rabbits under corresponding conditions, the rise in tension was more pronounced.

Pentobarbital sodium (nembutal), a hypnotic acting predominantly on the diencephalon, produced in normal and glaucomatous animals a slight immediate decrease in tension followed by a return to normal. There was also an inhibition of the usual rise in the ocular tension in normal animals which were given distilled water. The rise of tension in glaucomatous animals was delayed but not diminished.

It may be postulated, on the basis of these experiments performed under the conditions described, that the diencephalon contains a center or centers which exercise a regulating control of ocular tension. The experiments also suggest an instability of the diencephalic center or centers in glaucomatous animals.

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CYSTIC MALIGNANT MELANOMAS OF THE UVEAL TRACT*

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Cysts occurring in malignant melanomas of the uveal tract are chiefly of pathologic interest, but may, in themselves, present a clinical picture with a complicated diagnostic problem.

When cysts occur in ciliary body melanomas which extend behind the lens and in choroidal or iris melanomas which can be readily observed, there is no additional diagnostic problem. However, malignant melanomas projecting into the posterior chamber from the posterior surface of the iris, or from the ciliary body, may be difficult to differentiate from simple cysts. This diagnostic difficulty may be enhanced when malignant melanomas in this position become cystic. At least eight benign posterior-chamber cysts have been reported in the literature in which the eyes have been enucleated with the diagnosis of a malignant tumor.[1]

DIFFERENTIAL DIAGNOSIS

In the differential diagnosis, traumatic implantation cysts and retention or inflammatory cysts may be excluded if there is a negative history and no evidence of uveal inflammation. Developmental or spontaneous cysts of the iris stroma and pigmentary epithelium, particularly the latter, may be confused with malignant melanomas of the posterior chamber, especially since they may simulate a malignant melanoma closely, and occur in the older age groups.

Duke-Elder[2] lists the following diagnostic features of a cyst in the posterior chamber: multiplicity, tremulousness, mobility, presence of a notched margin, and, above all, translucency. However, the test of translucency by transillumination may be deceptive, since a cyst may have thick, pigmented walls and so appear solid. A tumor may undergo cystic changes with walls so thin the mass appears translucent. Thus while translucency may differentiate a cystic tumor from a solid tumor, it cannot differentiate between a benign cyst and a cystic malignant tumor. This is borne out by a patient seen by Hardy and reported by Doherty.[3] A 60-year-old white man had a black, spherical, pigmented spot on the pupillary border of the iris which was partially cystic by transillumination. Vision was normal. Because of its position, a complete removal of the mass by iridectomy was attempted. The tumor collapsed when grasped with forceps, and was excised through a wide keratome opening. A small pigment spot remained on the iris. Microscopic examination showed a malignant melanoma of the iris with cystic degeneration. The eye was later enucleated.

Diagnostic or exploratory puncture has been used to differentiate between a solid tumor and a cyst in the posterior chamber. This, however, is also unreliable, for, while an exploratory puncture may differentiate a cyst from a solid tumor, it cannot differentiate between a benign cyst and a cystic malignant tumor.

If a posterior-chamber tumor shows no evidence of cystic changes on transillumination or diagnostic puncture, it should be assumed to be solid and the eye enucleated. However, if either transillumination or diagnostic puncture indicates the possibility of cystic changes, it would appear the wiser course to remove the tumor by iridectomy, and await the pathologic report before deciding a more drastic surgical intervention.

REPORT OF A CASE

The complete clinical history and pathologic report of one case, which was studied in detail microscopically from serial sections, illustrates the type of lesions discussed.

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History

V. H., a 74-year-old white man, was first seen in December, 1945, by Dr. Eldred W. Kennedy of Rochester, New York.

Over a period of five months, the patient's vision had gradually failed in the left eye. During this time there had been frequent attacks of pain accompanied by redness and lacrimation. There were no previous ocular symptoms and no history of trauma. There was a family history of malignant disease. The past history was not significant, and the physical examination was essentially normal for a patient of his age. Routine laboratory studies were noncontributory.

Eye examination

The right eye was normal, with corrected vision of 20/20. The intraocular pressure was 18 mm. Hg (Schiøtz).

The left eye had a visual acuity of 20/400, unimproved with lenses. The eye was entirely white and the cornea clear. There were no keratic precipitates, and the aqueous ray was negative. When observed obliquely with direct illumination, a small black tumor could be seen in the lower nasal quadrant which filled the posterior chamber between the iris and lens. The anterior chamber was of normal depth except at the lower nasal quadrant where the iris bulged forward at its root to touch the cornea between the 7- and 8-o'clock positions. The iris in this region appeared thinned out with separation of the stromal fibers and the iris crypts appeared very dark. A small, black-pigmented, crescent-shaped area was present in the iris stroma near, but did not extend to, the root of the iris above the tumor. The pupil was equal in size to that of the right eye, but was slightly elongated or pear-shaped, with the apex directed downward and nasally. This abnormal shape was due to stretching of the iris by the underlying tumor. The pupil dilated slightly with mydriatics, but not at the site of the tumor. The tumor was well outlined by transillumination and appeared solid. The lens was cataractous and only vague fundus details were seen. Intraocular pressure measured 23 mm. Hg (Schiøz), and the field was full by confrontation.

The mass was thought to be a tumor of the posterior chamber, probably a malignant melanoma, arising from the iris or ciliary body. While a posterior chamber cyst was considered, there was no history of trauma, and the mass appeared solid to transillumination. The patient was observed for a period of three weeks, during which time other consultants concurred in the diagnosis. Enucleation was advised and performed during December, 1945, under cyclopropane anesthesia. The patient was in good health, and there was no local recurrence 14 months later.

Pathologic examination

Macroscopic. The globe was fixed in 10-percent formalin and opened in a vertical plane. There were no lesions other than the tumor which was approximately 2 by 2 by 1 mm. It appeared as a pedunculated mass suspended from the crown of the ciliary body among the ciliary processes, and was adherent to the posterior surface of the iris.

Microscopic. Serial sections were cut from paraffin blocks and stained with hematoxylin and eosin stain, Verhoeff-van Gieson stain, Prussian-blue stain, and the Wilder reticulum stain.

Aside from senile changes the sections were normal except for the lesion to be described. On one side a tumor mass occupied the anterior portion of the ciliary body and replaced the ciliary muscle in that region (figs. 1 and 2). A large oval cyst arose from the anterior portion of the tumor and extended into one of the ciliary processes. The cyst wall was adherent to the peripheral three fourths of the iris and was composed of several layers of tumor cells covered with pigmented and nonpigmented epithelium. The cyst was lined by a flattened layer of tumor cells, and contained a large amount of serous exudate, cellular debris, and a few

pigment-laden macrophages. A bridging layer of tumor cells divided the cyst into a large and small loculus. The cyst bulged the iris forward to form a peripheral anterior synechia. Many pigment-laden macrophages were present in the iris stroma near its root. Pigmented tumor cells invaded the iris root and the trabeculum to the canal of Schlemm (fig. 3). The underlying cornea and sclera were not invaded. The tumor was made up of whorls of irregularly arranged, closely packed, spindle-shaped cells. The nuclei were large, oval, and deeply staining, and contained a delicate reticulum. Nucleoli were present in a few of the nuclei. There were

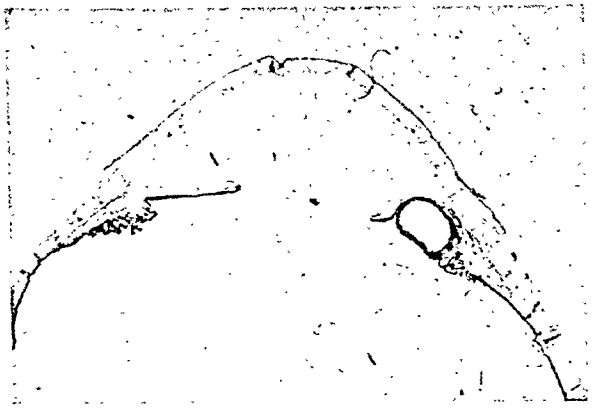


Fig. 1 (Kennedy). Posterior-chamber cystic malignant melanoma bulging iris forward to close angle. (E. W. Kennedy's case. Hematoxylin-eosin stain. Magnification, ×4.)

irregular areas of moderate pigmentation throughout the tumor, with both intra- and extracellular melanin granules. With the Wilder stain the reticulum fiber content of the tumor was marked, being more than 50 percent. The Prussian-blue iron stain was negative.

The pathologic diagnosis was cystic malignant melanoma of the ciliary body, spindle-cell type, predominantly subtype A.

Report of similar cases

There are three specimens in the Army Institute of Pathology, all of which are quite similar to the case here reported. These cases are as follows:

Case 1. Accession Number 71451 (contributed by Dr. L. Weston Oaks of Provo, Utah). Cystic malignant melanoma of the ciliary body. The patient was a 36-year-old trained nurse who is living and well six years after enucleation. The growth had been noticed four months before operation. A black mass behind the iris pushed the iris forward in the lower temporal quadrant. The iris stroma was attenuated, and the pigmentation normal. The mass appeared solid to transillumination. Corrected vision was 20/22 in the right eye, and 20/15 in the left eye. Intraocular pressure measured 13 mm. Hg

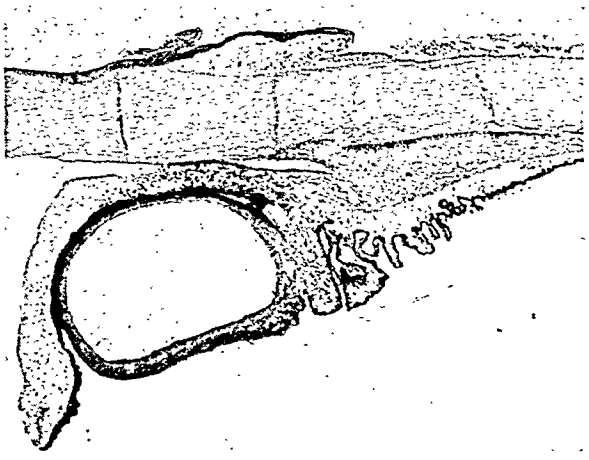


Fig. 2 (Kennedy). Higher power of Figure 1, showing extension of cystic melanoma into a ciliary process. Cyst is turned on pedicle so that section is to the side of tumor mass in ciliary body. (Hematoxylin-eosin stain. Magnification, ×10.)

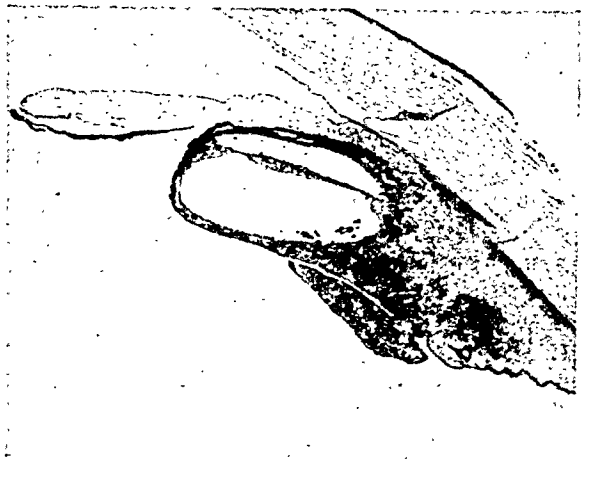


Fig. 3 (Kennedy). The same case as in Figure 2. Bilocular cyst arising from malignant melanoma of ciliary body, showing invasion of filtration angle to canal of Schlemm. (Hematoxylin-eosin stain. Magnification, ×10.)

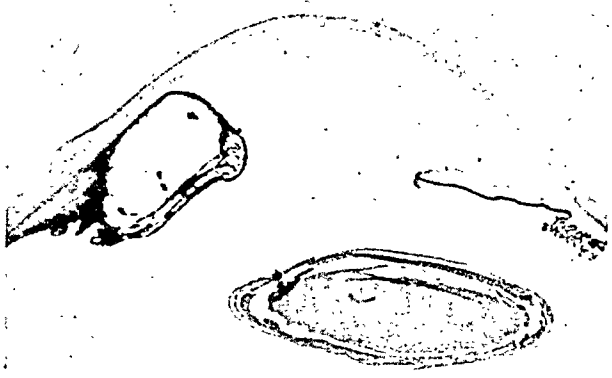


Fig. 4 (Kennedy). Posterior-chamber cystic malignant melanoma of ciliary body bulging iris forward to close angle. (Oaks's case. Hematoxylin-eosin stain. Magnification, ×4.)

(Schiøtz) in each eye, and the fundi were negative. The pathologic picture (figs. 4 and 5) was strikingly similar to the first case. The cyst was considerably larger and the adjacent wall was made up of many minute cystic spaces. The strands and islands of tumor cells within the cyst are evidence of walls of adjacent cystic areas which have broken down to coalesce.

Case 2. Accession Number 82272 (contributed by Dr. William L. Benedict of Rochester, Minnesota). Cystic malignant melanoma of the iris. The tumor involved the iris on one side and completely replaced the normal iris stroma, causing the iris to be several times its normal thickness. Bulging forward from the anterior surface of the iris into the anterior chamber, was a large cystic space, lined by tumor cells. The cell structure was made up of irregular whorls of spindle-shaped cells (fig. 6).

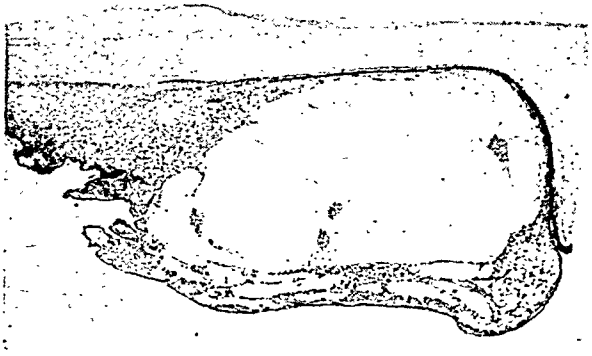


Fig. 5 (Kennedy). Higher power of Figure 4. Iris is pushed to back of cornea by cyst. Strands and islands of tumor cells within cyst are evidence of coalescence of adjacent cystic spaces. (Hematoxylin-eosin stain. Magnification ×10.)

Case 3. Accession Number 76213 (contributed by Dr. Charles C. Grace of St. Augustine, Florida). Cystic malignant melanoma of the ciliary body. The tumor extended forward into the root of the iris on one side. The anterior-chamber angle was closed off by the tumor. Many cystic spaces were present in the body of the tumor (fig. 7).

Typical cystic areas in choroidal malignant melanomas are shown in Figures 8, 9, and 10. These cases illustrate cystic malignant melanomas in various sites in the uveal tract.

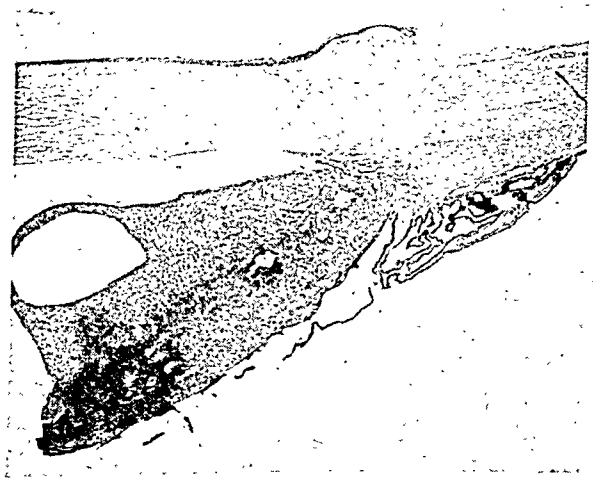


Fig. 6 (Kennedy). Cystic malignant melanoma of the iris. (Benedict's case. Hematoxylin-eosin stain. Magnification, ×10.)

Comment

Cystic areas in malignant melanomas are a degenerative change and a manifestation of tumor necrosis. Most malignant melanomas show minute focal points of necrosis, which are manifested by areas of irregularly staining cells showing pyknosis and karyolysis. The vessels of the growing tumor are large and there are no capillaries. As a result of this inadequate blood supply, there is a deficiency of nutrition. The result is death of the cells which are too far from the vessels to receive adequate nourishment. The

blood supply may also be limited by hyaline degeneration of the vessels, or by the actual compression of the vessel lumen by the growth of the tumor. The degenerated material in the focal areas of necrosis may become absorbed, forming minute cystic spaces, as shown in Figures 9 and 10.

The growth or development of the minute cysts may progress in many ways. A cyst may develop from a single area or from the coalescence of multiple cystic areas with further growth. Such cytotoxins may diffuse through the surrounding tumor tissue and may possibly have a histaminelike effect on the blood vessels in the tumor, causing an undue permeability and injury of the vessel walls which results in an extravasation of fluids into the cyst. A positive osmotic pressure in the cyst might increase its fluid content. The fact that these cysts grow by increase in their fluid content is suggested by the globular or spherical shape which they assume. This is apparent in sections showing larger cysts. In sections with small cysts, the spaces are usually more irregular in shape, indicating an earlier stage in development before growth has progressed.

Hemorrhage is another possible etiologic cause of cysts in malignant melanomas. Small hemorrhages in the tumor substance occur frequently in melanomas. Liquefaction of such a hemorrhagic area might leave a degenerative cystic space. However, the occurrence of red blood cells is very rarely seen in the cystic spaces, or the adjacent tumor tissue. In the first case, there was no evidence of old blood pigment in the tumor or cyst with the Prussian-blue stain.

Malignant melanomas are sometimes extremely vascular. Large blood-filled spaces may have only an endothelial wall between the tumor cells and blood spaces, and are sometimes lined with tumor cells in direct contact with the blood. These large blood spaces present a "pseudocystic" appearance which may be confused with true cystic spaces. An example of this is shown in Figure 11.

True areas of cystic degeneration may be

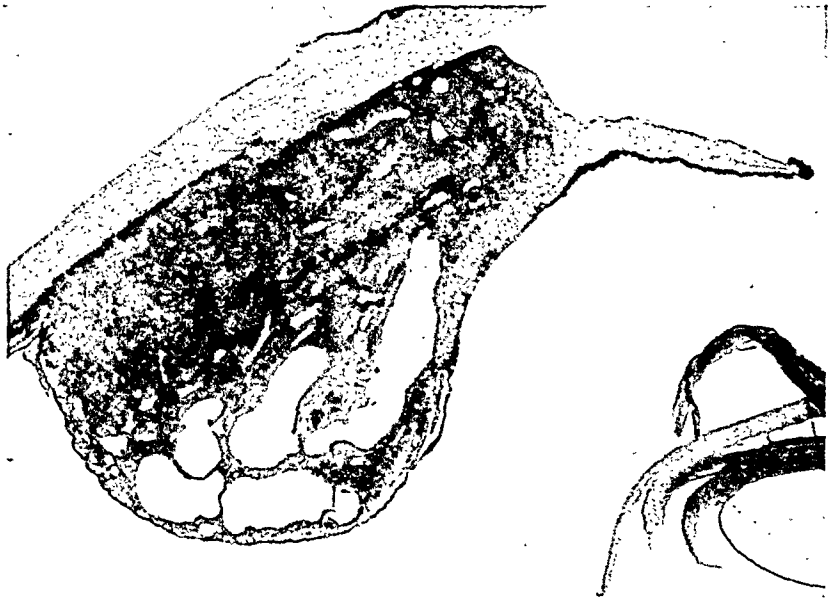


Fig. 7 (Kennedy). Multiple cystic malignant melanoma of the ciliary body invading the iris and obstructing the filtration angle. (Grace's case. Hematoxylin-eosin stain. Magnification, ×12.)

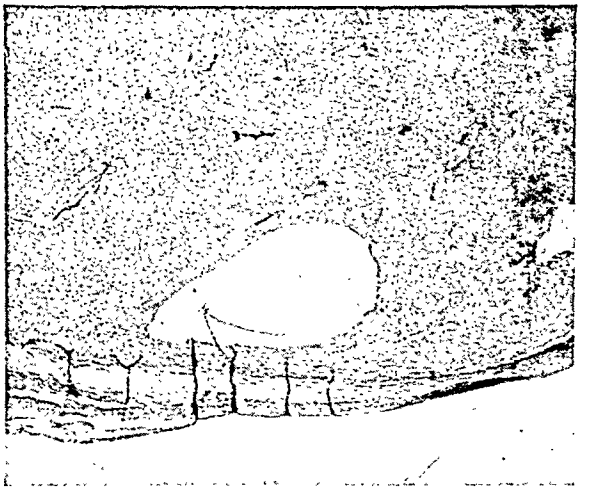


Fig. 8 (Kennedy). Typical cystic choroidal malignant melanoma. (Wilmer Pathology No. 7984. Hematoxylin-eosin stain. Magnification, ×10.)

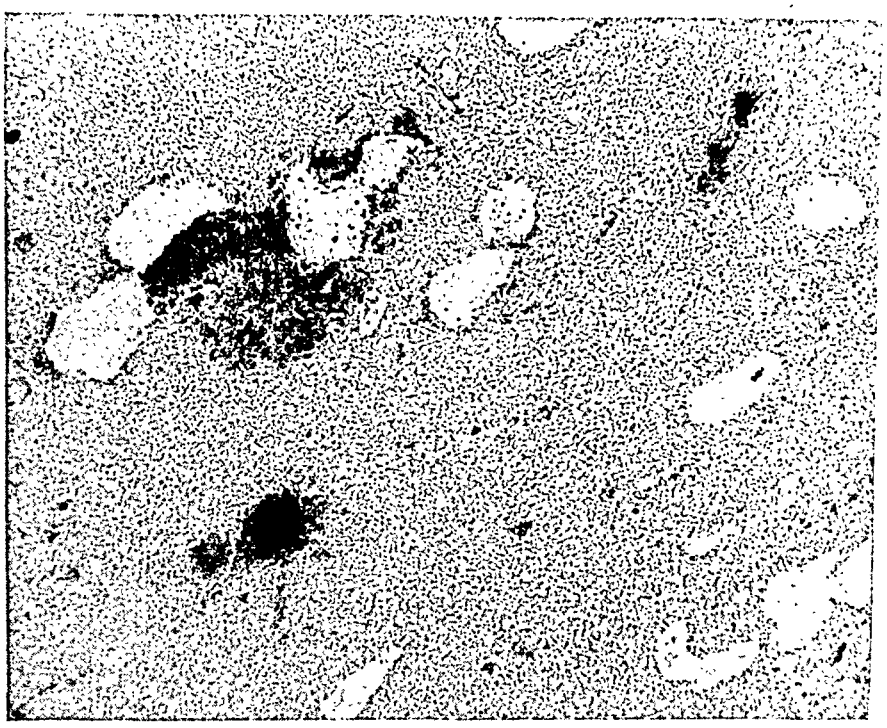


Fig. 9 (Kennedy). Focal areas of necrosis showing minute cysts. (Wilmer Pathology No. 3772. Hematoxylin-eosin stain. Magnification, ×40.)

differentiated from such blood spaces in malignant melanomas in many ways. The true cysts are usually much less numerous than the many vascular blood spaces. Red blood cells are very rarely seen in, or adjacent to, the true degenerative cysts, in contrast to the blood spaces which are usually filled. The cystic areas are usually lined by irregular cells projecting into the lumen, and many of the adjacent cells show necrosis. In contrast, the blood spaces are lined with endothelial cells, or a more regular wall of tumor cells. The cysts may show strands of tumor cells supporting islands of tumor cells as evidence of walls of adjacent cystic areas which have broken down to coalesce (fig. 5).

The Wilder stain[4] for reticulum fiber content and distribution may be used as a further point of differentiation between cystic and blood spaces. Dr. Grace's case (fig. 7), showing degenerate cystic spaces, is shown in greater magnification in Figures 12A and 12B. Figures 13A and 13B are sections of a typical vascular choroidal malignant melanoma of the same magnification. Figures 12A and 13A are stained with hematoxylin and eosin, and Figures 12B and 13B with the Wilder reticulum stain. The true cysts and the blood spaces stained with hematoxylin and eosin show a somewhat similar pic-

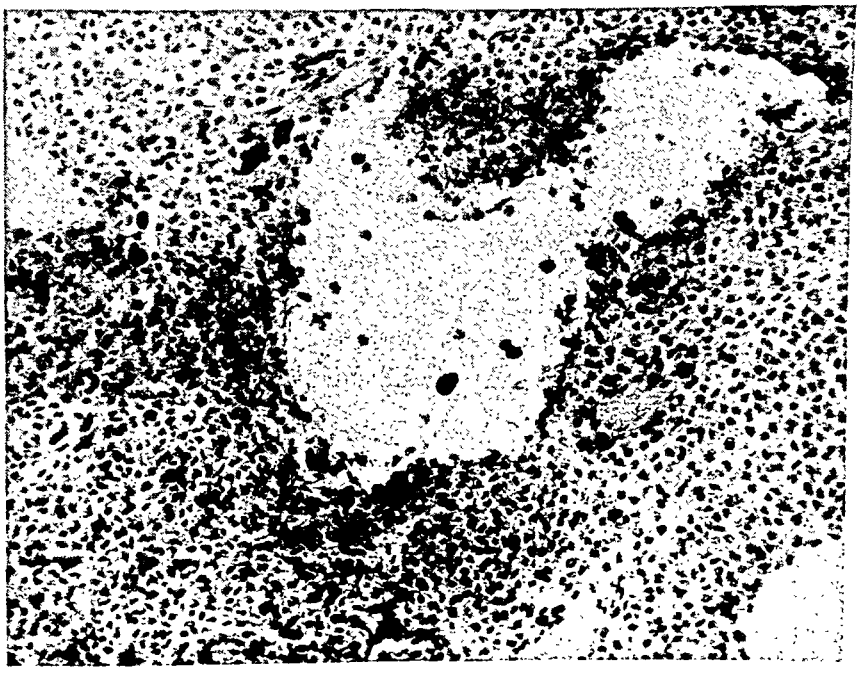


Fig. 10. (Kennedy). Higher power of Figure 9, showing irregular edges of cyst bordered by poorly staining cells. (Hematoxylin-eosin stain. Magnification, ×140.)



Fig. 11 (Kennedy). Vascular malignant melanoma of choroid giving a "pseudocystic" appearance. Blood spaces are numerous and all contain red-blood cells. (Wilmer Pathology No. 8613. Hematoxylin-eosin stain. Magnification, ×12.)

ture, but are easily differentiated with the Wilder reticulum stain. With the Wilder stain, the true cystic spaces show irregular edges relatively free from reticulum fibers, and the reticulum fibers may simulate an actual compression effect in the solid tumor away from the cysts. The blood spaces show more regular edges, with the reticulum fiber content most apparent, lining the walls and closely surrounding the blood spaces. The reticulum content around the blood spaces and vessels is also shown in relation to the blood vessels above the cystic spaces in Figure 12B.

To determine the frequency of cystic changes in malignant melanomas, a survey was made of all the routine sections of eyes containing malignant melanomas in the pathology department of the Wilmer Institute. In addition, the material from the Army Institute of Pathology was made available so that an additional group was studied. Thus a total of 440 routine sections of eyes containing malignant melanomas were ex-



Fig. 12 (Kennedy). A higher-power reproduction of Figure 7, showing degenerate cystic spaces. (Magnification, ×30.) (A) Hematoxylin-eosin stain. (B) Wilder reticulum stain. The irregular walls of the cyst are relatively free of reticulum fibers. Fibers in the solid portion of tumor give the appearance of compression. Blood vessels in the upper part of figure are clearly outlined with marked surrounding of the reticulum-fiber content in contrast to cystic spaces.

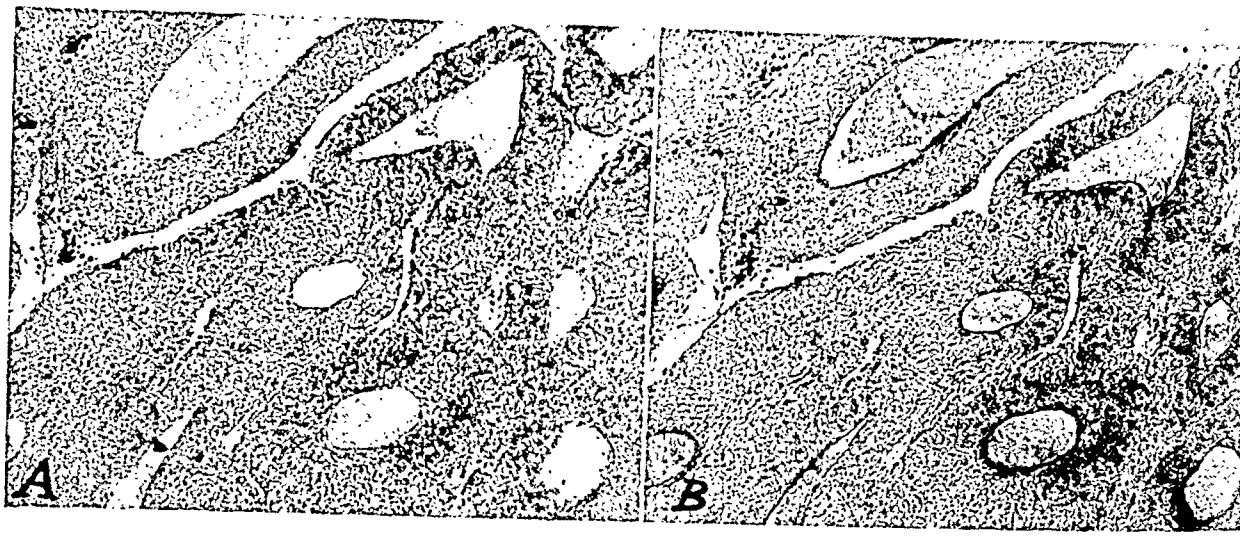


Fig. 13 (Kennedy). Blood spaces of typical vascular choroidal malignant melanoma giving a "pseudocystic" appearance. (Wilmer Pathology No. 6369. Magnification, ×30.) (A) Hematoxylin-eosin stain. (B) Wilder reticulum stain. Blood-space walls are more regular, and there is moderate adjacent reticulum-fiber content clearly outlining blood spaces.

amined (table 1). Of these, 148 sections were from the iris and ciliary body or both, and 292 were from the choroid. Thirty-seven of the 440 sections, or 8.4 percent contained cystic areas. Such a figure, 8.4 percent, can only be approximate, since the change from small focal areas of necrosis to the large, well-developed cystic formations is gradual and indefinite. Whether such changes are sufficient to be considered actually cystic depends upon the judgment of the observer. The occurrence of cystic changes was approximately equal in the iris and ciliary body (8.8 percent) and choroid (8.2 percent), so that there was no predilection for any particular site in the uvea. However, the cystic changes in malignant melanomas of the iris and ciliary body usually were larger in proportion to the size of the tumor, and were more apparent than the change in choroidal melanomas. The cystic changes in the malignant melanomas of the choroid were most apparent in those tumors which bulged freely into the vitreous cavity, or particularly those breaking through the lamina vitrea with the typical mushroom appearance. The decreased blood supply through the neck of these mushroom-shaped tumors and their uninhibited growth once they have broken through the lamina vitrea both, no doubt, aid cystic development.

TABLE 1

PERCENTAGE OF MALIGNANT-MELANOMA SPECIMENS SHOWING CYSTIC CHANGES

	Iris Ciliary Body	Choroid	Total
Total examined	148	292	440
Number showing cystic changes	13	24	37
Percentage showing cystic changes	8.8%	8.2%	8.4%

As shown in Table 2, the cystic malignant melanomas were grouped according to the cellular classification of Callender.[5] The percentages of cell-type distribution of the cystic tumors were compared to those of all malignant melanomas, as found by Callender, Wilder, and Ash[6] in a series of 500 specimens, and were found to be about the same. There was no statistically significant difference in the small series of 37 cases to indicate a preference for any cell type. No cystic malignant melanomas were placed in the necrotic group of Callender, Wilder, and Ash as being too necrotic for cellular classification. There were too few cases with

TABLE 2

CLASSIFICATION BY CELL TYPE OF CYSTIC MALIGNANT MELANOMAS: COMPARISON WITH NORMAL CELL-TYPE DISTRIBUTION

		Cystic Malignant Melanomas				All Malignant Melanomas % of Total
		Iris Ciliary Body	Choroid	Total	% of Total	
CELL TYPE	Spindle	7	9	16	43.2%	30.4%
	Fascicular	1	3	4	10.8	2.6
	Necrotic	0	0	0	0.0	9.0
	Mixed	4	11	15	40.6	55.2
	Epithelioid	1	1	2	5.4	2.8
	Total	13	24	37	100%	100%

a long enough follow-up to indicate whether there was any difference in prognosis between the cystic and noncystic groups, although with the facts available there appeared to be no difference.

CONCLUSIONS

Cystic malignant melanomas may present a diagnostic problem when they occur in the posterior chamber where their differential diagnosis from a benign uveal cyst is difficult.

The determination of translucency and the diagnostic puncture may differentiate a solid and cystic posterior-chamber mass, but cannot differentiate a benign and malignant cystic mass. Thus, they are unreliable diagnostic procedures.

When accessible, iridectomy and microscopic examination should be used to diagnose such lesions when their diagnosis is in doubt.

Large cystic spaces in malignant melanomas arise from the growth of small focal areas of tumor necrosis which are the result of inadequate nutrition.

The cystic manifestation is present in about 8 percent of all malignant melanomas of the uvea, has no predilection for the site in the uvea or the cell type, and has no apparent affect on the prognosis of malignant melanomas.

I wish to thank Mrs. H. C. Wilder for her help in making available for study the material from the Army Institute of Pathology.

Acknowledgement is made to my father, Dr. E. W. Kennedy, and to Dr. L. W. Oaks, Dr. W. L. Benedict, and Dr. C. C. Grace for permission to report their cases.

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PERIPHLEBITIS RETINALIS ASSOCIATED WITH INTRACRANIAL MANIFESTATIONS

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It has been my observation that symptoms of intracranial disease occur in patients with severe periphlebitis of the retina. Three cases are presented in which severe periphlebitis of the retina was associated with severe headaches and other signs of possible intracranial disease. A fourth case is presented, but other diseases were present in this case, which made it difficult to determine the etiology of headaches and coma. The first three patients were observed in the Army, the fourth at the Scott and White Clinic.

The ophthalmoscopic appearance of severe periphlebitis of the retina is spectacular. The veins are irregularly dilated and tortuous; the dilatation is usually marked; and sheathing of the veins may be very prominent. Often, portions of the vessels are obscured by retinal edema. New blood-vessel formation, "rete mirabile," is common. Hemorrhages and exudates are numerous, and usually fairly large and widely scattered. Large, vitreous hemorrhages are not of unusual occurrence. Glaucoma may terminate any possible useful function of the eye. It seems likely that the retinal arterioles are also, to some extent, involved, but the inflammation of the veins overshadows it.

Clinically, the term "periphlebitis" does not seem to describe the condition accurately and completely. With the markedly dilated veins and the many hemorrhages and exudates, thrombophlebitis would seem a more descriptive word. Of course, the lumens of the veins can be completely obliterated by proliferation without thrombosis.

Duke-Elder[1] states that the vast majority of the chronic cases of perivasculitis of the retina in young individuals are due to tubercle. Verhoeff and Simpson[2] found a tubercle obstructing the lumen of the central retinal vein on microscopic examination of an eye removed because of hemorrhagic glaucoma. Because the other eye had previously been affected with periphlebitis retinalis, the authors felt this gave strong support to the view that periphlebitis retinalis is tuberculous in nature.

CASE REPORTS

CASE 1

History. A 29-year-old, white officer developed severe occipital headaches and a low-grade fever on September 8, 1942. This was followed on September 15, 1942, by nausea and vomiting. On September 20, 1942, diplopia and photophobia developed and he noticed for the first time that his vision seemed diminished.

Examination on October 29, 1942, showed vision to be 20/20 and J1, both eyes. There were marked eyeground changes in both eyes, papilledema was present, the veins were irregularly dilated and tortuous, there was marked sheathing of the veins, and many hemorrhages and exudates were present. There was an intention tremor.

Labortory tests. Skin reaction to 0.01 mg. and 0.1 mg. of old tuberculin was negative. A spinal tap on December 8, 1942, showed pressure of 210 mm. of water, 150 lymphocytes were present, sugar was 78 mg. percent, total protein was 165 mg. Blood N.P.N., urea N. and creatinine were within normal limits. Widal, Kahn, blood cultures, stool examinations, sputum test for tuberculosis, agglutination for undulant fever, and smears for malaria were negative.

An X-ray film of the chest revealed Ghon's tubercle of the right lower lobe and calcification of the tracheobronchial nodes. A ventriculogram on January 24, 1943, showed no evidence of a brain-displacing mass.

Course. The patient remained relatively asymptomatic from January, 1943, to April, 1943. An afternoon temperature of about 100°F. was constant. On April 28, 1943,

the patient complained of dimness of vision. Thickness of speech, deviation of the tongue to the right, and definite weakness of the left facial muscles were noted at that time. The papilledema increased, although vision remained 20/20.

Diagnosis. A diagnosis of pneumonia, right base, was made on June 19, 1943, and the patient was given sulfadiazine. He complained of pain over the left inner thigh on June 23, 1943. Thickening of the great saphenous vein seemed to be present on palpation. On July 8, 1943, it was noted that the patient had lost ability to speak and to swallow, and he had to be fed with a tube. A complete right hemiplegia was present. A large amount of pleural fluid was aspirated on the right on July 15, July 24, and July 27, 1943. The report of a ventriculogram on August 20, 1943, was: "Diffuse, cortical atrophy of right frontal and anterior parietal areas; left ventricle enlarged; no evidences of space-consuming lesion."

By November 10, 1943, there was some return of muscle function on the right, and the patient was able to take liquids by himself. By December 10, 1943, there was a continued improvement in the general condition and the motion of the extremities continued to improve. The fundi had almost completely cleared. All the hemorrhages and exudates had disappeared and the vessels had returned to normal size, but some sheathing of the veins was still evident.

CASE 2

History. A young enlisted man, stationed outside continental United States, had been in good health until early July, 1943, at which time he complained of severe, left frontal headaches. Blurring of vision of the left eye was noticed on July 27, 1943. The blood pressure was found to be elevated at this time. The headaches continued with varying degrees of severity. An encephalogram performed on December 10, 1943, showed a possible lesion of the left frontal lobe. He was transferred to Lawson General Hospital on December 15, 1943, with the diagnoses of: (1) Tumor, type undetermined, right frontal lobe of the brain. (2) Hemorrhage, subretinal. (3) Arterial hypertension.

Examination revealed blood pressure to be 168/104 mm. Hg. Vision in the right eye was 6/200, and in the left, hand movements at one foot. There was complete detachment of the left retina. In the right eye there were the typical findings of a severe periphlebitis; that is, extreme tortuosities and dilatation of veins with sheathing, edema of the disc, new blood-vessel formation at the disc, and numerous hemorrhages and exudates.

Laboratory tests. All laboratory work, including four spinal-fluid examinations, Wassermann, blood counts, and urine analysis, indicated conditions within normal limits. The X-ray picture of the chest was reported as negative. A ventriculogram showed the left ventricle to be slightly larger than the right, but it was the opinion of the neurosurgeon that the patient did not have a space-taking mass.

The patient was transferred, so the final outcome was not known.

CASE 3

History. A 25-year-old member of the W.A.C. first complained of blurred vision in the right eye about September 15, 1943.

Examination. When first examined on September 30, 1943, the vision in the right eye was 20/50, and in the left, 20/20. Several areas of pigmentation were present in the right fundus, suggestive of old, healed choroiditis. Several areas of recent hemorrhage were present. She complained of severe, continuous headaches, beginning October 12, 1943. These headaches were not relieved by medication. On October 21, 1943, there were fresh hemorrhages noted along the course of the veins of the right eye. A diagnosis of "periphlebitis of vessels of right retina" was made.

Course. The hemorrhages in this eye increased until December 8, 1943, when the vision was reduced to light perception. Intraocular pressure remained normal. The pa-

tient continued to complain of severe headaches. All laboratory work was negative. Neurologic examination, including a ventriculogram, revealed no intracranial lesion.

The patient was transferred.

Case 4

History. A 28-year-old, white man was first seen in the clinic on January 12, 1947. He had been a known diabetic since the age of 15 years but, after he left school, very little attention had been given to dietary control.

The patient stated that he became suddenly blind in the left eye on July 4, 1946, following a blow on the face. Severe, recurrent headaches developed about this time, although there was a history of frequent, frontal headaches since 1935. In August, 1946, the patient developed severe headache, nausea, dysarthria, muscular unsteadiness, violence, and unconsciousness. Similar attacks developed in October, November, and December, 1946. The periods of unconsciousness lasted 2 or 3 days. The patient stated that he had been taking from 24 to 60 units of regular insulin a day and his urine was sugar free. He was told, during one of these hospitalizations, that his sputum was positive for M. tuberculosis. An encephalogram was advised because an intracranial lesion was suspected.

Examination. An eye examination upon admission revealed vision to be: R.E., 20/200; L.E., hand movements at one foot. In the right eye the typical findings of severe periphlebitis were present. In addition, small, "hard" exudates and small hemorrhages were seen around the macular region. There was no light reflex from the left eye.

Diagnosis. The following diagnoses were made by Dr. Ralph G. Greenlee of the medical department: (1) Diabetes mellitus. (2) Glomerulonephritis, chronic, with uremia. (3) Pulmonary tuberculosis. (4) Arterial hypertension. (5) Neuritis, peripheral.

Course. After discharge from the hospital, a competent internist to whom he was referred reported that he continued to complain of severe headaches when his diabetes was known to be under control.

Comments

The simultaneous occurrence of intracranial lesions and periphlebitis of the retinas in Case 1 does not prove a common etiology, or even a relationship. The occurrence of severe, continuous headaches in Case 2 and Case 3 does not prove intracranial involvement. Symptoms were of sufficient severity, however, that ventriculograms were believed to be indicated. In Case 4, the severe headaches and coma may have been due to hypoglycemia; however, severe headaches were present at a later date when diabetes was known to be under control. With inflammation as widespread and as severe as it is in many cases of periphlebitis retinalis, it would seem logical that the process would not end abruptly at the lamina cribrosa or optic foramina.

Summary

1. Four cases of periphlebitis retinalis, associated with severe headaches and other signs of possible intracranial disease, have been presented.

2. The cases are not presented as proof that intracranial pathologic conditions are a frequent occurrence in periphlebitis retinalis, because the series is too small. The simultaneous occurrence of periphlebitis retinalis and symptoms of intracranial disease is suggestive of a common etiology.

Scott and White Clinic.

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HISTOLOGIC STUDY OF EXPERIMENTAL CORNEAL TRANSPLANTATION*

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INTRODUCTION

Although corneal transplantation has been studied since 1824, the biologic process that takes place between host and graft remains as yet incompletely understood. There have been two leading points of view, one seemingly quite different from the other. Thus Fuchs,[22] Elschnig,[14] Castroviejo,[8,9] Ascher,[2] and others believed that in corneal transplantation there is true healing, with preservation of the vitality of the graft within the tissues of the host's cornea; Salzer,[30-35] Ribbert,[29] and others, however, claimed that there is an active regenerative process on the part of the host's cornea, which eventually totally replaces the transplant. A less definite point of view seems to have been taken by others like Loehlein,[28] and Filatov,[19] although Loehlein seems to be more in favor of the regeneration theory in his later publications.

It is not our aim in this present article to go too deeply into this theoretical discussion, but chiefly to present our own histologic experimental data. We hope, however, that this data may contribute to a better understanding of the extremely interesting biologic process taking place between the host's cornea and the transplant.

HISTORICAL REVIEW

Our review of the literature on this subject is restricted to those publications on corneal transplantation that contain histologic studies, without considering the development of the different operative techniques.

In general, these studies have been done either on human eyes obtained some time after corneal transplantation, or from animal eyes which have been operated upon and subsequently enucleated for experimental purposes. The clinical material for the first type of examination has always been meager, and according to a report of Filatov,[19] up to 1935, not more than 3 or 4 clinical cases have been reported in the literature.

The first of these cases, reported by Fuchs[22] in 1901, was obtained from a 20-year-old girl with bilateral interstitial keratitis on whom a keratoplasty was performed with a donor cornea taken from a human eye enucleated because of iridocyclitis. Two-and-one-half years later, the graft turned opaque so that a second keratoplasty was undertaken; the opacified part of the cornea, removed in full thickness, was studied microscopically by Fuchs. Thus, he found that the graft healed well at the beginning but that opacification and vascularization took place later. The most anterior portion of the graft tissue remained largely unchanged except that the stroma lamellae were more wavy in appearance, with a few nuclei of wandering cells beside the fixed cells. The posterior portion of the graft presented considerable changes. Descemet's membrane appeared folded and shortened, and between the corneal lamellae there were numerous nuclei and blood vessels. The posterior surface of Descemet's membrane was covered by a layer of thick fibrous tissue, which Fuchs believed to be thick scar formation. Descemet's membrane of the host cornea, surrounding the graft, extended out behind the graft on one side, but its posterior surface was also covered by the same fibrous tissue. Fuchs drew the conclusion that the transplant preserved most of its elements even after a period of 2½ years, and no sign of replacement of the graft by the sur-

* This study was carried on under the auspices of the Ayer Foundation and the Eye-Bank for Sight Restoration, Inc.

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rounding corneal tissue was demonstrable.

The 2nd and 3rd clinical cases examined histologically were reported by Ascher[2] in 1919. Besides material which he obtained from the removal of opaque grafts taken out in the course of a secondary transplantation, Ascher was able to report on two clinical cases with detailed histologic studies.

His first eye was from a 15-year-old girl treated for corneal fistula by partial penetrating keratoplasty. The eye was enucleated six weeks after operation because of the danger of sympathetic ophthalmia. The second case was a trachomatous corneal leukoma on which a keratoplasty had been performed. The patient died two months after the operation.

After describing the histologic findings in both instances in great detail, Ascher concluded that up to the time of enucleation in each case there was no sign of structural changes in the transplanted tissue or of its replacement by the surrounding cornea. Not only did Bowman's membrane and Descemet's membrane retain their identity, but even the epithelium at the junction did not show any definite sign of regeneration.

Sommer,[38] in 1925, enucleated an eye because of glaucoma, 15 months after a partial penetrating keratoplasty, and a histologic study of this eye was made. He found that the original tissue of the graft was essentially maintained and no replacement could have taken place.

Another case was reported by Frieberg[21] in 1927. It was a case of keratitis scrofulosa, treated by repeated keratoplastic operations. The graft was taken out 21 months after the first operation and used for histologic sections. It was found that an adhesion between Descemet's membrane of the host cornea and that of the graft had taken place. According to the opinion of the author, this adhesion might have hastened the process of healing between the graft and the surrounding cornea. As regards the fate of the stroma tissue of the graft, the author admitted the possibility of true healing, as well as that of invading growth from the host cornea.

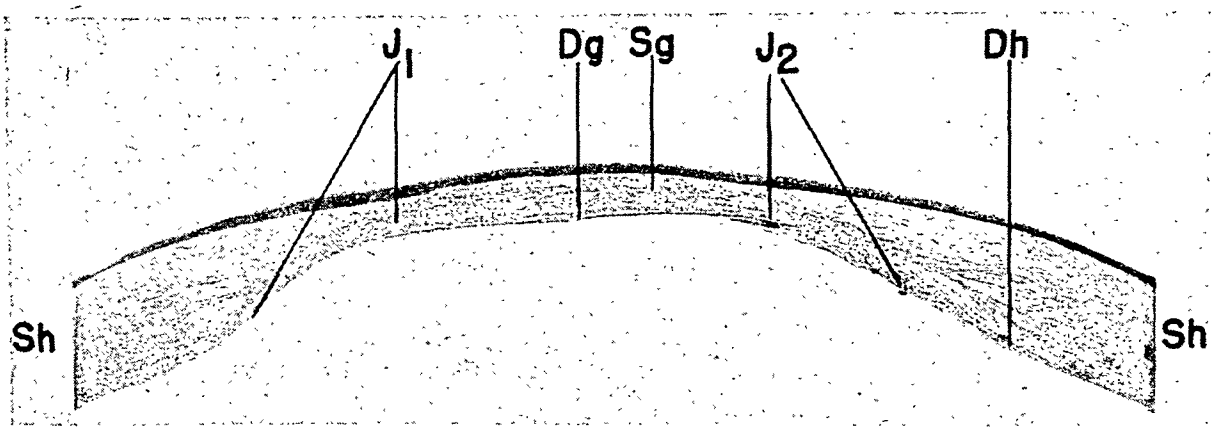
Filatov,[19] in 1935, was able to report his own clinical case in which the transplanted cornea retained its transparency for three years, until the patient's death. The transplantation was done on a leukoma that formed due to interstitial keratitis. The histologic findings were given in great detail. The epithelium over the center of the graft became thinner. Bowman's membrane of the host's leukoma was indistinct, but that of the graft remained well preserved. The stroma of the host cornea was infiltrated more under the epithelium than in its posterior portion. Some infiltration, though to a lesser degree, was also present in the tissue of the graft. At the junction, the substantia propria was scarred and contained remnants of cellular infiltration and blood vessels mostly in the anterior layers. The beginning of the transplant could be identified by the appearance of the corneal lamellae, which at a short distance from the scar acquired the arrangement of a normal cornea and preserved it along the entire length of the transplant.

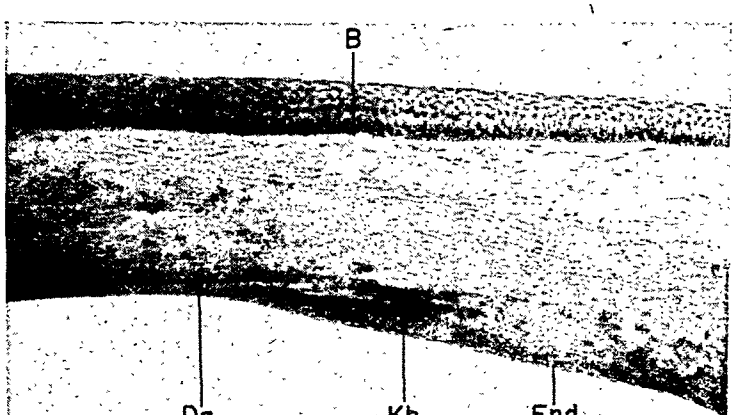
Descemet's membranes of the host and graft were both present, separated from each other by scar tissue. No endothelium, either of the host or of the graft, was present. There was an iris adhesion in this specimen. In considering the pathologic changes, Filatov was rather skeptical in the interpretation of his findings. "Does the permanent transparency of the transplant signify that an actual union has taken place, or does a substitution of the transplanted cornea by regenerated corneal elements of the host occur? This question is of great pathologic interest, and cannot be answered decisively at present." Filatov, however, concluded that the transplant as such remained well preserved and was distinctly separated from the host tissue by the fibrous ring, and that Bowman's and Descemet's membranes undoubtedly belonged to the transplant.

In the same year, 1935, Thomas[42] pub-

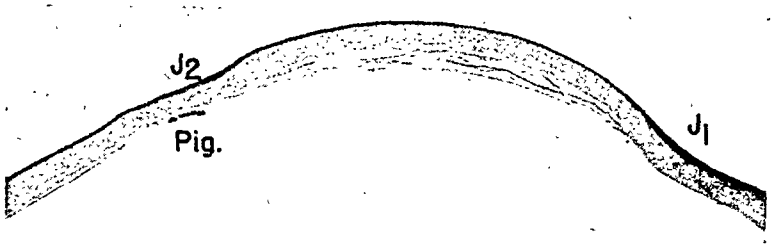
KEY TO THE ABBREVIATIONS IN THE FIGURES

A.c.: anterior chamber;
B.: Bowman's membrane;
b.v.: blood vessels;
b.v.l.: blood vessels cut in length;
C.: cornea;
Ce: corneal edema;
Cg: graft cornea;
Ch: host cornea;
c: cystic formation;
cy: cyclitic membrane;
D: Descemet's membrane;
d: denuded surface;
Dg.: Descemet's membrane of graft;
Dh: Descemet's membrane of host;
End: Endothelium;
End.c: endothelial cyst;
Ep: Epithelium;
Ep.c: epithelium cornified;
Ep.d: epithelium detached;
Ep.f: Epithelial fold;
Ep.h: epithelium of host;
Ep.i: epithelium in growth
Ep.j: Epithelium of junction;
F: thickened fibrinous membrane;
f: fibrin or fibrinous clot;
Fib: fibroblasts;
fib.t: (f.t.) fibrous tissue;
f.s.: fibroblastic synctium
g: interval between host and graft;
g.c.: giant cells;
g.t.: granulation tissue;
i: iris;
id: indentation;
Inf.: infiltration;
J: junction between host and graft;
Kb: keratoblasts;
L: lens;
Pig: pigment adhesions;
R.d: retina detached;
S: suture;
Sc: sclera;
S.t: scar tissue;
Sg: stroma of graft;
Sh: stroma of host;
Sp: space;
t.n.: tissue necrotic;
u.p: uveal pigment;
v: vacuoles.

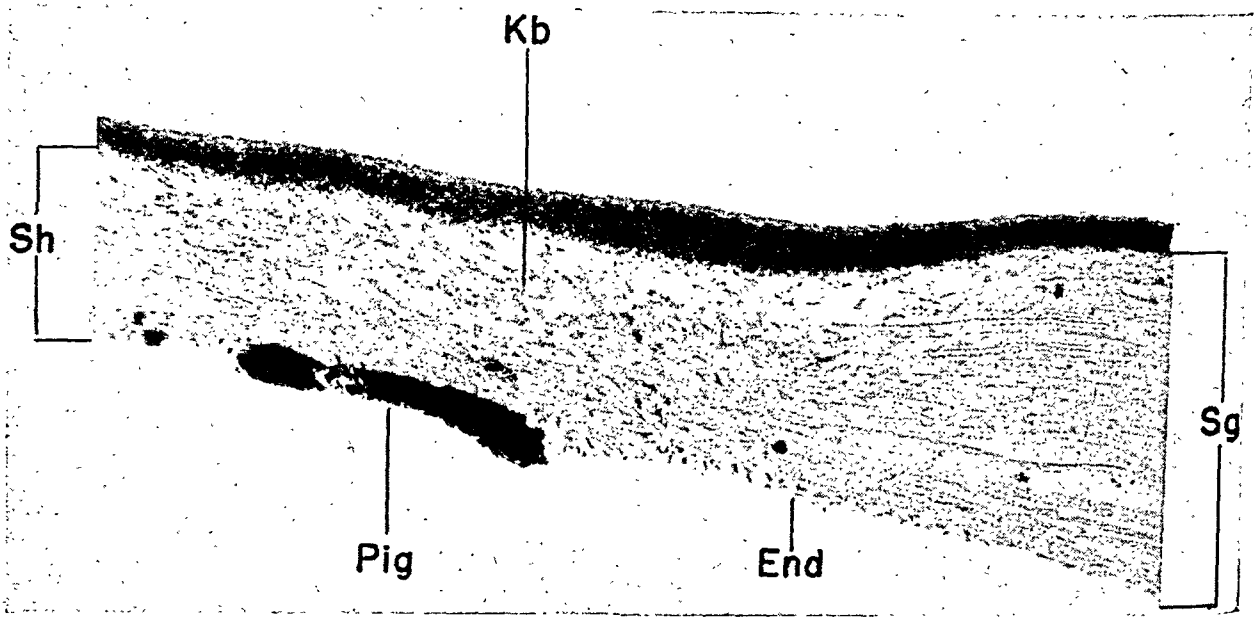




Figs. 1a and 1b (Katzin and Kuo). 1a (above). *Section through a transparent graft 4½ months after operation.* The epithelium extends evenly over the surface of the graft and that of the host with some thickening over the junction J_1; the stroma shows parallel arrangement of its lamellae and appears thinner than that of the surrounding host; Descemet's membrane of the graft is folded at J_1, but shows brushlike extensions at J_2; the endothelium shows budlike proliferation near J_2. 1b (at right) *Section of junction J_2 of Figure 1a under high power.* The thin homogeneous acellular layer B under the epithelium shows the weakly developed Bowman's membrane; the end of Descemet's membrane of the graft Dg is seen to show brushlike extensions, radiating into a group of keratoblasts Kb in the stroma of the junction; some thickening of the endothelium is noted.



Figs. 2a and 2b (Katzin and Kuo). 2a (at left). *Section through a translucent graft 21 days after operation.* The epithelium has an even surface but shows variations in thickness. The stroma lamellae of the graft appear slightly wavy and loose. Pigment adhesion on posterior surface at Junction J_2. 2b (below). *Section of junction J_2 of Figure 2a under high power.* Note the abundance of keratoblasts in the stroma tissue.



lished his data on the histology of two successful corneal grafts in man. The specimens —one six months, the other three weeks after the corneal transplantation—were obtained after the patients' deaths. Both grafts were successful in a clinical sense. The microscopic examination of the case six months after operation revealed good union of the graft edge with the host cornea. The epithelium appeared slightly thickened at the margin of the graft. Bowman's membrane was present but was separated in some places from the epithelium by a thin layer of fibrous tissue with long flattened nuclei. In the stroma of the graft, the fibers were found regular and well defined throughout, without signs of vascularization. The original host cornea was characterized by an increased number of nuclei which were interrupted by the scar formation at the margin of the graft. The nuclei did not seem to invade the graft to any appreciable distance. Some capillaries with cellular infiltration around them were also found at the junction between the host and the graft. The whole graft stroma appeared thicker than that of the host. No sign of newly formed Descemet's membrane was noted. The ends of Descemet's membrane of the graft and the host cornea did not meet. The former were folded. Behind Descemet's membrane of the graft, there was new tissue formation extending the whole length of the graft. The thin layer of fibrous tissue consisted of fibers regularly dispersed in parallel fashion with nuclei that were long, thin, and flat and with pointed ends. This, the author believed, was not incompatible with a graft that was clinically transparent.

The case of three weeks' duration manifested a histologic picture which in the regularity of the lamellar arrangement and

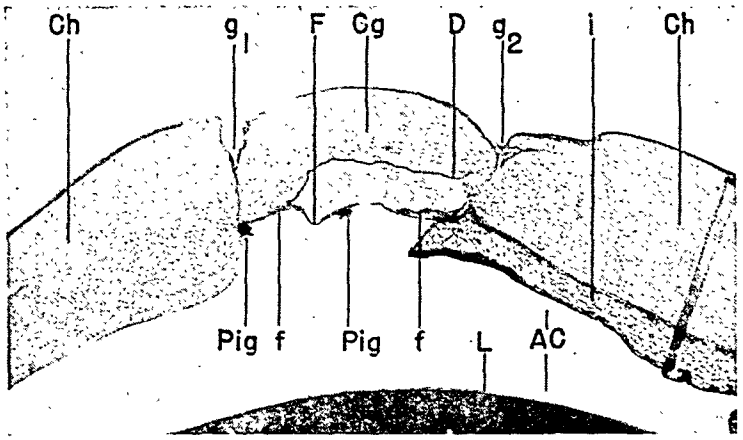


Fig. 3 (Katzin and Kuo). *Section through an edematous graft three days after operation.* The epithelium is proliferating into the wounds g_1, g_2. The stroma tissues of both the host and the graft appear markedly edematous. Descemet's membrane D of the graft is wrinkled. Fibrinous membrane F is seen behind it. Pigment adhesions and iris adhesions are present.

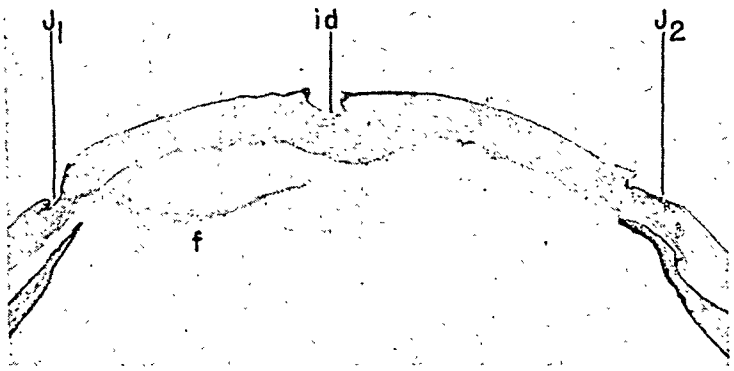


Fig. 4a (Katzin and Kuo). *Section through an edematous graft four days after operation.* The epithelium of the graft shows variation in thickness, peeling off in places, and proliferating over the suture indentation (id) at the center. The stroma appears edematous, its structure loose. Fibrinous mass f is seen in the anterior chamber.

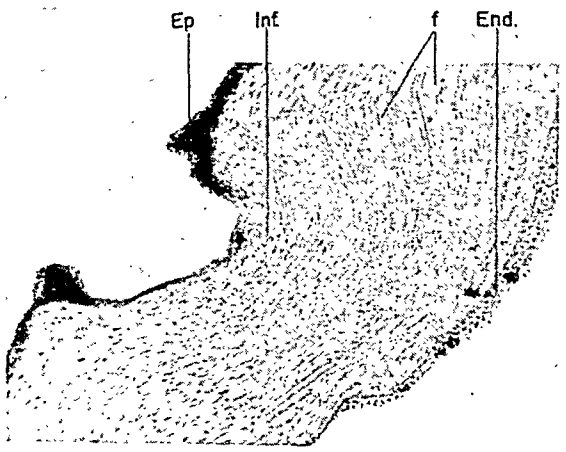


Fig. 4b (Katzin and Kuo). *Section through the indentation (id) of Figure 4a.* The proliferated epithelium over the edges of the indentation and the wide interlamellar spaces filled with fibrinous fluid f are well illustrated. Some cellular infiltration Inf. is seen in the stroma beneath the indentation.

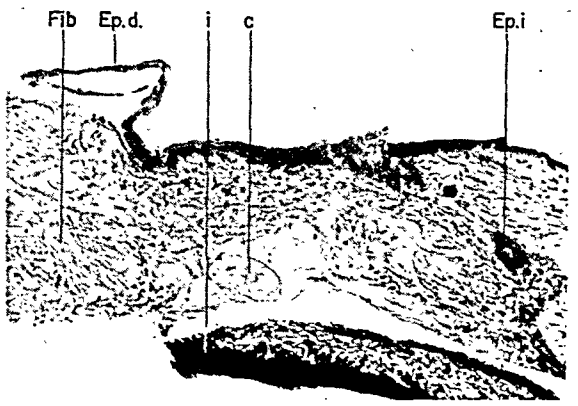


Fig. 4c (Katzin and Kuo). *Section through junction J_2 of Figure 4a.* Epithelium Ep.i is seen lying in the stroma tissue between the host and the graft and partially peeling off Ep.d in its total thickness over the surface of the graft. Numerous fibroblasts are present in the stroma.

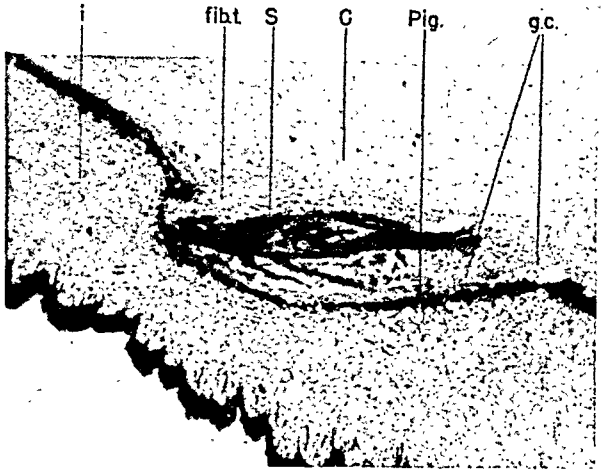


Fig. 5 (Katzin and Kuo). *Section through the adhesion between cornea and iris.* A silk suture S is embedded between cornea and iris and is surrounded by giant cells g.c. and fibrous layer fib.t.

nuclear content of the graft stroma was very normal in appearance. Marginal scar tissue was also present. The epithelium was continuous throughout. Bowman's membrane of the graft was also of the same thickness as in the donor cornea. There was tissue formation behind the graft of the same nature as in the previous case.

The descriptions by this author seem to show his preference for the theory of true healing, although he did not make any definite comment in this connection.

Castroviejo,[9] in 1937, included in his detailed histologic reports one case of microscopic examination of an opaque human cornea three months after a heteroplastic

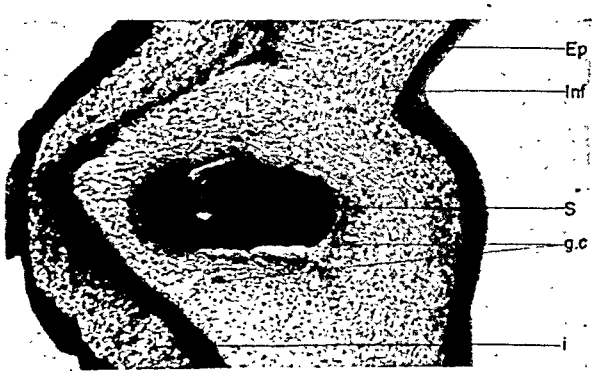


Fig. 6 (Katzin and Kuo). *Section through an adhesion between cornea and iris.* A suture S is embedded in the corneal tissue and is encapsulated by giant cells and a fibrous tissue layer as in Figure 5.

transplantation with the cornea of a monkey (macaccus rhesus). The microscopic examination revealed, "in the central part of the cornea, a necrotic area outlined on one side by blood vessels and lymphocytic infiltration, on the other side there was a perforation through which the lens capsule, lens matter, and vitreous were extruding. A dense lymphocytic infiltration along the entire surface of the cornea between the epithelium and the stroma was also seen. In the necrotic central plug or graft, there were many giant cells."

Subsequent histologic examinations of clinical cases were found in articles by Velter[44] in 1940, Babel[3] in 1945, and by Fieandt[16] in 1946. Velter published, in 1940, 18 corneal transplants; 15 of these were ob-

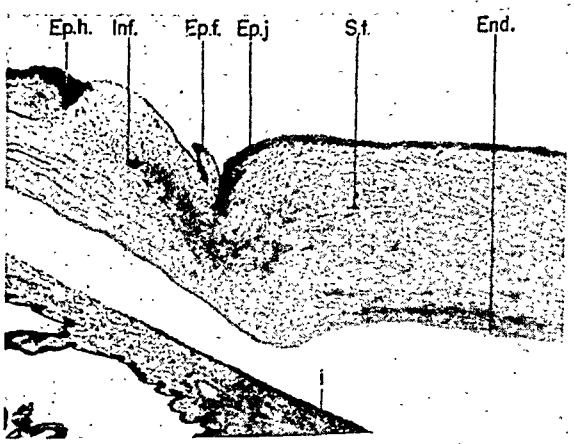


Fig. 7 (Katzin and Kuo). *Section through an opaque graft 22 days after operation.* A typical angular junction between the host and graft is noted, due to the effect of a tight suture. The epithelium is varied in thickness and presents a peculiar fold Ep.f. at the junction. Note the irregular pattern of the scar formation.

tained surgically when secondary transplants were used to replace the primary opaque ones. Three were obtained from eyes enucleated for glaucoma. The epithelium was usually thickened, sometimes vacuolated. Bowman's membrane was usually normal. The substantia propria showed only insignificant changes. Descemet's membrane was found preserved in over half of the cases and was usually detached and curled. The endothelium was absent in all cases. The demarcation between the transplant and the

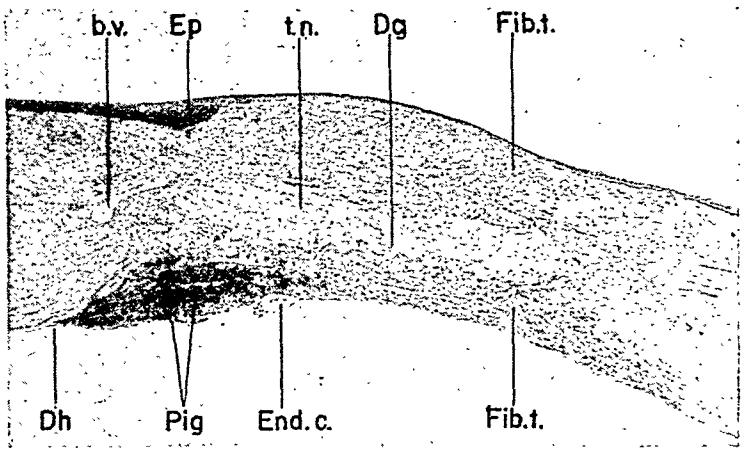


Fig. 8a (Katzin and Kuo). *Section through an opaque graft one month after operation.* The epithelium is thickened over the junction but thinner over the graft. Anterior and posterior fibrous tissue layers are present; wrinkled Descemet's membrane, necrotic tissue area t.n., pigment granules, and an endothelial cystic formation End.c. are seen in the part of the graft. Vascularization at the junctions and Y-shaped Descemet's membrane of the host are clearly illustrated.

scar was very sharp in all cases. Membranes were found developed behind the graft in 7 out of 18 cases; in 6, they originated in the corneal scar. The iris, when adherent to the transplant, did not contribute to the formation of the connective tissue invading the transplant. The author seems to be in favor of the true healing theory.

Babel,[3] in 1945, after presenting his 11 cases of transplanted corneas, ranging from four days to five years after operation, claimed to have substantiated the experimental findings of Bonnefon and Lacoste. The graft tissue, including Bowman's membrane, stroma lamellae, and Descemet's membrane, remained intact and was not replaced by the surrounding corneal tissue. The author mentioned, however, that the stroma tissues of the graft showed a marked degree of swelling, pyknosis of the nuclei, and so forth, as if they would subsequently disappear and be replaced by the surrounding elements. The epithelium may manifest signs of proliferation, overgrowing the wound edge and preventing the proper union between the host and the grafted cornea.

Fieandt's[16] case was the enucleated eye of a patient with interstitial keratitis, treated by corneal transplantation with subsequent development of an anterior chamber cyst. The histologic picture, the author believed, supported the view of true healing of the graft, because the transplanted area contained all the corneal layer. Bowman's membrane was found in the transplant, but was partially absent in the surrounding cornea and completely absent at the margin of the transplant.

Although the clinical histologic data is limited, experimental histologic reports are so much more numerous and elaborate, that we will simply summarize.

Salzer's[30-35] work along these lines seemed to be most comprehensive. His publications appeared between 1898 and 1945. According to this author, the fate of the transplanted cornea is that of gradual replacement by the host corneal tissue, in which the epithelial cells of the host cornea play the main role in the process of regeneration. Thus Salzer[30]

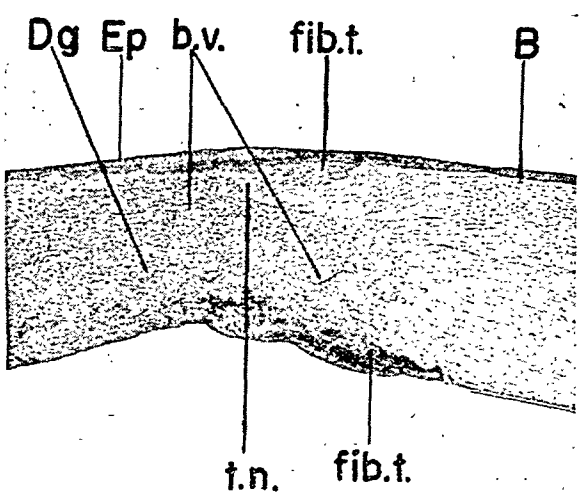


Fig. 8b (Katzin and Kuo). *Section through the same opaque cornea as Figure 8a.* The epithelium is thickened over the graft. The fibrous stroma of the graft is seen vascularized. A ring of Descemet's membrane Dg. is present. The necrotic area t.n. is seen more anteriorly than in previous figure.

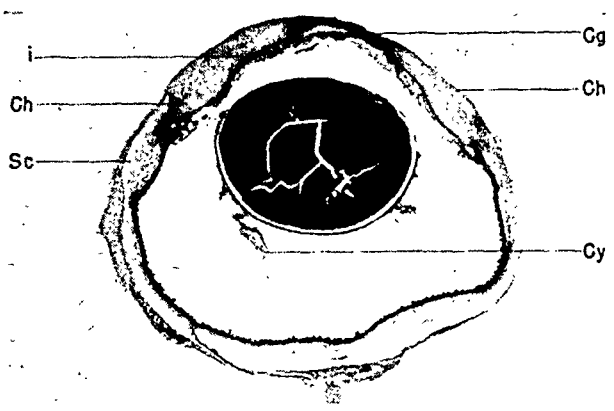


Fig. 9a (Katzin and Kuo). *Section through an eyeball of an opaque graft one month and 24 days after operation.* Total anterior synechia is noted. The graft tissue is totally cicatrized; edema is present in the host cornea as well as in the sclera.

said, in 1908, "The fact that heteroplastic operations have been performed with success, even in those cases where heteroplastic material from animal corneas from different species were used, is from the scientific point of view enough proof that there can be no true transplantation in the operation of keratoplasty, but rather that the graft heals only as a dead tissue or foreign body."

In order to show the regenerative power of the cornea, amplifying the results of Ribbert,[29] Salzer carried out the following experiment: He cut a pocket in the cornea of a rabbit and used different materials for implantation: egg membrane, a flap of guinea-pig's cornea, or a flap of the cornea of a rabbit. Two months later he carried out histologic examinations of these specimens and found profound changes in all parts of the implanted tissue. Although Salzer claimed on the basis of his results that regenerated tissue actually invaded the implanted material, he was rather skeptical in drawing any definite conclusions and suggested that further experiments with different materials and different staining methods should be pursued to bring more light to this problem.

In 1910, Salzer[32] carried on another series of experiments in which he implanted a flap of formalinized horse cornea in the cornea of a rabbit and found that the implant actually "healed." The microscopic examination three months after the implantation showed that, although the whole implant was still recognizable, the margins appeared to be absorbed and replaced by invading regenerating tissue. Subsequent observations found that in one specimen, the implant had entirely disappeared after a period of about 15 months, clinically as well as histologically.

In the same year, Salzer[31] made another interesting observation, based on the results obtained by Nielson and Angelucci, on the filling in of a large defect in the rabbit's cornea produced with a trephine. It was found that the hole was eventually filled up with newly formed corneal tissue which, in the course of a few weeks or months, resulted in almost normal transparency. The whole process took place on the basis of a fibrinous clot which initially bridged the hole



Fig. 9b (Katzin and Kuo). *Part of the section of Figure 9a through the cornea of the host and the adherent iris.* Note the total denudation of the epithelium; the stromal edema and the total anterior synechia of the iris.

and was subsequently organized. The whole regenerative process was not accompanied by any sign of vascularization whatsoever.

In the year 1921, Salzer[33] discussed the significance of this regenerative capacity of the cornea from the clinical point of view. The corneal defect in cases of perforation due to blennorrhea neonatorum is often filled with regenerated corneal tissue so completely, that only insignificant opacity remains. A unique case of Elschnig, reported by Ascher, was cited of a 12-year-old boy whose one eye suffered from deep keratitis. The cornea of this eye was trephined without receiving a graft. After seven years, the defect was replaced by completely transparent corneal tissue. The surrounding cornea also became transparent, leaving only a very fine ring surrounding the regenerated tissue.

In the course of his studies, Salzer[33] found that the regenerative process of the cornea is associated with the activity of the keratoblasts, which seemed to be most abundant in the subepithelial layer of the cornea. On the basis of this observation, together with additional microscopic evidence, Salzer believed that the keratoblasts are of epithelial origin. He performed homo (rabbit cornea to rabbit) as well as hetero (horse cornea to rabbit) implantations and obtained histologic preparations which substantiated his view regarding the origin of the keratoblast.

The more recent work of Salzer,[34] in 1937, may be summed up as follows: In higher animals, transplanted tissue does not remain intact for a long time, but soon undergoes slow degeneration. At the same time, as a result of the natural regenerative tendency of the wound regions, newly formed tissue elements from the surrounding host tissue enter into this substance and gradually replace it, provided there is no infection or inflammation in which case a cicatricial mass will result. Regeneration of corneal wounds originates from the spindle cells lying directly below the corneal epithelium, called keratoblasts, which enter into and replace the transplanted corneal disc. The fixed

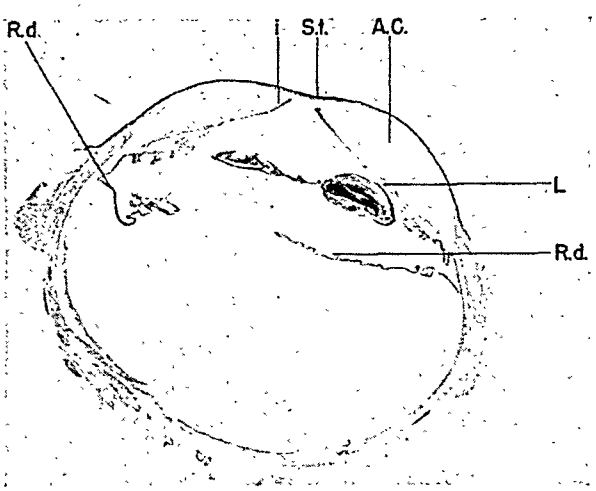


Fig. 10a (Katzin and Kuo). *Section through a hypotonic eyeball, which has lost its graft and healed (2½ months after operation).* Note the total detachment of the retina and the slight invagination over the healed corneal scar S.t. The lens has been largely extruded, and the margins of the iris are adherent anteriorly.

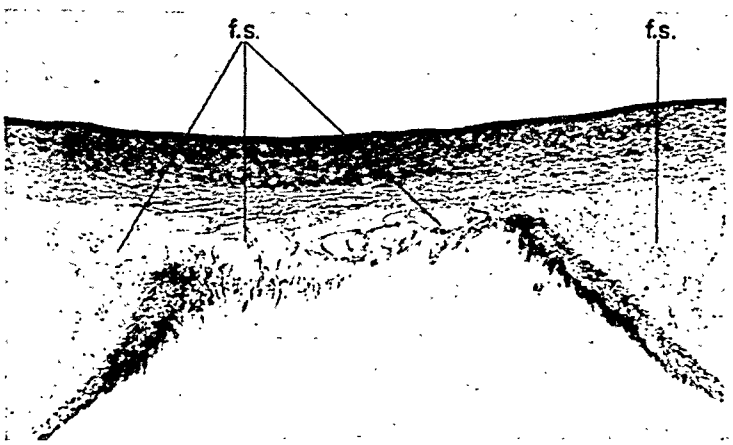


Fig. 10b (Katzin and Kuo). *Section through the central portion of the healed corneal scar of Figure 10a,* showing the fibroblastic synctium f.s. connecting the iris tissue with the posterior surface of the healed cornea. The stromal lamellae are in fairly parallel arrangement.

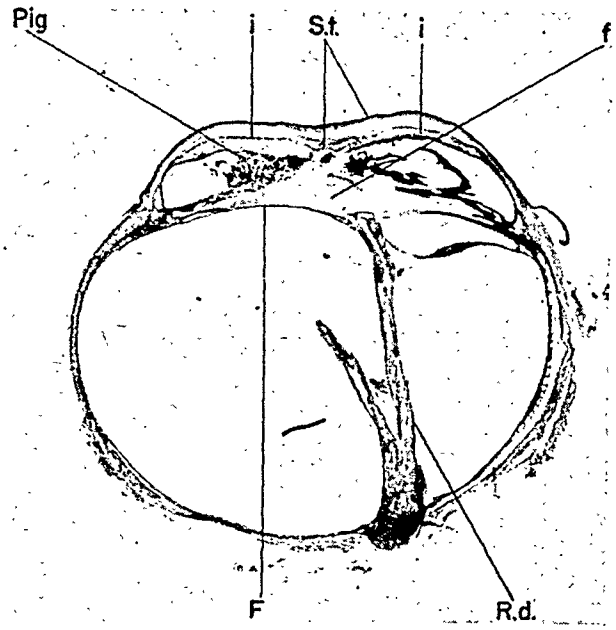


Fig. 11a (Katzin and Kuo). *Section through a hypotonic eyeball, which has lost its graft and healed (3 months and 2 days after operation).* Note the absence of the lens and the total detachment of the retina. The healed corneal scar appears also slightly invaginated as in Figure 10a.

corneal cells do not take part in the regenerative process. That the replacement of corneal graft tissue must originate from the epithelial layer is consistent with the new embryologic conception that does not hold firmly to the specificity of the germinal layers. It is of no consequence whether one uses discs from the same species or from widely different ones, for even dead materials kept in preserving fluids have been

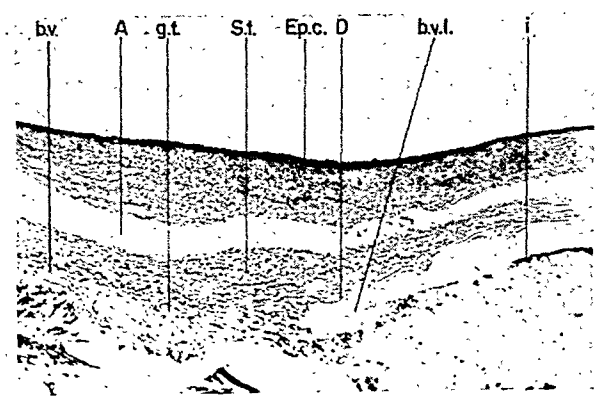


Fig. 11b (Katzin and Kuo). *Section through the invaginated portion of the healed corneal scar of Figure 11a.* Note the cornification of the epithelial surface and the presence of the granulation tissue between the corneal scar and iris tissue.

successfully transplanted. For a successful transplantation, it is necessary that the leukoma should contain well-preserved corneal elements from which regeneration may proceed. Total adherent vascular leukoma forms an unsuitable bed for transplantation.

Salzer's[35] publication, in 1941, dealt with the results of studies in comparative histology and embryology, as well as tissue cultures. All seemed to point to the same conclusion, that the cornea is epithelial in origin, development, and regeneration.

In 1910, Loehlein[28] published his histologic report of a rabbit cornea three months after transplantation. There was thickening of the epithelium as well as penetration of the epithelium into the stroma. No sharp demarcation existed between the graft and the host cornea. No changes in Bowman's and Descemet's membranes of the host were noted. A slight degree of vascularization prevailed in the marginal region between the host and the graft.

Bonnefon and Lacoste,[7] in 1913, based on 200 partial lamellar keratoplasties in animals and histologic studies on the specimens ranging from 10 hours to five months after operation, concluded that the only elements preserved up to five months were the epithelium, the lamellae of the corneal stroma, and a few corneal corpuscles. Most of the corpuscles were regenerated (immigrant fibroblasts) and in time the stroma of the cornea was probably also replaced slowly by new stroma.

Forster,[20] in 1923, prepared a review of keratoplastic surgery and reported his own experiments on the subject. He concluded that a successful graft from another species is a biologic impossibility because it is inconsistent with the biologic law of tissue specificity.

Castroviejo,[8] in 1932, carried out a detailed histologic examination on normal rabbit corneas on which partial penetrating keratoplasty had been performed. The transparent grafts showed no signs of replacement by the host. In 1937, Castroviejo[9] made

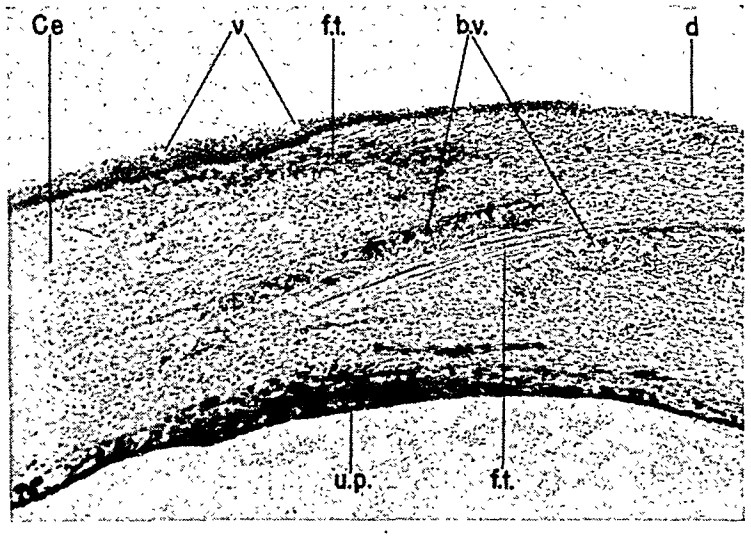


Fig. 12 (Katzin and Kuo). *Section through a formalinized opaque graft two months and 21 days after operation.* The epithelium is vacuolated; the stroma tissue is scarred with cellular infiltration, vascularization, and edema. The iris pigment is adherent and interwoven with the corneal stromal tissue.

another series of histologic studies based upon some 300 partial penetrating keratoplasties on normal and pathologic corneas of different species of animals and on 80 keratoplasties of the same type on human beings. His results appeared to show that the transparent corneal graft retained its individuality and preserved its own cellular elements. There is no evidence of a gradual replacement of this type of graft by the tissue of the host. He mentioned as the main causes of nebulosity and opacification of a graft:

1. Poor coaptation of the margins of the implanted segment into the cornea of the host.
2. Postoperative infection.
3. Incarceration of intraocular structures with subsequent development of connective tissue behind the graft.
4. Vascularization of the graft always associated with infiltration of the stroma by wandering cells.

Thomas,[39] in 1931, published a case of experimental corneal transplantation in a rabbit to replace a central opacity. His histologic study revealed that the opaque graft was densely nucleated and contained many connective tissue cells with spindle-shaped nuclei. A second series of three cases also of Thomas's[40] reported in the same year, showed that the degree of clarity of the graft was closely associated with the extent to which the iris was adherent.

In 1934, Thomas[41] performed transplantations on rabbits, using devitalized grafts heated in olive oil at 100°C. for a few seconds, and obtained good healing. There was some degree of thinning of the graft tissue and a linear scar was formed around

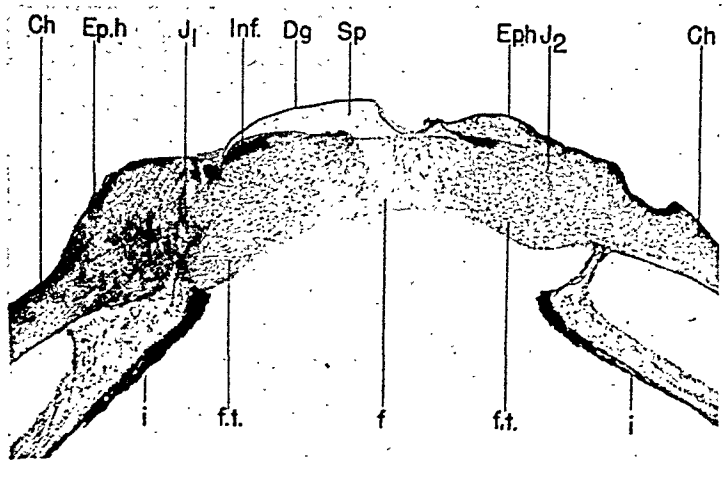


Fig. 13 (Katzin and Kuo). *Section through an opaque graft (frozen and dehydrated) 16 days after operation.* The entire tissue of the graft has been lost except for Descemet's membrane which can be seen on the anterior surface. Partly organized fibrin fills in the gap, which is beginning to be covered with epithelium. Note the polymorphonuclear infiltration in the stroma tissue near the junctions.

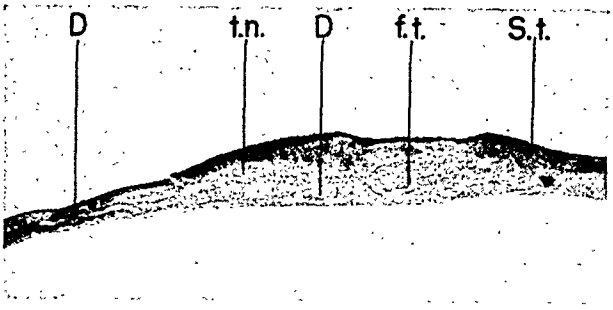


Fig. 14 (Katzin and Kuo). *Section through an opaque graft (frozen and dehydrated) 26 days after operation.* The epithelium appears uneven over the graft. Note the anterior and posterior layers of fibrous tissues with necrotic tissue in between. Descemet's membrane of the graft is wrinkled.

the graft. The reaction of the eye was minimal and the graft tissue remained avascular. Because of the thickening and contracture of the heated graft tissue, the posterior portion was cut off before being implanted so that the transplant actually consisted only of the epithelium and the anterior layers of stroma. Nevertheless, the graft took well. The author concluded that union between the graft and the host cornea could only have taken place by virtue of regenerative activity on the part of the surrounding corneal tissue.

In 1936, Thomas[43] carried out experiments on heterogeneous corneal grafts on six rabbits, using human cornea on one, and cats' corneas on the remaining five. It was found that the heterogeneous grafts could also unite with the host's cornea, but unlike

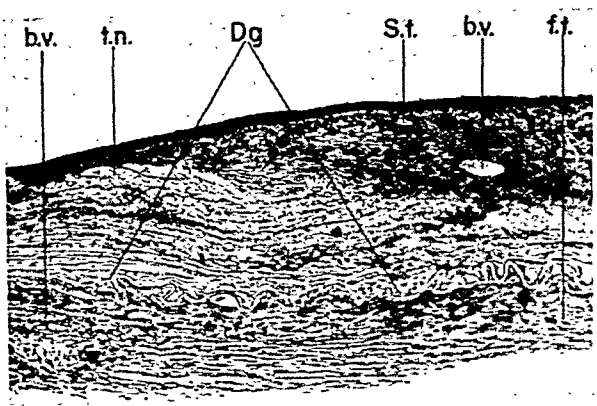


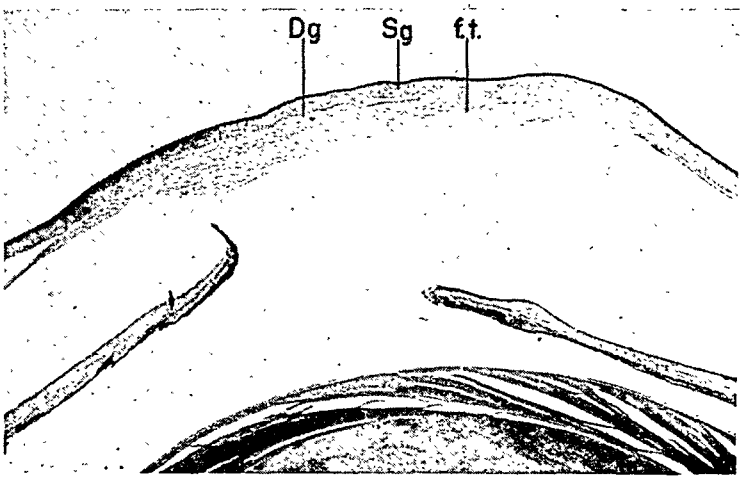
Fig. 15 (Katzin and Kuo). *Section through an opaque graft (frozen and dehydrated) one month and 11 days after operation.* Histologic details are seen in this picture similar to Figure 14, with the addition of blood vessels.

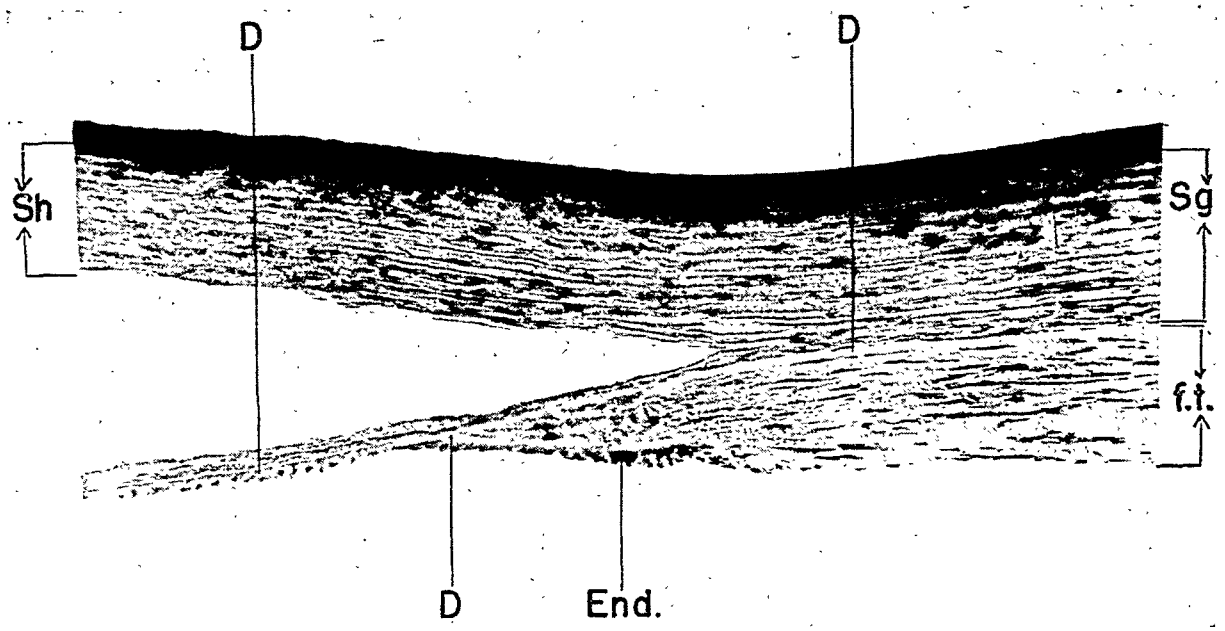
successful homogeneous grafts, they did not remain transparent, but became vascularized. After a period of 3 years and 10 months in one specimen, the graft was composed of tissue derived from the host cornea, but Descemet's membrane remained. The original stroma of the graft was retained to some extent, in the form of isolated fibers, subepithelially, and a homogeneous mass in its posterior portion where no blood vessels were present. This finding seemed to warrant the conception that the tissue was tolerated but largely ostracized by the recipient eye.

Kiyama[27] in 1934 claimed to have proved the theory of true healing of a transplant from a histologic as well as immunologic point of view. It was first shown that tissue-juice of the chicken embryo hastened the process of corneal epithelial regeneration of an artificial defect in a rabbit's cornea, and that the addition of a mixture of tissue juice and secondary aqueous promoted the healing of the graft in its bed. Subsequent histologic examination revealed that all layers of the graft tissue were well perserved. His immunologic experiment showed that a corneal transplant taken from a rabbit immunized against vaccine virus, retained its immunity after being transplanted. Kiyama concluded, therefore, that a cornea can be transplanted without dying and that true keratoplasty exists.

Scherschewskaya,[36] in 1940, carried out 37 experimental keratoplasties on rabbits with formalinized transplants. Of these, 12 healed, with retained transparency in three cases. Of five keratoplasties on human beings, one remained clear. Detailed histologic data were presented both for opaque and clear grafts. No conclusive interpretation was given for the histologic pictures, except that the formalinized grafts can actually heal and become transparent, thus substantiating the experimental data of Salzer to the fullest extent.

Deutman,[12] in 1940, used formalinized cornea for keratoplastic operations on five





Figs. 16a and 16b (Katzin and Kuo). 16a (right). *Section of an opaque graft (frozen and dehydrated) six months after operation.* Note how the necrotic tissue of the graft has been organized into fibrous tissue. 16b (below). *Section through the junction between host and graft of Figure 16a.* Note the Y-shaped extension of the host's Descemet's membrane and the thickening of the endothelium.

normal rabbit eyes. All the transplants clinically observed during the period from 3 to 11 months, postoperatively, remained opaque, due to connective-tissue formation behind the graft. From the histologic pictures, the author had the impression that the formalinized transplant was surrounded by the neighboring corneal tissue in an attempt at encapsulation.

Sena,[37] in 1941, reported two cases of experimental keratoplasty on rabbits with subsequent histologic examination. The author concluded that the histology showed definitely the maintenance of cellular autonomy on the part of the transplants.

Wiener and Rosenbaum,[46] in 1941, published their experimental data on 22 formalinized heterogeneous and homogenous corneal transplantations, five of which were formalinized dog cornea to rabbit and 17 were chemically fixed rabbit cornea to rabbits. The heterogenous transplants caused more reactions in the eye than the homogenous transplants, where 8 out of 9 healed, and three of these showed definited signs of clearing. From the histologic sections it was seen that the epithelium and the endothelium of the graft had been derived from the corresponding layers of the host. Descemet's membrane, on the other hand, was probably the remnant of the donor material. Regarding the fate of the stroma

of the graft, the authors believed that there was some true replacement taking place.

Imre,[23] in 1942, reported clinical and histologic experiments with corneal grafts on more than 20 eyes. No detailed reports are available.

Bashoff,[5] in 1946, described 30 cases of keratoplasty. Results of formalinized and autografts were compared. Of the former, the results were negligible to bad. In the autografts, 13 good results were obtained out of a total of 17 cases.

Comment on the literature

From the foregoing review of the literature, it is evident that the controversy between the leading points of view, regarding the biologic process taking place between the graft and the host cornea, has been going on for 5 or 6 decades and, in spite of the numerous publications, clinical as well as experimental, as reviewed above, no solution has yet been reached.

In general the conception of true healing has been built chiefly upon these arguments:

1. The original graft tissue remains unchanged, especially Bowman's and Descemet's membranes. The graft stroma does not totally disappear even 2½ years after operation, as reported by Fuchs,[22] and three years, as reported by Filatov.[19] Only the epithelium and endothelium seem to have been replaced.

2. The biologic principle of the individual specificity of tissue is inconsistent with the conception of active regeneration of the cornea. So said Forster,[20] "Transplantation from another species is a biological impossibility." The repeated failures reported in the literature of heterogeneous transplants seem to speak in favor of this conception.

3. The fact that devitalized transplants seldom succeed in taking and even more seldom remain transparent proved that, in order for a transplant to heal, the preservation of its vitality is necessary.

4. Immunologic experiments by Kiyama[21] have shown that the transplant retains its acquired immunity against vaccine virus even after it has healed to the donor tissue, so that any replacement of the donor tissue can be excluded.

5. That the transplant possesses unusual vitality is demonstrated clinically by its therapeutic effect in promoting the process of clearing and absorption of opacity in the vicinity of the graft as shown by the so-called "amelioration" treatment of Filatov,[17] and by the healing effect on serpiginous ulcers, as reported by Chechik-Kunina.[10]

6. The clinical experience of Elschnig[14] and Filatov,[19] which emphasizes the importance of normal surrounding corneal tissue for the maintenance of nutrition of the transplant, is but another evidence that the transplanted cornea actually possesses its own vitality.

The proponents of the regeneration theory, on the other hand, base their data chiefly on the experimental results of Salzer.[30–35] They believe that corneal tissue, like most other tissues of the body, possesses the power of regeneration by virtue of which the transplant is replaced eventually by the regenerated corneal tissue from the surrounding host. Thus the transplant does not retain its own structure, but merely acts as a dead foreign body, which is absorbed and disappears within the tissue of the host. They support their theory by the following data:

1. Implanted egg membrane and heterogeneous corneal tissue from a guinea pig placed in a pocket in a rabbit's cornea were found histologically to be invaded by the regenerated corneal tissue from the surrounding host.

2. Formalinized horse cornea implanted in the same manner first healed and then disappeared 15 months after implantation so completely that no trace was demonstrable, either clinically or histologically.

3. Corneal wounds uncovered by any

graft tissue when left alone can regenerate in the region of the gap with newly formed corneal tissue which is almost indistinguishable from normal cornea histologically.

Besides successful grafting with formalinized corneal tissue in animal experiments, as shown by Scherschewskaya,[36] and Wiener and Rosenbaum,[46] clinically transparent transplants have also been obtained in human beings with formalinized grafts by Scherschewskaya. Thus she said, "The healing of formalinized discs with preservation of their functional capacity can only be explained from the point of view of hidden regeneration or, in other words, by the role of the transplant as a carcass." But even more precise are the remarks of Wiener or Rosenbaum,[46] "If there is a true replacement, it is an extremely orderly one, and yet this must be the modus operandi, for surely one cannot conceive that dead tissue, such as formalinized cornea undoubtedly is, could be revitalized."

5. The reported success of heteroplastic transplantations on animals, as one finds in the literature (and clinically the case of lamellar keratoplasty by Von Hippel,[45] in 1888, using a dog cornea for a man where a graft actually "healed" with some degree of transparency) alone tends to disprove the theory of the biologic specificity of the corneal tissue. As Salzer says, "Since we are always dealing with the healing of a dead tissue, or a tissue which is sooner or later going to disappear, and not dealing with a true transplantation, it is absolutely indifferent (except from the mechanical and technical point of view) whether the graft is taken from the same species or from a widely different one."

Methods and Materials

Before we express our opinions on the subject, we wish to present our own experimental data in this connection for reference.

The material to be presented was obtained from a study of over 200 corneal transplantations on rabbits, and over 100 histologic sections of operated eyes. The technical methods of transplantation are presented elsewhere in the publications of one of the authors (H. M. K.).[24-26] Some of the operations were done with the use of sutures and some were done with fibrin as an adhesive to cement the graft in place. The rabbits were killed after a variable period of time up to nine months after operation, and the eyes were fixed in formalin and stained with hematoxylin and eosin. Some of the donor eyes were preserved in saline, some in other buffered physiologic solutions, some in merthiolate, and some in a moist chamber. Several transplants were obtained from formalinized eyes and some grafts were preserved by freezing and dehydrating at very low temperatures.[25] The sections were selected as typical of certain types of tissue reactions of interest to the ophthalmologist. The data on these sections will be found in Table 1 and the descriptions of the figures in Table 2.

Discussion of the Histologic Findings

Epithelium. The epithelium of the host grows rapidly into the wound at the margin of the graft and is the first cellular repair mechanism. In early sections epithelial cells can be seen lying between the stroma of the host and the graft.

Ordinarily these epithelial cells disappear later. There has been some controversy as to whether they are transformed into keratoblasts. It is our belief that the epithelium of the graft is lost within the first three days after transplantation and this is replaced by the growth of the host's epithelium.

The epithelium tends to fill in uneven surfaces and will be thicker in some places than in others in order to maintain a smooth optical surface. When the intraocular pressure is normal, the epithelium presents a fairly normal appearance after transplantation. When there is glaucoma, the cells become vacuolated, swollen, and cornified.

Bowman's membrane. In the rabbit, Bow-

TABLE 1

DATA ON HISTOLOGIC SECTIONS OF CORNEAL TRANSPLANTS IN RABBITS

Slide No.	Case No.	Fig. No.	Time Elapsed after Operation	Preservation of Donor Eye	Sutures Used	Diameter of Disc	Postoperative Course	Clinical Result
315 O.S.	1	1a 1b	4½ months	4 hrs. in saline at +2° C.	fibrin	6 mm.	Slightly hazy on 12th day, then clearing, no synechia	Clear
323 O.S.	2	2a 2b	8 months 21 days	2 hrs. in saline at +2° C.	fibrin	4.5 mm.	Uneventful except for anterior synechia, at 6 o'clock, detached on atropinization	Translucent
347 O.S.	3	3	3 days	4 days in 1.1% $NaHCO_3$ Sol. at +2° C.	fibrin	4.5 mm.	Graft found edematous, anterior synechia	Opaque Edematous
305 O.D.	4	4a 4b 4c	4 days	4 hrs. in 1/20,000 Merthiolate at room temperature	silk	5.5 mm.	Anterior synechia	Edematous sl. cloudy
305 O.D.	5	5	4 days	4 hrs. in 1/20,000 Merthiolate at room temperature	silk	5.5 mm.	Anterior synechia	Edematous sl. cloudy
305 O.D.	5	6	4 days	4 hrs. in 1/20,000 Methiolate at room temperature	silk	5.5 mm.	Anterior synechia	Edematous sl. cloudy
344 O.S.	6	7	22 days	3 hrs. in saline at +2° C.	fibrin and silk	4.5 mm.	Suture too tight, graft surface hazy, showing marks of suture	Opaque
351 O.S.	7	8a 8b	1 month	½ hr. in saline at room temperature	fibrin	5 mm.	Anterior synechia	Opaque
325 O.D.	8	9a 9b	1 month 25 days	Graft removed and replaced in situ	fibrin	5.5 mm.	Graft not well fixed iris prolapsed	Opaque Edematous
395 O.D.	9	10a 10b	2½ months	From freshly enucleated eyeball	fibrin	4.75 mm.	Graft put upside down during operation, lost, lens protruded	Opaque
361 O.S.	10	11a 11b	3 months 2 days	2 hrs. in moist chamber at +2° C.	fibrin	4.5 mm.	Graft lost, corneal tissue shrank, narrowing the gap	Opaque
310 O.D.	11	12	2 months 21 days	Formalinized	silk	5 mm. sq.	Anterior synechia formed, marked inflammation, cornea ectatic	Opaque
23 O.D.	12	13	16 days	Frozen and dehydrated	silk	4.75 mm.	Severe iritis, graft edematous, vascularized	Opaque
30 O.S.	13	14	26 days	Frozen and dehydrated	silk	5 mm.	Graft healed with anterior synechia	Opaque
21 O.D.	14	15	1 month 11 days	Frozen and dehydrated	silk	5 mm.	Disc healed with anterior synechia, opaque on 7th day	Opaque
26 O.D.	15	16a 16b	6 months	Frozen and dehydrated	silk	4.75 mm.	Iris prolapse, graft at first edematous	Opaque

man's membrane is very poorly developed and some authors state that it is entirely absent.[10] Our studies tend to show that it is present, although in a very weakly developed form. We are led to this conclusion by the fact that a thin homogenous acellular layer can be seen underlying the epithelium, and that the epithelium peels off without great difficulty. However, in the rabbit this membrane is not a true membrane as it is in the human being.

Stroma. Shortly after transplantation a considerable amount of edema occurs in the stroma not only of the graft and host cornea but of the entire sclera as well. This edema is undoubtedly due to absorption of anterior-chamber fluid through the cut margins, and it subsides as the cut stroma becomes covered over with epithelial and endothelial cells. A considerable amount of early edema is still consistent with a perfectly transparent graft. The cornea also becomes markedly edematous in the presence of increased intraocular pressure, which usually results from exten-

TABLE 2

A TABULATED DESCRIPTION OF THE FIGURES

Fig.	Epithelium	Stroma	Descemet's Membrane	Endothelium	Iris Adhesions
1a 1b	Thickened, especially over junctions	Thinner than host with normal arrangement of lamellae	Y-shaped branch uniting with host's on one end, well preserved	Proliferated at junction, single layer elsewhere	None
2a 2b	Thinner over graft, thickened over junctions	Normal thickness structure loose, lamellae wavy	Only partly preserved no union with host	Intact	Pigment adhesion
3	Thin in middle, thicker near wound edges	Edematous, lamellae normal structure	Intact, wavy, fibrinous membrane behind, no union with host	Intact, partly proliferated	Pigment and anterior synechia
4a 4b 4c	Thin, peeled off toward edges; proliferated around central suture indentation; epithelial ingrowth into stroma at junction	Suture indentation in middle; edematous, lamellae wavy; fibroblastic repair	Partly preserved, reduced in thickness	Intact, partly proliferated at junction	Anterior synechia
5	Embedded suture between iris and cornea, showing giant cells and signs of fibrous encapsulation				Anterior synechia
6	Embedded suture in corneal stroma, showing same as above				Anterior synechia
7	Proliferated over wound edge, epithelial fold	Scar tissue. Cellular infiltration	Entirely absent	Intact	None
8a 8b	Variations in thickness	Anterior and posterior fibrous tissue layers with necrotic area in between	Well preserved, curled and embedded between fibrous layers	Intact, partly proliferated	Pigment adhesion
9a 9b	Totally lost	Totally cicatrized (edema of host cornea and sclera)	Entirely absent	Absent	Total anterior synechia
10a 10b	Intact, normal in thickness, darkly stained	Cicatrized with compact fibrous tissue	Absent	Absent	Synechia with fibrous syncytium
11a 11b	Cornified with variations in thickness	Irregular compact scar tissue	Partly preserved	Absent	Synechia with granulation tissue formation
12	Vacuolated and partly lost	Vascularized, infiltrated, edematous and scarred	Absent	Absent	Total anterior synechia with pigment proliferation
13	Absen	Partly organized fibrinous mass	Curled, pushed onto anterior surface	Absent	Iris adhesions at junctions
14	Uneven and irregular	Anterior and posterior fibrous tissue layers with necrotic area in between	Well preserved, curled and embedded between fibrous layers	Intact	None
15	Uneven and irregular	Anterior and posterior fibrous tissue layers with necrotic area in between	Well preserved, curled and embedded between fibrous layers	Intact	None
16a 16b	Uneven and irregular	Anterior and posterior fibrous tissue layers	Well preserved, curled and embedded between fibrous layers	Intact	None

sive anterior synechias. It is interesting to note in this connection that the sclera also becomes markedly edematous.

As is well known, the parallel arrangement of corneal lamellae is essential to transparency, and a pathologic process that interferes with this arrangement will impair transparency. Cellular infiltration due to infection, vascularization, increased intraocular pressure, and synechias, will all prejudice the transparency of the graft. If the graft tissue is unacceptable to the host, the stroma will be replaced by fibrous tissue, which will not have the regular parallel arrangement. This fibrous tissue tends to form beneath the epithelium and in front of the endothelium.

The reaction of the stroma to suture material is illustrated and consists of partial encapsulation with giant cells and the ingrowth of connective-tissue cells.

At the margin of the graft, keratoblasts grow in to heal the graft in position and these tend to form a parallel arrangement, so

that histologically the line of demarcation is hard to see in perfectly transparent grafts. Fibroblasts or keratoblasts are found at the junction long after the wound has apparently healed.

Synechias have a deleterious effect on the graft. If complete, they cause secondary glaucoma; if incomplete, they leave pigment deposits in the healing margin of the graft. They also serve as the origin for vascularization and scar-tissue formation. In marked cases they form the basis for granulation tissue.

Descemet's membrane. This membrane is well developed in rabbits and has a tendency to be regenerated, presumably by the endothelium. In the case of a perfectly fitting graft, Descemet's membrane can heal end to end, otherwise it tends to have several brush-like or Y-shaped extensions. In the grafts that degenerate or are replaced by fibrous tissue, Descemet's membrane can be seen usually in coiled or wrinkled state and is the last structure to be absorbed.

Endothelium. This layer covers the internal surface in all instances and is probably derived from the host. We have no definite knowledge as to the fate of the endothelium of the graft except that injury to the endothelium will increase the amount of postoperative edema. In some instances, the endothelial proliferation produces cystlike formations.

General discussion

We have learned several important factors in corneal transplantation from our study and we are able to infer others. In order for a corneal graft to remain clear and heal properly, it must be obtained from fresh viable cornea of the same species. The occasional reports that clear grafts have been obtained from transplantations of variously preserved corneas or from other species of animals are probably the result of laying down of fibrous tissue by the host cornea in parallel arrangement during the healing process. The epithelium and probably the endothelium are replaced in the graft by the appropriate cell layers from the host. The healing that takes place at the stromal level involves the ingrowth of a great number of fibroblasts or keratoblasts from the host. We are not sure as to the fate of the stroma cells in the central part of the graft. But in view of the fact that bodily tissue cells are normally replaced from time to time in the course of their metabolism, we believe that this also occurs in the cornea and that, over a period of years, the stromal cells replace the donor cells so that eventually the host takes over. However, the graft must be performed under such circumstances that it is surrounded by a sufficient number of normal corneal cells, and the transplanted cornea must be sufficiently viable so that a large proportion of its structure does not need to be replaced rapidly. When rapid replacement occurs the resultant membrane is translucent or opaque and often blood vessels find their way through the surrounding cornea to the site of the graft. Thus, our frozen and dehydrated grafts were sufficiently acceptable to remain in place and allow rapid replacement, but the latter process rendered the grafts opaque.

Anterior synechias are very prejudicial to the success of the graft. They form the basis for vascularization, fibrosis, glaucoma, and iridocyclitis. Uveitis is very much more prone to occur in human grafts, where the eye is not normal to begin with, than it is in the rabbit. Anterior synechias can be avoided by careful coaptation of the wound margins and through thorough dilatation of the pupil.

We really do not agree entirely with either extreme point of view as to the biologic process taking place in corneal transplantation. From the preceding discussion, it can be seen that our views agree in part with each. It is not necessary to regard one theory as completely exclusive of the other.

SUMMARY AND CONCLUSIONS

The literature on the histology of corneal transplantation, both human and experimental, is summarized, together with a discussion of the evidence in favor of true healing versus replacement of the graft.

Our experimental studies are presented, with sections showing normal healing as well as operative complications. Since corneal tissue is unique in its properties of transplantability, considerable emphasis is placed on this phase.

The authors believe that, in successful cases, the cellular elements of the transplant are replaced by the host, and that the intercellular structures of the graft are accepted and persist.

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EFFECTS OF PRACTICE AND THE CONSISTENCY OF REPEATED MEASUREMENTS OF ACCOMMODATION AND VERGENCE*

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INTRODUCTION

This laboratory has been interested for some time in the problem of standardization and methodologic evaluation of physiologic procedures and measurements.[1] The knowledge of their variability is essential for the interpretation of the significance of experimentally induced changes. In the clinical practice, the knowledge of the magnitude of "chance" variations in repeated measurements is important from the point of view of the confidence with which we can appraise the presence or absence of functional abnormalities in patients, trends of deterioration or of spontaneous improvement, and the effects of therapy.

Appropriate statistical methods of analysis of the repeatability of the measurements were developed (see Appendix) and analyses of several physiologic functions and biochemical characteristics were made.[2-5] In a recent series of investigations on visual fatigue, several routine ophthalmic methods were used together with other visual tests, the measurements being made before and after the completion of strenuous visual work. The values taken before the start of the work period are suitable for an analysis of the variability of measurements obtained on normal subjects in repeated determinations under well-defined, standard conditions.

In this paper we shall deal only with the ophthalmic tests of accommodation and motor function. There is very little information on the effect of repeated administration of these tests and of the repeatability (consistency) of the scores. This is rather surprising, for one would expect that variations of a method which is used in clinical routine would be known. Obviously, the variability of measurements in normal subjects is important for the interpretation of changes in patients, particularly in the consideration of borderline cases.

METHODS

Measurements were made of accommodation and vergence. Current clinical methods were used.

The accommodation near point was determined by the Prince rule, manufactured by the American Optical Company. The rule was supported on the infraorbital bony rim. The subject was asked to fixate a short line of letters, 0.031 inches in height; at 14 inches the height of these letters corresponds to the size of symbols at the "14/21" line in tests of the acuity for near vision. The letters were printed on dull-white cards, placed in a metal carrier which slides along the rule. The illumination at the level of the card was about 5 foot-candles, about one half of the value recommended by Berens and Zuckerman;[6] the illumination was constant throughout the whole experimental series. The card was brought toward the eye from the range of clear vision to the point at which the letters started to become blurred, and the reading was recorded. Three consecutive measurements were made using the dominant eye; the score is the average of the three determinations and indicates the accommodation near point, in centimeters. The true accommodation near point should be determined as the distance from the anterior focus of the eye, located about 14 mm. in front of the cornea, to the

* This work has been supported in part by a grant from the Verd-A-Ray Corporation, Toledo, Ohio. From the Laboratory of Physiological Hygiene, University of Minnesota.

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point of blurring. The correction is essential when the power of accommodation is expressed in terms of diopters; to compute the latter, the reading (in cm.) obtained on the rule is corrected for the distance of the anterior focal point from the cornea and divided into 100.

The convergence near point was also obtained by the Prince rule, this time held against the bridge of the nose, in midplane. A white circular target, 2 mm. in diameter, taken from a Berens perimetry set, was brought in from the distance of clear vision to the point of binocular diplopia. The distance, in millimeters, from the bridge of the nose to the point at which the break in fixation occurred, served as a score. Three consecutive readings were made and averaged.

Values for abduction (prism divergence), adduction (prism convergence), and positive vertical divergence (prism supravergence) were obtained by the Risley rotating prism, held in front of one eye, while the subject was fixating with both eyes a spot of light six meters distant. The prism strength was increased until the "breaking point" was reached at which the light spot was seen double. A strain was imposed in the direction of abduction, adduction, and positive vertical divergence. The instrument readings were recorded in prism diopters. Each measurement was obtained in triplicate; the score is the average of the three successive determinations.

Subjects

The subjects were six men in the age group of 20 to 30 years, who had served in the laboratory for the year preceding the visual research as full-time experimental subjects in nutritional investigations. They were physically normal, intelligent, and coöperative, with no significant ophthalmic defects, well accustomed and adjusted to the routine of laboratory work and testing.

The visual characteristics (table 1) were well within the normal range, except for the accommodation near point.

TABLE 1

Characterization of the group at the start of the experimental work

Function	Subject Number						Mean	Standard Deviation	Normal Average	Normal Range	Desirable Values
	1	2	3	4	5	6					
Abduction, in diopters	4.3	8.0	5.7	10.0	5.3	5.3	6.43	2.14	6	3 to 8	High
Adduction, in diopters	7.7	5.3	15.7	18.3	16.3	10.0	12.22	5.28	12	(6 to 16)	High
Vertical divergence, in diopters	2.7	2.8	2.7	3.0	2.0	2.3	2.58	0.37	2.5		High
Accommodation near point, in diopters	6.9	6.8	8.4	9.3	6.8	9.9	8.02	1.39	(10.5)	(8.3 to 12.6)	High
Convergence near point, in centimeters	7.7	6.7	4.8	6.3	2.0	6.2	5.62	2.00	6.4	up to 8.0	Low

N =6 subjects, average age 23 years; range, 22 to 25 years. The "normal" values were obtained directly or by interpolation from Berens.[6]

The average accommodation value for the group is eight diopters which is near the subnormal range for the age group. In Duane's table the average-normal value of accommodation for 23 years of age is 10.5D., with the normal-minimum at 8.3D. Following Berens's statement that accommodation may be considered normal if it is not more than 3D. below the mean for the subject's age,[6] we arrive at 7.5 D. as the lower limit of normality.

The value is affected by a number of factors, environmental (illumination intensity on the test object), technical (speed at which the test object approaches the eyes), and subjective (criterion of blurring). The somewhat lower illumination level and the fact that the subjects were encouraged to report the very first sign of blurring may well be the major reasons for the low accommodation values in subjects whose ocu-

lar equipment was clinically considered as a "good normal."

Effects of practice

In a number of variables used in testing different aspects of "fitness" in man the repeated performance leads to an improvement in the test scores. Such an improvement represents an effect of "practice." Practice consists of small modifications in the "work method" of the subject and, in tests involving discrimination, a change in the sensory criterion of identity or difference. Practice does not necessarily bring about an "improvement" in performance but simply a change in the score, not related to any organic, physiologic, or structural alterations. Practice should not be confused with "training" in which a true increase in the functional capacity takes place.

The factor of practice, when present to a significant degree, considerably complicates the experimental design in which provision has to be made for an adequate and sometimes prolonged practice period. The test scores have to be brought up to a relatively stable practice plateau before the start of the experiment proper or other measures of control must be provided. In patients, the practice effects may produce an erroneous impression of improvement.

What is the effect of practice on the ophthalmic tests described above? The tests were administered before and after two hours of strenuous visual work, in a series of 18 testing sessions, with three testing days per week. The effects of practice on the prework test scores will be studied by comparing the means of Trials 1 through 3 with the mean of Trials 4 through 6, and 16 through 18. The individual scores obtained in the testing sessions compared will be considered as paired variates, Y′ and Y″.

TABLE 2

Average scores of the first, second, and sixth set of three successive testing sessions; the mean differences ($\bar{d}$); and the F tests of their statistical significance

Function	Means			Differences		F-tests	
	1st Set	2nd Set	6th Set	2nd vs. 1st	6th vs. 1st	2nd vs. 1st	6th vs. 1st
Abduction, in diopters	5.81	5.40	5.02	−0.41	−0.79	0.70	2.86
Adduction, in diopters	14.96	15.60	12.55	+0.64	−2.31	0.21	2.34
Vertical divergence, in diopters	2.68	2.70	2.50	+0.02	−0.18	0.04	1.33
Accommodation near point, in diopters	7.94	8.14	7.93	+0.20	−0.01	0.58	0.00
Convergence near point, in centimeters	5.43	4.51	3.75	−0.92	−1.68	8.10*	17.35**

For 1 and (18−1)=17 degrees of freedom, the value of the F ratio at the 5% level of significance is 4.45, at the 1% level it is 8.40. The level of significance has been indicated by one and two asterisks, repectively.

With six subjects, each tested on three days in each series, we have 18 values of d, defined as the difference between the paired values, $d = Y'' - Y'$. The F-test of the statistical significance of the mean difference, d, can be expressed in a simple form:

$$F = \frac{(\sum d)^2/n}{\frac{\sum d^2 - (\sum d)^2/n}{n-1}}$$

where n is the number of differences.

The mean differences—that is, the differences between the average scores obtained in the three sets of testing sessions—and the F test of their statistical significance are given in Table 2.

All changes accompanying repeated administrations of the tests are slight and have no statistical significance except for the change of the convergence near point

which shows a significant improvement on 4th, 5th, and 6th testing; this trend is even more marked in the 16th, 17th, and 18th testing session.

Consistency of repeated measurements

When a test has been repeated under standard conditions on a group of n individuals, I, in a series of k testing trials, D, the consistency of the measurements can be characterized in terms of:

1. The amount of the *intraindividual variation,* measured as $S.D._{wI}$, the average *standard deviation* of the scores *within individuals.* It should be noted that the use of $S.D._{wI}$ for characterizations of the repeatability of a measurement is legitimate only when the mean scores of a group of subjects, tested in a series of repeated testing trials, do not show a systematic trend.

2. The magnitude of the *random variation,* expressed either in the form of the *standard deviation* of the *random* components of the scores, $S.D._R$, or of a *consistency* coefficient, r_C. Neither the $S.D._R$ nor the r_C are affected by the changes in the trial means of the group as a whole.

The derivation of these concepts and the computational formulas are given in the Appendix.

The two types of criteria of consistency, the $S.D._{wI}$ and the $S.D._R$ on the one hand, and the consistency coefficient, r_C, on the other hand, have each some advantages and some limitations.

The concept of intraindividual variation may be readily understood and the term $S.D._{wI}$ indicates the magnitude of the variation in the repeated measurements directly, in terms of the units used in the test. However, the $S.D._{wI}$ values are, as a rule, not commensurable from test to test and do not yield a criterion in terms of which the consistency of different tests could be compared. The evaluation of a given absolute value of $S.D._{wI}$ as a criterion of consistency remains, therefore, impressionistic and the validity of the judgment depends on the breadth of clinical and research experience of the experimenter who is making such a judgment. He actually compares the obtained value with an impression obtained from measuring a large number of subjects and evaluates the given magnitude of the "error of measurement" in reference to the range of "normal" variation or to the differences between "normal" subjects and patients.

The use of the standard deviation of the random components of the scores, $S.D._R$, is subject to similar limitations. It is not a value in terms of which different tests can be directly compared. It becomes much more useful when related to the amount of interindividual variation, measured as the "variance within days" (Appendix, Formula 7).

From this is a short step to the second type of a criterion of consistency, r_C; this modified coefficient of intraclass correlation is an index which may be used directly for comparison of different tests and is closely related to the ordinary product-moment coefficient of correlation computed when only two repeated trials are available. The term r_C depends on two factors (Appendix, Formula 8): (1) the variation between individuals (reflected in V_{wD}) and the random variation (indicated by V_R). In the present experiment, efforts were made in advance to secure a highly homogeneous group of "normal" subjects. Thus the variation between individuals has been decreased and the obtained r_C values are underestimates of the consistency which could be expected in a relatively unselected group of subjects, particularly if patients would be included in the sample.

For the purpose of evaluating the consistency of the battery of ophthalmic measurements on repetition we shall use a set of data obtained in the third series of testing sessions, each series consisting of six trials. At this time the technique of the experimenters and the manner of response of the subjects can be considered as ideally stabilized, and the analysis should be expected

TABLE 3

MEASUREMENTS OBTAINED ON REPETITION IN SIX TESTING SESSIONS IN TRAINED SUBJECTS

A. ACCOMMODATION NEAR POINT, IN DIOPTERS

Subjects								$\bar{Y}_I$
	H	6.6	7.8	6.3	7.4	7.6	7.5	7.2
	R	7.9	7.9	7.9	8.5	9.0	8.6	8.3
	O	8.6	9.0	9.2	7.9	11.0	9.6	9.2
	P	7.4	7.4	6.9	7.2	7.6	7.4	7.3
	B	7.4	7.9	6.8	6.8	7.6	7.4	7.3
	V	9.0	7.9	7.6	7.5	9.0	7.2	8.0
	$\bar{Y}_D$	7.8	8.0	7.4	7.5	8.6	7.9	

B. CONVERGENCE NEAR POINT, IN CENTIMETERS

Subjects								$\bar{Y}_I$
	H	5.5	5.0	5.2	5.8	5.5	4.5	5.2
	R	5.0	4.0	3.5	3.7	4.7	3.5	4.1
	O	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	P	7.5	5.7	5.5	5.0	5.0	3.3	5.3
	B	3.8	3.5	3.0	3.3	3.5	3.0	3.4
	V	4.5	4.0	3.7	2.8	5.5	2.5	3.8
	$\bar{Y}_D$	4.7	4.0	3.8	3.8	4.4	3.1	

C. ABDUCTION, IN DIOPTERS

Subjects								$\bar{Y}_I$
	H	3.0	3.3	4.3	3.0	3.0	3.3	3.3
	R	5.0	5.3	8.0	6.7	5.0	6.3	6.0
	O	5.0	4.3	5.3	6.3	6.0	7.0	5.6
	P	5.3	5.7	6.7	5.3	4.7	6.0	5.6
	B	4.0	5.3	5.3	4.0	5.0	5.3	4.8
	V	4.0	5.0	3.7	6.0	3.0	4.3	4.3
	$\bar{Y}_D$	4.4	4.8	5.6	5.2	4.4	5.4	

D. ADDUCTION, IN DIOPTERS

Subjects								$\bar{Y}_I$
	H	4.7	5.3	7.0	5.3	4.0	6.0	5.4
	R	9.0	9.7	9.0	9.7	7.3	7.3	8.7
	O	20.7	30.0	30.0	20.3	14.7	30.0	24.3
	P	9.3	19.0	14.7	19.7	11.3	14.3	14.7
	B	15.3	14.0	14.0	11.7	15.3	15.7	14.3
	V	10.0	17.0	12.7	12.7	10.0	12.3	12.4
	$\bar{Y}_D$	11.5	15.8	14.6	13.2	10.4	14.3	

E. POSITIVE VERTICAL DIVERGENCE

Subjects								$\bar{Y}_I$
	H	2.0	2.0	2.0	2.0	2.2	2.0	2.0
	R	2.3	2.0	2.5	2.0	2.3	2.5	2.3
	O	2.5	2.8	3.0	2.5	3.0	2.8	2.8
	P	3.0	3.0	3.0	3.5	2.5	3.0	3.0
	B	2.0	2.0	3.0	2.0	2.5	2.3	2.3
	V	2.0	2.2	2.8	2.5	2.5	3.0	2.5
	$\bar{Y}_D$	2.3	2.3	2.7	2.4	2.5	2.6	

to yield the highest measure of consistency obtainable under standard conditions of over-all physical fitness, nutritional status, activity, and illumination. The interval between test sessions was 2 to 3 days. The original data are given in Table 3, A to E. Variances basic to the evaluation of consistency of repeated measurements are presented in Table 4, the consistency criteria in Table 5.

In terms of $S.D._{wI}$, the tests on repetition appear to yield values of acceptable consistency; that is, the intraindividual variability is relatively small as compared to the extent of the normal range and, more importantly, to the differences between normals and patients. Sometimes efforts are made to provide a criterion suitable for comparing the consistency of different tests by expressing $S.D._{wI}$ as percentage of the grand mean of the n.k scores. This is a hazardous procedure and the figures in Table

TABLE 4

VARIANCES BASIC TO EVALUATION OF CONSISTENCY OF REPEATED MEASUREMENTS

Function	V_{wI}	V_R	V_{wD}
Abduction	0.77	0.63	1.57
Adduction	11.90	9.40	49.60
Vertical divergence	0.08	0.07	0.18
Accommodation near point	0.42	0.30	1.25
Convergence near point	0.60	0.40	1.90

V_{wI} = variance between daily scores within individuals; V_R = random variance; V_{wD} = variance between individual scores within days.

SUMMARY

1. Measurements of ocular accommodation and vergence were made in six subjects under standard conditions.

2. The measurements were repeated at intervals of 2 to 3 days in a series of 18 testing sessions.

3. Two preliminary trials were sufficient in the majority of the routine ophthalmic tests used to stabilize the scores at a plateau.

4. The measurements provide reasonably

TABLE 5

CONSISTENCY OF REPEATED MEASUREMENTS. ABSOLUTE VALUES OF $S.D._{wI}$ AS AN INDEX OF DAY-TO-DAY VARIABILITY; $S.D._{wI}$ EXPRESSED AS PERCENTAGE OF THE MEAN ($\bar{Y}$); AND r_C, THE COEFFICIENT OF CONSISTENCY

Function	Mean ($\bar{Y}$)	$S.D._{wI}$	$\frac{S.D._{wI} \times 100}{\bar{Y}}$	r_C
Abduction	4.96 D.	0.88 D.	17.8%	0.60
Adduction	13.30 D.	3.45 D.	25.9%	0.81
Vertical divergence	2.48 D.	0.28 D.	11.3%	0.61
Accommodation near point	7.90 D.	0.65 D.	8.2%	0.76
Convergence near point	3.97 mm.	0.78 mm.	19.6%	0.79

3 should be accepted with reservation and interpreted with caution.

The r_C values vary from 0.60 to 0.81; in a reasonably heterogeneous group of subjects, values of r_C below 0.70 would be regarded as indicating a low consistency of the scores on repeated testing, $0.71 \leqq r_C \leqq 0.80$ would be interpreted as an index of moderately high consistency. Thus in the present test battery only the measurements of adduction, accommodation near point, and convergence near point appear to have the desired degree of reliability on repeated testing. However, it should be realized that the interindividual variability in our group was small; the r_C values are spuriously low. For a definite judgement as to the consistency of these tests similar investigations should be carried out on larger samples and on clinical material.

constant characteristics of the individual subjects.

STATISTICAL APPENDIX

The day-to-day variation in the scores of a group of n individuals tested on k days can be expressed as the average *standard deviation of the scores within individuals:*

$$(1) \qquad S.D._{wI} = \sqrt{\frac{\sum_{1}^{n} \frac{\sum_{1}^{k} (Y_I - \bar{Y}_I)^2}{k-1}}{n}}$$

We obtain the variances of the scores of each individual,

$$\frac{\sum_{1}^{k} (Y_I - \bar{Y}_I)^2}{k-1},$$

where Y_I is a score of an individual, I, on

a given trial, $\bar{Y}_I$ the mean of his scores on the k trials, D; we sum the intraindividual variances for all n individuals, average for an individual by dividing the numerator through n, and take the square root.*

Under certain conditions there may be present a continuous trend in the average scores obtained by a group of subjects in successive trials, resulting from a continued practice. In other situations, there may be significant shifts in the level of the mean score resulting from factors which affect the group as a whole; for example, change in environmental illumination. In such cases the value $S.D._{wI}$ will be large and would yield an underestimate of the reliability of the given test method.

The effect of "trend," both continuous and reflected in the shifts of the group means, is removed when we use the second criterion of consistency of repeated measurement, the random variance, V_R. If $\bar{Y}_I$ = mean of the k scores for a given individual, $\bar{Y}_D$ = mean of the n scores for a given day (or trial), $\bar{Y}$ = the grand mean of the n.k scores, then the *expected value* ($\hat{Y}$) of the score for a given individual and day will be obtained as follows:[7]

$$(2) \qquad Y=\bar{Y}+(\bar{Y}_I-\bar{Y})+(\bar{Y}_D-\bar{Y})$$

The grand mean, ($\bar{Y}$), indicating the general level of the scores, is adjusted for the average level of the scores of the given individual by adding the component ($\bar{Y}_I - \bar{Y}$) and for the average level of the scores on a given day by adding the component ($\bar{Y}_D - \bar{Y}$).

The actual score (Y) may then be regarded as a sum of the expected score ($\hat{Y}$) and a random component (R):

$$(3) \qquad Y=\hat{Y}+R$$

Therefore,

$$(4) \qquad R=Y-\hat{Y}$$

Substituting for Y from Equation 2 we obtain:

$$(4a) \qquad R=Y-[\bar{Y}+(\bar{Y}_I-\bar{Y})+(\bar{Y}_D-\bar{Y})]$$

After removing the brackets

$$(4b) \qquad R=Y-\bar{Y}-(\bar{Y}_I-\bar{Y})-(\bar{Y}_D-\bar{Y})$$

In a table of n.k scores, there are (n-1) (k-1) independent estimates of R, as both the individual and trial means were used in computing the R values; (k-1) (n-1) is the number of the "degrees of freedom" which will be used as denominator in computing V_R.

The *random variance* is then defined as:

$$(5) \qquad V_R=\frac{\sum_1^{nk} R^2}{(n-1)\,(k-1)}$$

$$(5a) \qquad V_R=\frac{\sum_1^{nk} [Y-\bar{Y}-(\bar{Y}_I-\bar{Y})-(\bar{Y}_D-\bar{Y})]^2}{(n-1)\,(k-1)}$$

In order to evaluate the magnitude of V_R we compare it with the differences between individuals. Ideally we should like to use the variance (= standard deviation squared) of the scores in a large, representative sample of individuals for whom the test will be used. Such a variance value is a stable characteristic of each test and would provide a criterion in terms of which different tests could be legitimately compared. Unfortunately this datum is known only for a very few physiologic functions.

Our best substitute is the value V_{wD}, the *"within days" variance,* which represents the interindividual variance obtained for each day (or trial) and averaged:

$$(6) \qquad V_{wD}=\frac{\sum_1^{k} \frac{\sum_1^{n}(Y_D-\bar{Y}_D)^2}{n-1}}{k}$$

We obtain the variances of the scores on each of the k days,

$$\frac{\sum_1^{n} (Y_D-\bar{Y}_D)^2}{n-1},$$

* In this and other cases the standard deviation is obtained as the square root of the sample variance, thus $S.D._{wI}=\sqrt{V_{wI}}$ and $S.D._R=\sqrt{V_R}$.

where Y_D is an individual score on a given day, $\overline{Y}_D$ the mean of the scores of the n individuals measured on that day; sum for all k trials, and average for a trial by dividing by k.

In evaluating the magnitude of the random variance, V_R, we may express it as the percentage of V_{wD}

$$V_R\% = \frac{V_R}{V_{wD}} \times 100 \tag{7}$$

Also we may express it in a form of a consistency coefficient

$$r_C = 1 - \frac{V_R}{V_{wD}} \tag{8}$$

Equation 8 may be written also as

$$r_C = \frac{V_{wD} - V_R}{V_{wD}} \tag{8a}$$

It is evident that when $V_R = O$, $r_C = 1.0$; the closer V_R approaches the value of V_{wD}, the closer r_C approaches zero.

For a rapid computation of the values needed for the characterization of the reliability of a test we may apply formulas which use the scores directly, without computing the deviations from the grand mean. The formulas 1, 6, and 8 may be written as follows:

$$S.D._{wI} = \sqrt{\frac{\sum_1^{nk}(Y^2) - \frac{\sum_1^{n}(T_I^2)}{k}}{n(k-1)}} \tag{9}$$

$$V_{wD} = \frac{\sum_1^{nk}(Y^2) - \frac{\sum_1^{k}(T_D^2)}{n}}{k(n-1)} \tag{10}$$

$$V_R = \frac{\sum_1^{nk}(Y^2) - \frac{\sum_1^{n}(T_I^2)}{k} - \frac{\sum_1^{k}(T_D^2)}{n} + \frac{(GT^2)}{nk}}{(n-1)\quad\quad(k-1)} \tag{11}$$

where Y = any score, n = number of individuals, k = number of days (trials), $T_I = \sum_1^k Y_I$ = total for an individual, $T_D = \sum_1^n Y_D$ = total for a day, $GT = \sum_1^{nk} Y$ = grand total.

Stadium South Tower (14).

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NOTES ON THE HISTORY OF OPHTHALMOLOGY IN CANADA*

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Colonial medical history

A glimpse into the early medical history of Canada is, I think, important before entering into the history of ophthalmology which did not exist as a specialty until many years later. According to Freedman,[1] in a recent paper on "The History of Medical Licensure in Canada," the early medical practice in Canada, under the French régime, was influenced by the medical practice in France, where all trades were controlled by guilds and membership in a guild was a certificate of competency. Surgery was controlled by the barber surgeons. They did traumatic surgery but most of their work consisted of blood-letting, and of opening boils and abscesses. Medicine was practiced by physicians who were graduates of medical schools and were licensed by examination.

A few surgeons came to Canada with the French military forces. Colonists had to be induced to come to Canada, and one of the promises in this inducement was that, if a man came to Canada and followed a trade for 6 or 8 years, he would, on his return to France, be admitted into the guild of the trade or profession he had followed. This resulted in many colonists taking up surgery and the number of charlatans and quacks soon exceeded the number of qualified men. To overcome this deplorable state, the Intendant Bigot, in 1750, passed the first piece of medical legislation in Canada.

The bill enumerated the harmful acts of the charlatans and strangers of unknown ability. Such persons were forbidden to practice under the penalty of a fine with forfeiture of their drugs and instruments, and those who wished to practice medicine were obliged to pass an examination before a representative of the Intendant and the King's Surgeon.

Early medical education

Thirteen years later New France fell to the British and at first, under British rule, there was no control of practice, so that conditions reverted to the old order.

In 1788, however, a medical act was passed in an attempt to relieve chaos in the practice of medicine. This act forbade the practice of unlicensed practitioners under a penalty of 20-pounds fine for the first offense; 50 pounds for the second offense, and 100 pounds and three months in prison for subsequent offenses.

The prerequisites to the study of medicine were examinations in the mother tongue and in Latin. Medical education required a certificate from a recognized university or a five-year apprenticeship with a practicing physician in the province.

Canada was divided into Lower and Upper Canada in 1791. The first legislation affecting the Province of Quebec alone was in 1831, and it is interesting that this act provided for penalties against American practitioners who crossed the border into Canada to see patients.

In 1823, the Montreal Medical Institution was formed by a group of men who taught students in the wards of the Montreal General Hospital, which had opened four years previously. Then, in 1829, the Montreal Medical Institution became the Medical Faculty of McGill University, the first university medical faculty in Canada.

Howard, first ophthalmologist in Canada

It was not until many years later that

* Read at the Centennial Meeting of the Section of Ophthalmology, New York Academy of Medicine, New York, March 17, 1947.

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ophthalmology was practiced as a specialty in Canada, and the first man to limit his practice to it was Henry Howard, M.D., M.R.C.S., London. He was born at Nenagh, Tipperary, Ireland, December 1, 1815, where he was educated.

Dr. Howard studied his profession in Dublin, attending lectures in the College of Surgeons and the University of Trinity College. His early studies in Dublin were under the guidance of one of the most learned and successful European practitioners of ophthalmology—Arthur Jacob, professor of anatomy and physiology in the Royal College of Surgeons of Ireland, and one of the surgeons of the City of Dublin Hospital. Jacob made many contributions to medicine among which was *A Treatise on the Inflammations of the Eyeball,* published in 1849.

After practicing in Dublin and County of Leatrim for a time, Dr. Howard immigrated to Canada in 1841. For a short period he resided on Amherst Island, in Upper Canada, then at Kingston, and finally he took up residence in Montreal. Here, he was offered an opportunity for which he had always longed—to devote his whole time to eye and ear surgery.

Publishes textbook

In the preface to his book on *The Anatomy, Physiology, and Pathology of the Eye,* it is stated that he had for the past four years, as the surgeon to the Montreal Eye and Ear Institution, devoted his labors exclusively to the treatment of disease incident to these organs. This book, published in 1850, by Armour and Ramsay, Montreal, and John Churchill, London, was an octavo of 517 pages. It is a very good textbook for the time, and it is not simply a compilation of work done by previous authors but it also includes his own conclusions based on his studies and practical experience.

From the *Montreal Directory of 1847,* it was learned that the Institution for the Treatment of Diseases of the Eye and Ear, conducted by Surgeon Howard, M.D., and the Rev. W. A. Adamson, secretary and treasurer, was situated in the Hay Market. Subscribers of one pound per annum had the privilege of recommending poor patients to the institution. This institution was separate from Dr. Howard's house; but, in 1849, the address of the institution was 6 St. François Xavier Street, which was also his domicile. This address appears in the foreword of his book.

In 1861, he was appointed medical superintendent of a lunatic asylum at St. Johns, Quebec. The last year in which the Montreal Eye and Ear Institution was listed in the *Montreal Directory* was 1860, and Dr. Howard's name does not appear in the directory thereafter. This would conform to his appointment to the mental hospital.

From here on, as he left the field of ophthalmology, his later life does not concern us, except to mention that his tenure of office was a successful one. When confederation placed the insane under provincial management and the asylum at St. Johns was closed and the patients were moved to St. Jean de Dieu Asylum, near Montreal, Dr. Howard then became government inspector, a position which he held until his death in 1887.

Writings of Dr. Howard

Among many articles written by Dr. Howard was one on "On the Observations on the Curability of Opacities of the Cornea Treated by Prussic-Acid Vapor," a method of treatment suggested by a Dr. Bigger. He mentions six cases cured by this method. The article was published in the *British-American Medical and Surgical Journal, 1846-47.*

In the same journal, in the same year, there was a paper by Howard on "The Physiology of the Muscles of the Eye with Some New Views on Their Action." He emphasized in this paper that the inferior oblique and the superior oblique muscles are involuntary or reflective and that the rectus muscles are voluntary in their action. And in the same journal, same year, is an-

other paper by Dr. Howard on the "Physiology of the Fifth Pair of Nerves, But More Particularly the Ophthalmic Branch." He believed that the effect produced on the eye by belladonna was through its action on the fifth pair of nerves.

In 1850, he reported a case of traumatic cataract in which the lens was absorbed by the aqueous. Outside the subject of ophthalmology, in 1871, he published a pamphlet on a "Treatise on the Howard System of Ventilation." In this it is proposed to "expel foul air as fast as generated and admit pure air as fast without sensible draught on the person." The pamphlet contains 13 pages and at the end, under caution, is the warning that "any person found using one of Howard's expellers or ventilators without the patent stamp being on it would be prosecuted with the full rigor of the law. The prices can be learned from the maker on application." Dr. Howard was a highly esteemed member of the medical profession.

Early 19th century oculist

Perhaps the first well-trained oculist of his time to go to Upper Canada was Dr. Samuel John Stratford, M.R.C.S., London. He was a graduate of St. Georges and Westminster Hospitals in London, and was a pupil of William Charles Bell, and also of Dr. Guthrie at his infirmary. He wrote *A Manual of the Anatomy, Physiology and Diseases of the Eye and Its Appendages,* published in 1828, by Longman and others. It is a work of 190 pages, well written, and although it covers the diseases and their treatment, as well as the anatomy and physiology of the eye, optics and refraction are not included. He was commissioned assistant surgeon in the 72nd Regiment Scotch Highlanders but later he disposed of his commission and came to Canada, and for a time practiced in Bye-Town, now Ottawa, in 1831.

Later, Dr. Stratford moved to Woodstock, Upper Canada, where he remained for 20 years in general practice. In 1868, he went to New Zealand. There is no mention of restriction of his practice to diseases of the eye. He probably was influenced by his father, Dr. John Stratford, who was also an M.R.C.S., London, and who came to Canada in 1833. At Brockville, he issued the following professional card: "Dr. Stratford, Surgeon, Accoucher and Oculist; 30 years a member of the Royal College of Surgeons, London; 20 years in his Majesty's Military Service in that capacity, and many years in extensive private practice. Dr. Stratford has extended his practice to the diseases of females and children with more than ordinary success in their treatment."

Rosebrugh, Toronto ophthalmologist

According to Dr. P. J. F. Houston,[2] Abner M. Rosebrugh was the "Father of Ophthalmology" in Toronto, since he was the first to limit his practice to diseases of the eye and ear. Born in Branchton, in Upper Canada, in 1835, he studied at Rolfe's School of Medicine and started practice at Preston.

Since he had no special training, Dr. Rosebrugh studied first on animals and then decided to go into the specialty. He did postgraduate work in New York and London and started practicing in Toronto, in 1863. He endeavored to get the endorsement of the medical practitioners of the city but it was not unanimous. Nevertheless, his office was soon filled with special cases so that with the help of a few business men an Eye and Ear Hospital was opened on Adelaide Street, where he gave years of service to the poor of Toronto and the surrounding country.

Invents an ophthalmoscope

He was an ingenious man and invented among other things a demonstrating ophthalmoscope and a modification of it by means of which photographs of the fundus could be taken. This was in 1865, and a description of the instrument is included in his course of lectures delivered before the

ophthalmic class of the Toronto School of Medicine. These lectures were published in the *Canadian Medical Journal,* in 1866, under the headings of "The Optical Defects of the Eye and Their Treatment by the Scientific Use of Spectacles," and also "On the Ophthalmoscope." The lectures show that Dr. Rosebrugh had a good knowledge of optics but that refraction at that time consisted of prescribing spheres because he mentions that cylinders were prescribed for astigmatism but he himself had only seen one case of astigmatism.

Early teacher of ophthalmology

In 1867, Dr. Rosebrugh was joined in the practice by his brother-in-law, Dr. Richard Andrew Reeve, who became one of the most outstanding oculists in Canada. Dr. Reeve was born in Toronto, in 1842, was educated at Toronto University, and followed his medical studies at Queen's University, Kingston, being graduated in 1865. He was a demonstrator in anatomy the next year and in chemistry the following year. He then decided to practice ophthalmology and joined Dr. Rosebrugh at the Eye and Ear Infirmary in Toronto.

In 1872, he became ophthalmic and aural surgeon to the Toronto General Hospital, and, in 1887, he was appointed professor of ophthalmology and otology at the University of Toronto, retiring in 1915. He was made dean of the Faculty of Medicine in 1896, and held that position for 12 years. In 1906, he was president of the British Medical Association when that society met in Toronto.

Dr. Reeve was a leader, not alone in his special field but also in medical and university circles. The high regard in which he was held was not only because of his character and dignity but also because of his wide clinical knowledge. In addition to a series of papers and addresses, Dr. Reeve, by his lectures and clinics, did his share in the training of successive generations of medical students.

Dr. Reeve was succeeded in the chair of ophthalmology at Toronto University by Dr. James Metcalfe MacCallum, who held the chair until 1929. Dr. MacCallum in turn was succeeded by Dr. William Lowry and later by Dr. Walter Wright. Many other Toronto oculists contributed their share in the teaching of ophthalmology, and of these, perhaps Dr. George Herbert Burnham and Dr. George Stirling Ryerson should be especially mentioned.

Influence of Desjardins

The first well-trained ophthalmologist among our French-speaking confreres was Dr. Louis Edward Desjardins who was born in 1837, at Terrebonne, Quebec. He was graduated from L'Ecole de Médecine et de Chirurgie de Montréal, in 1864, and after practicing general medicine for seven years went to Europe to specialize in ophthalmology. He worked in London under Bowman and Critchett, and in Paris under de Wecker, Galezowski, de Sichel, and Meyer, and returned to Montreal in 1873. He founded the Nazareth Ophthalmic Institute where he practiced ophthalmology for over 30 years.

In history of Medical Faculty University of Montreal

In 1882, he was named professor of ophthalmology at L'Ecole de Médecine et de Chirurgie de Montréal, and oculist to the Hotel Dieu, where he lectured until his last illness. He played a very important role in the history of L'Ecole de Médecine et de Chirurgie de Montréal, which today is the Medical Faculty of the University of Montreal.

This school originated in 1843, ostensibly to meet the needs of the French-Canadian student public but undoubtedly also as a protest against what was then considered the monopoly of teaching privileges and of appointments at the Montreal General Hospital by those in authority at McGill University.

Its first teachers were all English-speaking. The legislature of the Province of Que-

bec passed an act under which lectures were to be given in French and English and authority was given for certificates to be awarded to its graduates to practice medicine. The latter privilege was cancelled two years later, in 1847, that is 100 years ago this year, on the incorporation of the College of Physicians and Surgeons of the Province of Quebec, which gave licenses only to those holding a university degree. In the emergency, an agreement was reached with McGill University under which all the lectures were to be given at L'Ecole de Médecine et de Chirurgie, in the French language only, and the students who completed this course at this school were to be admitted to the final year at McGill, which would entitle them to a degree from McGill University. This arrangement lasted until 1850.

The school then applied to Laval University in Quebec for affiliation, but this failed and, in 1867, it became affiliated with Victoria University of Cobourg, Ontario, a Protestant institution.

New troubles arose; so, in 1877, Laval University of Quebec came forward with new proposals backed by the Roman Catholic Church. This caused a break-up in the school; some students going to Laval and others continuing with L'Ecole.

During the years, a serious misunderstanding arose which threatened L'Ecole for it found itself barred by the church from attendance at the Hotel Dieu, which was deeply regretted by the nuns, and its members and students were excommunicated on the grounds of disobedience to authority and association with a Protestant university.

The painful situation was saved by the direct intervention of the Pope, before whom matters were laid by Dr. Desjardins in person, representing L'Ecole. He said, "I will go to Rome to obtain justice for L'Ecole even if I have to remain there."

Founds medical journals

Dr. Desjardins was one of the founders of *L'Union Médicale* and some years later of the *Gazette Médicale*. He published a certain number of scientific works on cataract, glaucoma, affections of the lids, and refraction, and he was interested in ocular research among the deaf mutes. He devoted his leisure to music. He was the "Father of Ophthalmology" in French-speaking Montreal.

Among his successors were several very able ophthalmologists, all of whom were trained in France, and all of whom included diseases of the ear, nose, and throat in their practice. Dr. A. A. Foucher,[3] who succeeded him at the University of Montreal and was chief of the department at the Notre Dame Hospital, published a textbook on *Maladies des Yeux et des Oreille,* in 1894. The part on the eye consists of 243 pages. Dr. Rudolfe Boulet and Dr. Albert LaSalle deserve special mention. They were charming men who served long and well, as did Dr. J. N. Roy, who is still living.

Buller, first modern ophthalmologist

Dr. Frank Buller was the first modern ophthalmologist to establish himself in Canada, and the following history of his life is taken from a biography written by Dr. W. Gordon M. Byers.[4]

Dr. Buller's father, who was a descendant of an old Devonshire family, immigrated to America in 1831, and Frank Buller was born near Cobourg, Ontario, in 1844. He was educated in a local school, except for three years when the family moved to Iowa, and at Peterborough, Ontario, where he attended a grammar school.

During the summer months he learned dispensing in the office of Dr. Burnham, a leading practitioner of his day. Dr. Buller was graduated from Rolfe's Medical School in Toronto, in 1868, and after a year of general practice in Michigan, he went to Europe for special work in connection with the eye and ear. He remained there for about seven years. He first went to von Graefe's clinic in Berlin, and although von Graefe died in 1870, Dr. Buller had been in contact with and was inspired by him. During the Franco-Prussian war, Dr. Buller

served as a volunteer assistant in a German military hospital, and at the expiration of the war he returned to Berlin where he worked under Virchow in general pathology, and in physiologic optics under Helmholtz.

House surgeon at Moorfields

In 1872, he went to London, and after passing his examination for membership in the Royal College of Surgeons, he was appointed a house surgeon at the Royal London Ophthalmic (Moorfields) Hospital. Here he was under Bowman, Critchett, and Hutchinson, and worked with Nettleship and Gunn. He had gained a mastery of the ophthalmoscope in Berlin, and from him his English confreres learned the full use of the direct method of examination. During his service here he introduced the protective shield since known as the "Buller's shield." He began practice in Montreal, in 1876. In doing so he was influenced by two Canadians whom he had learned to know in London, Dr. F. J. Sheperd and Dr. William Osler.

Friendship with Osler

It is interesting to know that Osler himself had intended going into eye work and to locate in Montreal. Cushing,[5] in his *Life of Osler,* quotes the correspondence between the dean of McGill medical faculty, Dr. R. Palmer Howard, and Osler. In this the dean informed Osler that there were three candidates in the field with better chances and he advised him to abandon the field of ophthalmology and to cultivate the whole field of medicine and surgery, paying special attention to practical physiology. Osler was disappointed at the blighting of his prospects as an ophthalmic surgeon but accepted the inevitable with good grace.

That there was no ill feeling between Osler and Buller over this incident is shown by the fact that they remained close friends. In fact, Osler had an office in Buller's house on his return to Montreal. One cannot even dare to speculate on what ophthalmology would have gained and general medicine would have lost had Osler's original hopes been realized. But to return to Buller.

Establishes ophthalmic clinic

He was given permission to establish an ophthalmic clinic at the Montreal General Hospital, where at that time the entire clinical teaching of the McGill Medical School was carried on. At first the older men were unwilling to relinquish their ophthalmic cases but, in a short time, Dr. Buller's superior training and knowledge settled the question.

In 1883, he was appointed to the first chair of ophthalmology at McGill University and, in 1895, he resigned his position at the Montreal General Hospital to take charge of the ophthalmic clinic at the new Royal Victoria Hospital, which post he held until his death in 1905.

Dr. Buller was the most outstanding man in our special field in Canada, and his practice extended from one end of the country to the other. He had a good working knowledge of French and a mastery of German so that he kept abreast with the literature on ophthalmology.

In spite of his busy practice he found time to make 76 contributions to the literature. Included in these papers are descriptions of a protective bandage for the eye, an improved trial frame, a double needle for discission of secondary cataract, a temporary ligation of the canaliculi to prevent wound infection in operation of the eye, a modification of the Mule's operation, and skin grafting in ophthalmic surgery.

Stirling succeeds Buller

Dr. Buller's successor to the chair of ophthalmology at McGill University and chief of the ophthalmic department of the Royal Victoria Hospital was Dr. John W. Stirling. Dr. Stirling was a native of Halifax, Nova Scotia, where he received his early education. He was graduated in medicine from the University of Edinburgh in 1884, and afterward was a pupil of Argyll-Robertson. He continued his studies in Vi-

enna, Berlin, and London, and returned to Canada, in 1887, and took up practice in Montreal.

Dr. Stirling was an excellent ophthalmologist, a good teacher, and made many useful contributions to ophthalmic literature. I personally owe much to him as he was my first teacher and chief in ophthalmology. Dr. Stirling was succeeded by Dr. W. Gordon M. Byers, who was followed by Dr. Fred T. Tooke, who in turn was succeeded by the late Dr. S. Hanford McKee, at the university; all three men were outstanding in our special field and all were known personally to many of the men here tonight.

Trachoma in Canada

While in this period of the history of ophthalmology in Canada, I should like to digress and to mention that the scarcity of trachoma in clinical and private practice has always impressed me. Trachoma was a fairly common ocular disease, chiefly at ports of entrance in Canada, about the middle of the 19th century.

Howard in his textbook, in 1850, states that he had cured upward of 200 cases in the previous four years. The disease declined until about 1898, when an organized movement to settle Jews in Canada, increased its incidence. Moreover, in 1897, the United States government declared trachoma to be a menacing disease and closed the Atlantic ports to trachomatous immigrants; but they left the Canadian border open and many cases found entrance to the United States in this way.

To overcome this, in 1901, the United States government kept a close watch on the Canadian border, resulting in a large number of trachoma cases being left in Canada. As a result, in 1902, the Canadian government amended its immigration act to exclude immigrants and visitors suffering from loathsome, dangerous, and infectious diseases. These regulations became increasingly effective until, in 1927, exclusion became absolute. Dr. Gordon Byers took a very active part in obtaining this legislation, and the above information is taken from a paper by him on trachoma.[6] Today, trachoma is an extremely rare disease in Canada, except among some Indian settlements in western Canada.

Training of new generation

I have, of necessity, chosen only a few of the men who played an important role in the development of our specialty in Canada. Many others deserve special mention and in a more comprehensive paper their names would be included.

It is quite apparent that the history of ophthalmology is no more than the history of the lives and accomplishments of the men who practiced it and of the institutions in which their work was done or to which they were attached.

As a general rule, those who have contributed most to the subject are the ones who have had the best preliminary training. In order that the men of the future will obtain good preliminary training, much responsibility is thrown upon the present generation of teachers and practitioners.

Teachers of undergraduate students in medicine should try to make the subject so attractive that many of the students will be impressed and decide upon ophthalmology as their vocation. If they decide early, they can concentrate their studies along these lines and avoid loss of the time spent in indecision. I think the day is past for men to enter the field of ophthalmology through general practice.

Preliminary to medical studies some knowledge of the classics, especially Latin, is essential, and a reading knowledge of at least two modern languages, perhaps French and German, and in the future even Russian or Spanish, is necessary for those who wish to go far in the subject.

Training facilities in Canada

The need for trained ophthalmologists is great, but at the present time such training is not available for all those who apply.

Our training facilities in Canada are

limited because of our small and scattered population. I think the best we can possibly do is to turn out 10 well-trained men each year and this has to be done at university centers.

Until the war, our university training had been limited to undergraduate work where the object was to graduate good general practitioners with a knowledge of diseases of the eye encountered in general practice. A few internes on eye services in hospitals throughout the country, whose duties were limited to eye work only, were carried along for one or perhaps two years and then they continued their training in other centers either in the United States or in Europe. During and since the war, these opportunities for training in centers outside of Canada no longer exist so that we have had, fortunately, to fall back on our own resources.

At McGill University we have started a four years' diploma course—one year of basic studies, two years of internship and one year of research, requiring a thesis. A similar course has just been started in the University of Toronto, where for the first time in Canada a half-time director of ophthalmology has been appointed. In our course at McGill University, the diploma student must spend at least two of his four years with us, the other two may be spent at some other recognized center. This is done to give the student a broader view in his training. I think this is a good plan and I should like to see it become more widespread so that there may be interchange of internes among the various training centers.

I should like particularly to thank Dr. W. W. Francis, librarian, Osler Library, McGill University, and Miss Edith Gordon, medical librarian, McGill University, for their assistance in obtaining much information.

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In his book *Diseases of the Eyeground,* Adalbert Fuchs describes a disease under the name of choroiditis proliferans. This rare disease is characterized by many newly formed strands of connective tissue lying on the inner surface of the choroid over which run retinal vessels. The retina itself is relatively uninvolved. The choroid shows some shifting of pigment. The strands of the connective tissue are characterized by a tendonlike shiny color and delicate stripes. Adalbert Fuchs considers these strands of connective tissue to be the result of exudates occurring chiefly in the choroid. This characteristic picture seems to develop especially after reattachment of a detached retina. Even after reattachment of an ordinary serous retinal detachment, delicate strands of connective tissue seem to form now and then on the inner surface of the choroid. Fuchs shows such strands in Figure 5 of Table 37, and describes it as follows:

"The detached retina of a woman of 20 had reattached after some time spontaneously and, as usual in such cases, the vision was very poor due to the long duration of the detachment. The patient could count fingers at 1½ meters. The area of the reattachment could be recognized clearly because of the sharp demarcation and one could see several thin, branching and very white strands of connective tissue which were lying beneath the retinal vessels. In this case, however, the picture was not dominated by the white stripes but by the pigmentary disturbances which always develop after reattachments."

Recently I saw a similar picture in a young man who was operated successfully for a detached retina.

CASE 1

A short distance from the postoperative scars which could be easily seen as partly black, partly white lesions, a white, straight, delicate strand of connective tissue extended downward from above. Apparently a deposit of fibrin had become organized here.

In rare cases the formation of subretinal strands is so widespread that it dominates the picture, just as the formation of preretinal strands dominates the picture of retinitis proliferans. Such a picture is shown by Adalbert Fuchs in Figure 7 of Table 25, and described as follows:

"A boy of 16, showing a positive Wassermann test, developed a bilateral impairment of vision three years ago. Both fundi presented approximately the same picture. The discs were somewhat pale, the retinal vessels narrow. In addition to some pigment atrophy in several places there were broad, shiny white strands of connective tissue underneath the retina partially encircling the disc and branching in many places with a fringelike ending. In some places these bands had the width of one disc diameter."

Fuchs assumed that choroiditis exudativa interna might precede the formation of this abundant connective-tissue formation. I have had a case in my department, which I am inclined to consider as such an instance of choroiditis proliferans:

CASE 2

History. A merchant, aged 27 years, noted, 10 years ago, failing vision in his right eye which could not be improved with glasses. There was a dustlike shadow before his eye. After three years, the vision became very poor and a Japanese oculist diagnosed a retinal detachment. The left eye was normal at that time, but later became just as poor as the right eye. Three years ago, an oculist diagnosed bilateral detachment of the

* From Tung-Chi University, Department of Ophthalmology, Dr. Chen Yen, Director. Translated by Dr. Arthur Koeppl, 4554 North Broadway, Chicago, Illinois.



Fig. 1 (Yen). In the right eye, there was a small cataracta polaris anterior. In both eyes, there were numerous shiny, white strands in the neighborhood of the discs and in the peripheries which were crossed by retinal vessels.

retina. The patient did not receive any treatment.

Findings. Wassermann blood test was negative. Right vision was hand movements at one meter; left vision, 1/60. Right visual fields showed remnants, temporal and above; left visual fields were grossly normal.

In the right eye, there was a small cataracta polaris anterior. In both eyes, there were tiny opacities in the vitreous. The fundus findings were similar in the two eyes (figs. 1 and 2). The borders of the discs were sharp and the color normal. The retinal vessels were normal. There were numerous shiny, white strands in the neighborhood of the discs and in the peripheries which were crossed by retinal vessels. These strands were fairly straight with an occasional kneelike curve. In some places the strands originated from a single round spot. In the left eye the connective tissue between macula and disc occupied a large area with a fringelike appearance temporally, while the sharp nasal edge partly encircled the disc.

Comment. As happens so often in China it was very difficult to get an exact history.

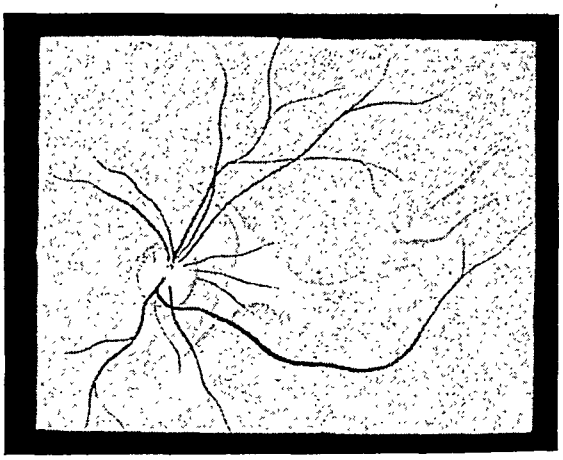


Fig. 2 (Yen). In the left eye, the connective tissue between macula and disc occupied a large area with a fringelike appearance temporally, while the sharp nasal edge partly encircled the disc.

Be that as it is, the result—a bilateral retinal detachment—was before us. The fundus, however, did not present the picture usually seen after reattachment of an ordinary serous detachment. There were no characteristic pigmentary disturbances and no sharp borders. This case was probably one of Harada's disease. This disease, extremely rare in Europe, is characterized by a bilateral detachment of the retina with iridocyclitis. After some time, when the retina reattaches again, the fundus appears depigmented and shows some isolated pigment proliferations. The vision usually improves. The condition is often associated with loss and graying of the hair and with auditory disturbances.

In our case we could not find any evidence of a previous iridocyclitis or of a systemic disease. The history of a bilateral retinal detachment with spontaneous reattachment and the appearance of the fundi suggest strongly the end result of Harada's disease.

CONCLUSION. Choroiditis proliferans seems to be the end result of an exudative, inflammatory detachment of the retina. A hemorrhagic origin can be ruled out almost with certainty. It is a well-defined clinical picture.

Tung-Chi University.

LYMPHOCYTOMA OF THE ORBIT SUCCESSFULLY TREATED BY ROENTGEN IRRADIATION*

Report of a case

Stefan Van Wien, M.D.
Chicago, Illinois

Lymphatic tumors of the orbit are either manifestations of a constitutional involvement of the lymphatic system or an independent local hyperplasia of lymphatic tissue. Although constitutional involvement usually occurs bilaterally, local hyperplasia almost invariably involves one orbit only. Birch-Hirschfeld, in his discussion of localized lymphatic tumors of the orbit, stresses that they comprise a heterogeneous group with transitions from undeniable forms of lymphosarcoma through benign tumors to a peculiar type which he calls "pseudotumor," and which actually are the result of chronic inflammation.

The lymphocytoma of the orbit represents an example of a benign lymphatic tumor. Histologically, it is a homogeneous mass, made up of lymphoid tissue that may show fibrous bands but is void of a well-developed reticulum. Since this condition is not seen too frequently, a brief report on such a case seems justified as an addition to the literature.

Report of case

History. A 67-year-old white woman was seen for the first time on October 31, 1946. She had noted a painless swelling in the region of the left upper lid that had gradually increased in size over a period of three years. At no time was there evidence of inflammation. The patient did not recall enlarged glands or swellings elsewhere on her body. Several ophthalmologists who were consulted advised an expectant and conservative attitude. There was no spontaneous complaint of diplopia; when questioned specifically she admitted occasional double vision.

Ophthalmological examination. The uncorrected visual acuity was: R.E., 20/50; L.E., 20/40. Vision in both eyes was improved to 20/20 by a +2D. sph.

There was an apparent ptosis of the left upper lid, and the left palpebral fissure was almost completely closed. The globe was proptosed and displaced downward and outward. The elevation of the upper lid was moderately limited. The globe could be freely rotated in all directions. Tests for diplopia suggested exotropia and left hypotropia. However, the two images were rather close together, and their distance did not alter in the cardinal directions. No chemosis of the conjunctiva bulbi was noted. Behind the left upper lid a fairly distinctly outlined mass could be palpated. The lid was freely movable over this mass. It was about 2.5-cm. long with a 1-cm. diameter, rather firm in consistency, and gave the impression of having a lobulated surface. The tumor seemed in no way connected with either the tear gland or the orbital walls.

Two small fleshy tumors could be observed in the subconjunctival tissue of the left globe. These tumors were flat, measured about 4 mm. in size, and were situated about 10 mm. above the limbus. They did not seem to be closely attached either to the conjunctiva or the sclera.

The eyegrounds were essentially normal.

Physical examination, as reported by the patient's own physician, was in no way remarkable. In particular, there was no increase in the size of the spleen, and no enlarged lymph nodes were noted.

Laboratory data. Red blood count: 4,560,000. Hemoglobin concentration: 14.8 gm. (88.8 percent). Color index: 98.

* From the Department of Ophthalmology, Northwestern University Medical School.

White blood count: 5,900, with 57-percent segmental, 2-percent eosinophilic, 1-percent basophilic cells, 34-percent small lymphocytes, and 6-percent monocytes.

Roentgenographic examination of the skull, including special films of the orbits and optical foramina, showed no evidence of increased intracranial pressure. There was no evidence of abnormal intracranial calcification. The petrous bones presented a normal appearance. The bones of the orbit showed no evidence of destruction or absorption and presented a normal orbital contour. The sphenoidal fissures also were normal. There was slight increase in the soft-tissue density in the left orbit when compared with the right.

Biopsy. One of the subconjunctival tumors was removed for biopsy on November 11, 1946. The report from the Department of Pathology, Mt. Sinai Hospital, was as follows: "Sections show accumulations of small round cells. There is no difference in the size of the cells, and no mitoses could be found. This picture is compatible with a so-called benign lymphocytoma, although a low-grade malignancy cannot be excluded with absolute certainty on a purely histologic basis (see fig. 1).

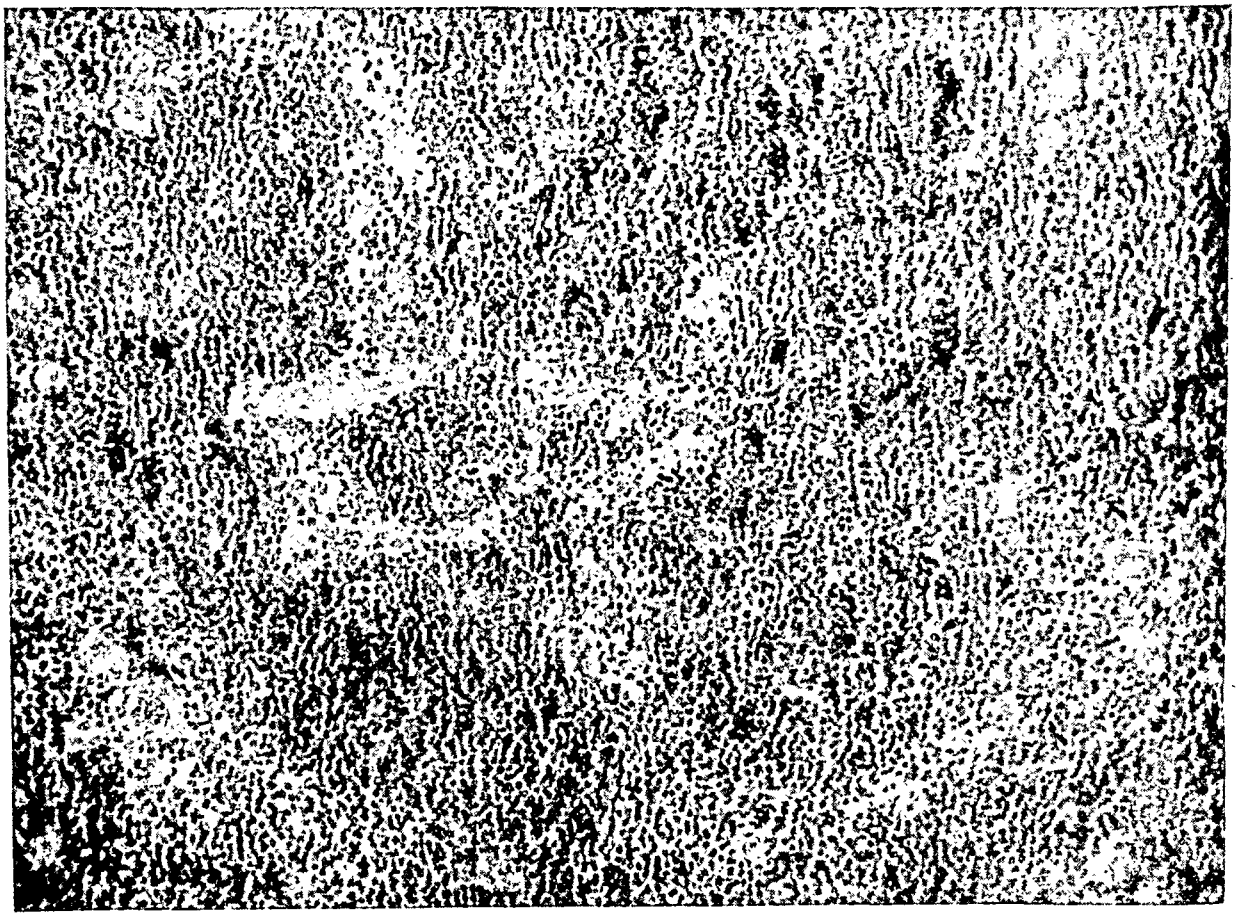


Fig. 1 (Van Wien). Photomicrograph of the biopsy.

Diagnosis. Tumor of left orbit: Lymphocytoma.

Treatment and Course. The patient received 20 drops of saturated potassium iodide for six weeks without any apparent result. She was referred to Dr. H. E. Davis, Chicago, for irradiation, and received 300R on January 7, 9, 11, 13, and 15, 1947—a total of 1,500R. The globe was protected by a lead

contact lens. A decided improvement was noticeable immediately after the first exposure, and the tumor had completely disappeared after completion of the series. There was a slight pigmentation of the episcleral tissue at the site of the small subconjunctival tumor that had not been removed for biopsy.

The patient was seen the last time on June 26, 1947. No recurrence of the tumor was in evidence (see fig. 2).



Fig. 2 (Van Wien). (A) Before treatment. (B) After treatment.

Comment

Hochheim[1] classified lymphomatous tumors of the lids and the orbit according to etiology. He distinguished simple lymphomas, leukemic, pseudoleukemic tumors, and doubtful cases.

Birch-Hirschfeld[2] doubted the correctness of Hochheim's classification, since no complete data of the blood examinations were furnished by this author. He was of the opinion that these tumors could exist with or without other constitutional manifestations. The former occurred in leukemic and aleukemic leukemia as well as in Mikulicz's disease. He admitted the occurrence of a malignant lymphosarcoma in the orbit, but did not believe that differentiation was possible on the basis of the histologic examination only. According to him, neoplasms of this nature may originate from smallest lymph nodes in the orbital tissues, from the lymphocytes of the connective tissue, or from the cells of the vessels. Meller[3] stressed the fact that lymphatic tumors of the orbit might spring from the tear gland.

It is a common experience that lymphomas of the orbit are very sensitive to actinic treatment, a fact that was stressed by Gifford.[4] Not all cases permit biopsy as easily as the one reported. But, if possible, it will help to prevent unnecessary surgery with its unpredictable complications. One such case was reported by Merigot de Treigny.[5] Surgical removal of the tumor was attempted first. This procedure was only a partial success and, to make matters worse, during this attempt the external rectus was severed, resulting in a permanent paralytic strabismus. Histologic examination revealed a lymphocytoma, and subsequent irradiation resulted in complete disappearance of the neoplasm.

Even if the protection of the globe with a lead prothesis should prove unsuccessful, and a cataract should develop subsequently, this may be a more desirable complication than an unsuccessful surgical approach, particularly if functionally important structures are infiltrated by the expanding tumor.

Conclusion

A case of lymphocytoma of the orbit is presented for record.

The diagnosis was established by means of a biopsy, and satisfactory response to roentgen therapy was obtained.

104 South Michigan Avenue (3).

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NOTES, CASES, INSTRUMENTS

REFRACTION CLINIC*

DISCUSSION BY

ALBERT E. SLOANE, M.D.†
Boston, Massachusetts

A-17-year-old boy had had poor vision as far back as he can remember. His vision had not become worse. He claimed that he could see well at a distance, but was unable to read. The examination revealed a pigmentary disturbance to both macula areas. His vision was: R.E., 15/200; L.E., fingers at five feet. This vision was not improved with lenses and was reduced with the use of a pinhole disc.

Refraction was attempted with the idea of prescribing a reading aid. Retinoscopy disclosed a negligible refractive error. The right eye was chosen for further testing because it had the lesser amount of involvement. It was found that he could read No.-7 type on the Wells card without glasses and by holding the print close so as to obtain a large retinal image. When a +5.D. sph. was worn, he could read Wells No.-4 type by holding the print at the proper short distance. When a telescopic reading aid (Aloe reading telescope) was placed before the +5D. sph., he could read Wells No. 1. It was suggested that he obtain the following prescription: a +5D. sph. for the right eye, to be worn for reading larger newspaper print, and the telescopic addition to be used when he wished to read very fine material.

DISCUSSION

In these cases, children have no difficulty in meeting ordinary visual needs. Their peripheral field of vision seems to compensate for their central vision loss; thus, this boy did not complain of poor distance vision, although by ordinary standards the visual acuity was substandard. For near, he was very definitely handicapped and could only read by holding the print close to his eyes, utilizing large retinal images, even if the details were not clear. Theoretically, any device which would further enlarge the retinal image size would enable him to read.

For this reason, a strong plus sphere, even though it makes for an awkward short range, can be of great help through enlarging the retinal image, and this can be further magnified by the aid of a telescope. A simple telescope, which is inexpensive, is the reading unit manufactured by Aloe Company. The success with such a device is directly proportional to the willingness of the patient to reëducate himself to its use.

The person must learn to utilize and recognize letters by a sort of piece-meal assembly, which is at first very difficult and later becomes quite easy. Parts of long words must be pieced together, a skill which is easily learned.

Further, a patient must learn to keep the print at a very definite distance which does not allow modification, and the print must be moved rather than moving the eyes. A newspaper, for instance, cannot be read if the pages are wide open and held unsupported. Rather, it must be kept flat on the table, and the light must be peculiarly adjusted to the needs of that individual. The successful patient will usually read at the same table and under the same lamp all the time. When successfully learned, the telescope allows the patient the use of both his hands.

Some other aids in such cases are these. First, and most generally used, is the ordinary hand magnifying glass. The hand magnifying glass has the advantage of allowing the patient a larger distance between his eyes and the glass, which allows a further increase in the effective magnification of the printed material. However, it ties up one hand.

* From the House Officers' Teaching Clinic, Massachusetts Eye and Ear Infirmary.
† Director of Department of Refraction.

Another reading aid is a magnifying glass mounted on legs, and cut in the shape of a rectangle. The length of the legs corresponds to the distance required for proper magnification, and it may be slid along the material read. Such a device, which contains within it an illumination system, is also manufactured. Another device is the utilization of magnifying loupes, such as are worn by the ophthalmologists in removing foreign bodies. A satisfactory loupe for this application is the Berger. This has the advantage of being enclosed in a metal casing, thus eliminating glare from the sides. It is moderately priced.

In general it is best to avoid correcting both eyes, and simply to correct the better of the two. Occasionally it is possible to correct both eyes, in which case one has to depend upon strong plus spheres, with or without prisms, but no telescope. The telescope should be reserved for monocular use.

QUESTIONS

House Officer: Have you ever used a device with a linear aperture so that only one line of letters can be seen at a time, thus eliminating confusion in losing one's place?

Dr. Sloane: I have never used such a device, but it would seem to have practical value in certain places. Such devices, I know, are incorporated in many of the methods used to help children who have reading difficulties.

House Officer: Why do you not usually correct both eyes?

Dr. Sloane: The answer to that is: (1) It would seem advisable to utilize both eyes, but we may be introducing difficult problems in binocularity due to the power of the lenses we have to use. (2) The pathologic conditions in such cases may not be perfectly symmetrical and thus again produce incongruous factors. (3) The visual field is limited by such devices, particularly the telescope, and it requires very precise adjustment to keep the field of each eye in proper position.

House Officer: Are telescopic lenses suitable for distance wear?

Dr. Sloane: As a rule telescopic aids have limited uses for distance wear. This is primarily due to the narrowing of the visual field, which is a necessary part of the corrected picture. Incidentally, a very effective type of telescopic lens may be procured for distance wear, in this manner. First, give the patient the best distance correction possible with ordinary lenses, and then, secondly, have him purchase a "Sportoscope,"* which is in reality a pair of opera glasses made with temples which fit over one's ordinary glasses. The cost is not excessive and this device can be used effectively for sport events and at the theatre, but of course not in walking.

243 Charles Street (14).

LEIOMYOMA OF THE IRIS

E. C. MOULTON, M.D., AND
E. C. MOULTON, JR., M.D.
Fort Smith, Arkansas

A search of the literature reveals that seven proved cases of leiomyoma of the iris have been reported. In 1923, Verhoeff[1] reported a case, and at the same time reviewed the literature and established certain criteria as necessary for the diagnosis of this tumor. According to these criteria, he accepted only two previously reported cases as being authentic, Thompson's[2] case, in 1899, and van Duysen's[3] case, in 1911. Frost,[4] in 1937, and Ellett,[5] in 1939, each reported a case. In 1943, Kahler, Wallace, Irvine, and Irvine[6] described a case, and, in 1944, Davis, Sheppard, and Romejko[7] reported one. In addition, two cases which were not the subject of separate reports have been mentioned in the literature. These include a separate case of Verhoeff's, mentioned by Li,[8] in 1923, as a "probable epiblastic leiomyoma," and a case of Zentmayer's, previously reported as

*Also known as "All-scope" and obtainable (before the war) from Andrew J. Lloyd Company, Boston, Massachusetts.

a primary leukosarcoma of the iris, but mentioned in Davis's[7] paper as having been proved on reëxamination to be a leiomyoma.

In order for the diagnosis of leiomyoma of the iris to be made, Verhoeff has said that the tumor must be made up of long spindle-shaped cells of uniform size, containing rod-shaped nuclei, and showing a tendency for the cells to occur in bundles with their nuclei arranged in rows. In addition, differential staining should show myofibrils "coursing along the cells and their terminal processes."

Case report

B. H. C., a white man, aged 56 years, was first seen by one of us on April 17, 1946. He gave a history of having noticed a small growth on the right eye 1½ years previously, and that it had gradually grown to the present size. There was no history of discomfort or inflammation in that eye, although he had noticed that the vision had failed considerably.

Eye examination showed vision to be: R.E., 4/200, unimproved; L.E., 20/200, improved to 20/25 with a +2.5D. sph. There was a large, egg-shaped, salmon-colored tumor mass, approximately 5 by 7 mm., filling the angle of the anterior chamber in the lower outer quadrant, and seeming to replace the iris in that area. The mass was beginning to encroach upon the pupillary area. Blood vessels were seen on the surface of the tumor. The pupil reacted normally except in the area of the tumor. There were no cells in the anterior chamber. The lens showed advanced cataractous changes and details of the fundus could not be made out through these opacities. A diagnosis of leukosarcoma was made.

An attempt at local removal was thought impractical because of the large size of the tumor, and removal of the eye was advised. Enucleation was performed on April 25, 1946, and the eye was sent to the pathologic laboratory of the Massachusetts Eye and Ear Infirmary for examination.

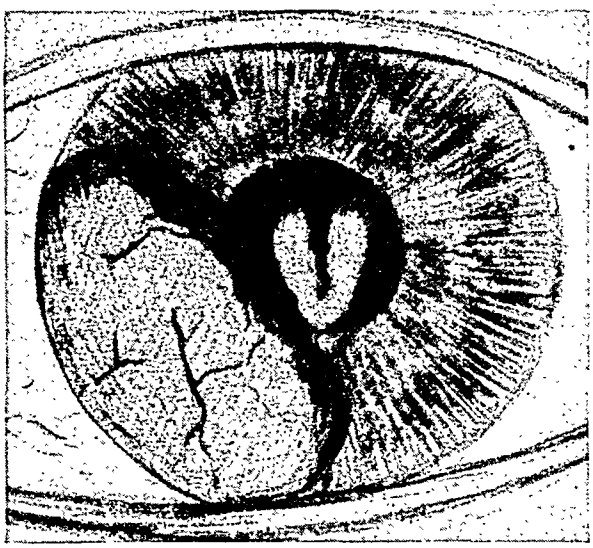


Fig. 1 (Moulton). A drawing made at the time the patient was first seen, showing the size and location of the tumor mass.

Pathologic report

The specimen consisted of an eye of approximately normal dimensions, showing in the gross a mass occupying most of the anterior chamber. Microscopically the angle of the anterior chamber and the iris on one side were essentially normal, except that the pigment epithelium of the iris showed some vacuolization. The pillar of the iris on the other side was largely replaced by a tumor mass extending forward to occupy the entire lateral two thirds of the anterior chamber in apposition with the posterior surface of the cornea.

This tumor was made up of fascicles of spindle-shaped cells showing rod-shaped nuclei with no nucleoli. The cells were arranged in interlacing bundles, with the nuclei occasionally arranged in rows. None of the cells appeared pigmented, although pigment was scattered extracellularly throughout the mass.

The tumor merged gradually into the anterior border of the ciliary body, without any sharply defined border, but did not extend into the ciliary muscle. There was very little vascularization. No necrosis was present and no mitoses were seen. The lens was

cataractous. The rest of the eye was not remarkable.

Further sections were made and stained with Mallory's phosphotungstic acid-hematoxylin stain. These showed a rather dense arrangement of myofibrils coursing along the cells and from their terminal processes. Sections were reviewed by Dr. F. H. Verhoeff who concurred in the diagnosis of leiomyoma of the iris.

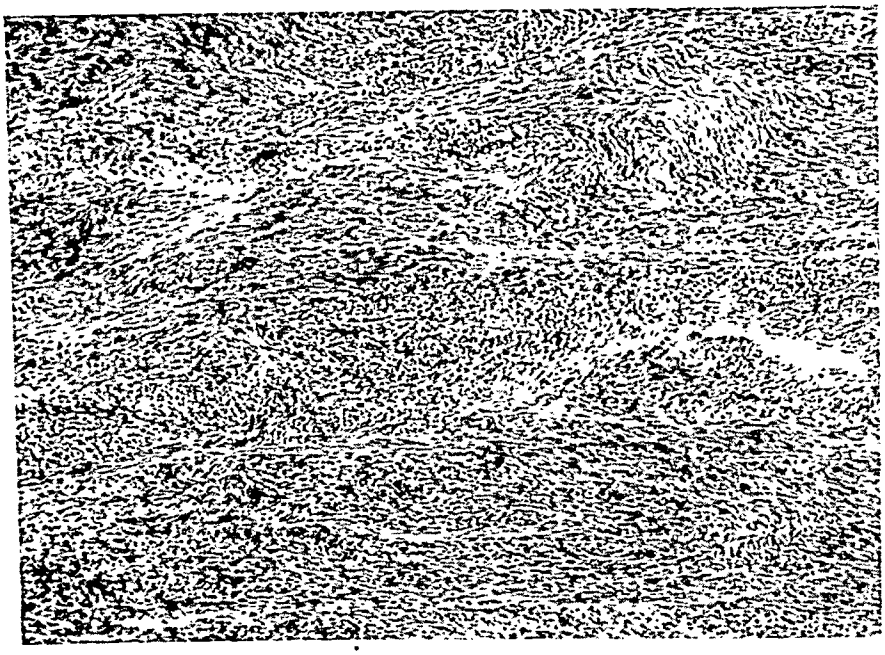


Fig. 2 (Moulton). A photomicrograph (×100) of a section of the tumor tissue, showing the typical architecture of this tumor.

Comment

It was impossible to tell whether this tumor arose from the iris musculature or from the iris stroma, since the tumor mass occupied the whole of the iris pillar, and the individual sphincter and dilator muscle groups were not recognizable in any of the sections showing tumor.

Of the previously reported cases, five were said to be epiblastic and one mesoblastic in origin. The origin of the other three was not stated. Of these cases, six were in males and four in females, ranging in age from 10 to 56 years. The ages in the largest group, five, were between 46 and 56 years of age. All of these growths were described as salmon or flesh colored.

The duration of the growth was from 1 to 2 years in three cases, 20 years in one case, had "always been present" in two cases, and was not stated in the other four cases. Six of these cases were treated by local removal, or iridectomy, and three by enucleation because of suspected malignancy. The other case, reported by Verhoeff, resulted in enucleation after two unsuccessful local procedures.

Of considerable interest was the location of these iris leiomyomas. Of these 10 cases, 8 were found in the lower outer quadrant, 1 in the lower inner quadrant, and the location of the other case was not stated.

Whether there is any connection between this finding and the fact that the lower outer quadrant of the globe is the typical location of the fetal fissure is a matter for conjecture. The fetal fissure is normally closed anteriorly long before the iris proper develops, and these cases do not usually come to a physician's attention before the third decade of life is reached.

There are 93 cases of malignant and nonmalignant melanomas of the iris on file in the pathologic laboratory of the Massachusetts Eye and Ear Infirmary. Of the available

clinical records only 32 mentioned the original location of the tumor. Eight, or 25 percent, arose in the lower outer quadrant; 12 were described as ring sarcomas; and the remaining 12 were evenly distributed among the other three quadrants.

These few cases do not necessarily indicate that leiomyomas of the iris have a predilection for the lower outer quadrant. However, the occurrence in the lower outer quadrant of the iris of a localized, salmon- or flesh-colored tumor mass of slow growing tendencies should suggest leiomyoma, and, if the size of the tumor permits, an attempt at local removal should be considered before the eye is removed.

Merchants National Bank Building.

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A CORNEOSCLERAL SCISSORS

William P. McGuire, M.D.
Winchester, Virginia

In an effort to obtain a smoother incision in enlarging the original limbal incision in cataract surgery, a new scissors has been designed. The blades of the scissors are blunt pointed and are angled up 15 degrees at the proximal end of the cutting surfaces. From this angle the blades are curved downward in a gentle curve closely approximating the curve of the anterior surface of the cornea.

In practical application the advantages of this scissors have been found to be:

1. The upward angulation makes for easier manipulation.

2. The downward curve of the blades produces a smoother cut along the limbus than does the ordinary flat-bladed scissors or scissors with the blades curved upward.

3. It is unnecessary to cut the conjunctiva with the scissors as the curve permits the outer blade to be inserted beneath the conjunctiva and the limbal incision to be enlarged beneath a conjunctival bridge.

4. In the event of involuntary upward movement of the eye, the danger of trauma to the corneal endothelium is lessened and the blunt point slides along the angle of the anterior chamber.

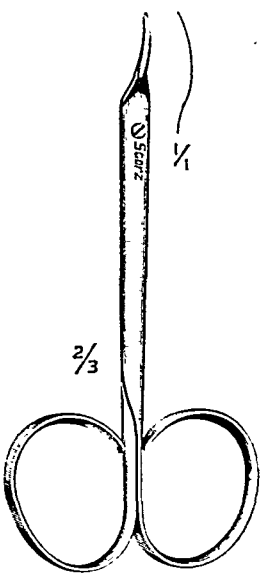


Fig. 1 (McGuire). Corneoscleral scissors of new design.

This instrument is manufactured by the Storz Instrument Company, St. Louis, Missouri.

105 North Braddock Street.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

February 19, 1947

DR. HOWARD F. HILL, *presiding*

RHEUMATOID IRITIS

DR. LLOYD MILLS presented the preliminary paper of the evening, reviewing the records of 42 patients with iritis that were found in 600 cases of rheumatoid arthritis now being followed by the arthritis service of the Massachusetts General Hospital. In 29 of these 42 cases, no other possible alternative etiology, such as focus of infection and so forth, was found, suggesting a direct association between the arthritis and the iritis. Of these 29 cases, 19 occurred in men, 10 in women. The age of onset varied from 3 to 63 years. In 9 cases the iritis was unilateral; in 20 cases it was bilateral, both eyes being involved at the same time in 15 cases. The visual result in the bilateral cases was approximately the same in both eyes even though the severity of the iritis varied between the two eyes. Usually the iritis was first noticed 1 to 17 years after the onset of arthritis. In one case the onset of the iritis and arthritis coincided, and in three cases an iritis of "unknown etiology" preceded the arthritis with later exacerbations of iritis characteristic of this group. About half the iritis episodes occurred during chronic activity or an acute exacerbation of the arthritis, the others occurring during remissions of months to years or, in three cases, prior to joint symptoms. The severity of the iritis varied widely—three cases had single brief attacks; nine, recurrent mild attacks; four, a mild chronic course; two were classic cases of ophthalmia lenta. There were two fulminating cases, one severe recurrent case, and eight severe chronic cases, all ending in marked visual impairment. The visual end results varied with the course of the disease. In 11 cases, normal vision was retained; seven cases ended with vision of 20/70 to 20/200, and 11 with vision of hand movements or less. Secondary glaucoma resulted in eight of these cases, and enucleations were necessary in two.

Dr. Mills noted that only meager statistics with poor etiologic studies appear in the literature. Evaluation of treatment that has been recommended is difficult because the disease has no known specific treatment and has a fluctuating, if progressive, course. In his series, no case with glaucoma had an iridectomy or filtering procedure early enough to learn the value of early surgery, and he thought such intervention must be strongly considered in obviously progressive cases.

In conclusion, he noted that, statistically, 6,000,000 people in the United States have rheumatic diseases, that iritis of rheumatoid arthritis is an etiologic entity and occurs frequently enough so that adequate medical investigation with thorough case following will decrease the enormous group of cases which at present are diagnosed as "Iritis—cause unknown."

SURGICAL TREATMENT OF STRABISMUS IN CHILDREN

DR. MAYNARD WHEELER of New York gave the principal paper of the evening. He said that preoperative analysis is of the greatest importance in cases of strabismus. The cases can be divided into two groups: (1) those in whom the deviation is discovered soon after birth and (2) those in whom the squint appears gradually after the age of two years. In the first group the deviation is large, frequently with a vertical component; refraction is usually unimportant. Measurement is done by corneal reflexes.

Operation should be done early (one year) for the psychologic effect on both the child and his parents; to avoid muscle changes, amblyopia, and abnormal retinal correspondence; and to give the best chance for binocular vision. In the second and much larger group, refraction is usually of some importance. A more complete analysis is possible with greatest reliance on the cover test. When hyperopia is very high, surgery is usually contraindicated. If glasses are essential for vision but do not straighten the eyes, the portion of the deviation remaining with glasses may be corrected cautiously by surgery. When glasses are not essential to vision, after a trial of several months, they may be discontinued for surgery. In all cases, amblyopia should be treated by occlusion. Operation should be done as soon as other measures fail; surely before the child enters school.

The choice of operation and the technique used were not stressed because of the difficulty of trying to tell anyone how to correct a given deviation. Each surgeon must select the operation that he can do best, and find out what it will accomplish.

In the discussion that followed, Dr. Walter Lancaster suggested the use of the red-green test for measuring the deviation of the eyes in the six cardinal directions. Dr. Wheeler said that he had not found it satisfactory in the usual strabismus cases, possibly because of incorrect use. Dr. Lancaster also commented that he thought that a certain amount of upshoot in extreme adduction is normal, and that he agreed with Dr. Wheeler that the teaching of Bielschowsky and Adler in regard to the overaction of the inferior obliques is the correct one. Dr. Lancaster then brought up the point of orthoptic training to break up the convergence-accommodation relationship and to teach the patient with hyperopia to keep the eyes straight without wearing his correction.

Dr. Frederick Verhoeff discussed the factor of "anticipatory movement" complicating the cover test. He suggested that instead of passing the cover from one eye to the other, it was only necessary to cover the fixing eye, thus decreasing the anticipatory movement. He also said that in a strabismus that is not strictly concomitant it would make a difference as to which eye had the prism in front of it when doing the cover test. He stated that so-called alternating hyperphoria is an incorrect term. A better name is exclusion hyperphoria, the eye turning up because it is excluded from vision. This condition sometimes upsets the cover test. He suggested that, instead of using a complete occluder in the occlusion test, one might use a strong sphere in front of one eye, thus using both eyes right along, one for distance, and the other for near. Dr. Wheeler in reply agreed with Dr. Verhoeff's comments on anticipatory movements. He thought that prisms could be used to measure the exclusion hyperphoria, by measuring each eye separately, passing prisms of varying degrees in front of the eye until motion was stopped.

Dr. Paul Chandler asked after what age it is probably not worth while to occlude to improve amblyopia, and also after what age the vision is maintained when the occlusion has been stopped. Dr. Wheeler said that after the age of 6 or 7 years he did not urge occlusion unless the parents were keen for it, since constant occlusion after that age is psychologically bad and results are not too gratifying. He also thought that at about this same age vision is maintained when occlusion has been stopped.

In closing, Dr. Wheeler answered Dr. Howard Hills's questions in regard to prisms and catgut. He said that glass prisms are far preferable to plastic because the latter are inaccurate, rather thick, scratch, and are spoiled by alchohol. He has found that plain catgut is softer, easier to work with, and absorbs more easily. Since he started to use it, he has had no regrets.

Mahlon T. Easton,
Reporter.

COLORADO OPHTHALMOLOGICAL SOCIETY

February 15, 1947

Dr. George Stine, *presiding*

Boeck's sarcoid

Dr. Morris Kaplan presented a paper, including a case report, on this disease which was published in the Journal, 31:83-85 (Jan.) 1948.

Dr. S. S. Kauvar (by invitation) presented a paper on the medical aspects of Boeck's sarcoid. He stressed its close similarity to tuberculosis, both clinically and pathologically. It is entirely benign except in the eye and in such places as the central nervous system and mediastinum where the tubercles cause difficulty because of mechanical interference. He stressed the spontaneity of recovery, with an occasional relapse. In several cases of sarcoid, the patients, years later, developed pulmonary tuberculosis, all of the fulminating miliary type.

Dr. Fritz Nelson presented three oil sketches of sarcoidosis of the iris, made many years ago, in which the true diagnosis was not made for years after the acute phase of the illness. Dr. George Filmer stated that in the Army he had treated five proved cases of uveitis caused by sarcoid. All were mild and painless and were characterized by blurring of vision, with numerous cells in the aqueous. All were bilateral. Four of these cases occurred in Negroes.

Malignant melanoma

Dr. James C. Strong presented a white woman, aged 32 years, who came on February 12, 1947, for an eye examination. Her chief complaint was blurring of vision in the right eye for the past three months. She stated that objects seen with this eye had a wavy appearance, which was first noticed while reading. Progress was slow but her vision failed more with each passing week. She had occasional headaches which were not severe and for the past two months she had noticed flashes of light especially in the nasal field. She also noticed that vision to the left, with the right eye, was somewhat impaired.

The general physical examination was entirely negative except for the eye findings. Examination of the right eye showed the extraocular muscles to be normal. The right iris was as active as the left. The pupil reacted to light and accommodation, direct and consensual. The cornea was normal. No keratic precipitates were present. There was a faint beam in the anterior chamber; however, no cells were observed in definite clumps. The iris was normal throughout its substance. The lens was clear. No opacities were present. The vitreous was filled with golden particles which were quite large. The vitreous was not liquid. Upon opthalmoscopic examination, there was found a large retinal detachment. The detached retina was quite smooth and rounded and was seen in the temporal portion of the eye. It extended from the 11- to the 6:30-o'clock positions, from the ora serrata to within six disc diameters of the optic nerve. At the 9-o'clock position, there was an area composed of brown pigment and some old hemorrhage with a vessel running into this area. Part of the vessel showed sclerotic changes. This pigment area protruded above the level of the retina, surrounding it. Hemorrhage was observed near the ora serrata and inferiorly, at the 6-o'clock position. This hemorrhage seemed very recent.

Six disc diameters from the optic nerve, the retina lost its healthy normal appearance. It took on a grayish cast and there were numerous traction lines which ran vertically and obliquely. There was an area of chorioretinitis superior and temporal to the macula. The margin of the temporal portion of the nerve was not well defined, there being an area of gray, opaque tissue passing from the nasal portion of the disc inferiorly and temporally. New blood vessels were

growing into this tissue. No retinal tears could be observed; however, this pigmented area over the retinal detachment suggested degeneration of the retinal tissue with possible tumor formation showing beneath. The vessels over the greater part of the detachment did not have their normal appearance. Many of the vessels inferiorly and temporally had white streaks along their walls.

The tension of the right eye was 18 mm. Hg (Gradle-Schiøtz) and of the left eye, 19 mm. Corrected vision was: R.E., 20/40; L.E., 20/15. The right eye did not transilluminate in the temporal portion. The field of vision showed marked constriction in the upper and nasal field on the perimeter and on the Bjerrum screen. The left eye was normal throughout. The patient stated that her right eye had previously been her better eye.

Laboratory findings were negative except for the presence of melanin in the urine. X-ray studies of the skull and chest showed no pathologic condition.

Discussion. Dr. Fritz Nelson said that the condition was most likely a malignant melanoma, with detachment over the solid mass and felt that enucleation should be done as soon as possible. Dr. John C. Long quoted Theobald as saying that these melanomas may well originate in the long nerves which should give corneal anesthesia.

Ten days after this case was presented to the Society, the patient's right eye was enucleated. The laboratory report was as follows:

Macroscopic examination. The specimen is an intact globe measuring A/P 23 mm.; horizontally and vertically, 23 mm. each. The cornea is transparent. The anterior chamber is deep and in it there is a white flaky piece of material, measuring 3 x 1 mm.

On section, the cornea appears normal. The lens has been displaced by sectioning. The anterior lens capsule displays a ring of pigment. The outstanding feature of the section it is a rather large oval-shaped grayish mass, measuring 9 x 5 mm., which appears to arise from the choroid and protrudes into the vitreous cavity. The retina is lying over this mass. Numerous hemorrhages are visible in this portion of the retina. Posterior to the mass, the retina is detached for a distance of approximately 10 mm. A white, gelatinous, semisolid material, together with a small amount of blood, lies beneath the retina in this location.

The vitreous chamber is filled with a clear, jelly-like material.

Microscopic examination: The paraffin section shows a tumor mass arising from the choroid. The tumor is composed of spindle cells with oval nuclei, most of which show a definite nucleolus. The reticulation in the nuclei is rather coarse. Both the inner and outer surfaces of the tumor show extensive pigmental deposits. The retina shows extensive hemorrhagic areas and is separated from the tumor by a serous exudate at one margin.

Diagnosis. Melanoma spindle cell, subtype B.

Morris Kaplan,
Secretary.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

February 3, 1947

DR. BENJAMIN FRIEDMAN, *president*

TREATMENT OF LINDAU'S DISEASE

DR. STERLING BOCKOVEN AND DR. PAUL LEVATIN presented a case of Lindau's disease with unusual manifestations. Dr. Levatin stated that cord compression was caused by a histologically verified sclerosing hemangioma arising from the cord; whereas, a solitary coexisting retinal angioma was asymptomatic. The retinal tumor was treated by electrocoagulation without any loss of vision and the success of this treatment furnishes additional support for the view that puncture diathermy is the method of

choice in the treatment of von Hippel's disease. The cord tumor had previously been treated by X ray, but one year later further cord involvement had occurred. Dr. Levatin concluded that funduscopic examination under a mydriatic be done preoperatively in all instances of suspected cord tumors to detect isolated cases of Lindau's disease.

Discussion. Dr. Ludwig von Sallmann said that, in 1935, he had reported a case of Hippel-Lindau's disease which was treated successfully with beta rays. He stated that he did not know which was preferable, the beta ray or the diathermy treatment. Dr. von Sallmann concluded that the good result in Dr. Levatin's case would indicate that there is no contraindication for the diathery-puncture treatment in circumscribed lesions.

Dr. Joseph Igersheimer stated that in his experience these cases always become so much worse that they finally become blind. Therefore, he felt that it is justifiable to try the diathermy procedure. Dr. Igersheimer said that von Hippel first described the retinal changes on the ground of anatomic investigations and called them a "very rare disease of the retina." By further studies he came to the conclusion that the retinal disease was a hemangioma and in this conclusion he was correct. About 20 years later, Lindau found that the central nervous system and other organs show these angiomas and that involvement of the eye was a manifestation of a general disease. Dr. Igersheimer proposed that this disease be called von Hippel-Lindau's disease, especially when there are characteristic changes in the eye.

Dr. Adolph Posner said that from his experience in diathermy treatment of retinal detachments, he felt there is no great danger involved in the treatment of dilated veins of von Hippel's disease by this method. Dr. Posner said that he had frequently seen the vena vorticosa coagulated or even punctured with no untoward consequences.

Dr. Levatin (in closing) replied to Dr. Benjamin Friedman as to the advisability of any treatment in cases of angiomatosis retinae, which are nonsymptomatic. Because blindness due to detachment of the retina and secondary glaucoma is the eventual result in all untreated cases of von Hippel's disease, Dr. Levatin said that Dr. Bockoven and he believed that treatment by electrosurgery or irradiation is indicated. Since this was a very early case, it was possible to distinguish between the feeding artery and vein, for the artery was of a light pink color and was beaded.

In reply to Dr. Adolph Posner, Dr. Levatin said that Dr. Posner's observation that surprisingly little bleeding occurs when electrosurgery is used in operations on the eye is important. He said that he felt that diathermy puncture is a safe procedure in treating von Hippel's disease because the electric current coagulates the blood vessels.

Oxycephaly with optic atrophy

Dr. Jack V. Lisman presented a paper on this subject which will be published in the March, 1948, issue of the Journal.

Neosynephrin in glaucoma simplex

Dr. Adolph Posner suggested the use of neosynephrin hydrochloride (10 percent) before considering surgery, in cases of chronic simple glaucoma, when the usual miotics fail to maintain the tension at a normal level. While neosynephrin, alone, has only a fleeting action, it may benefit the patient by increasing the responsiveness of the tension to the subsequent use of miotics. Dr. Posner said that the exact mechanism by which this is accomplished is not known.

Dr. Posner told of two cases in which this method was used. He said that one

drop of 10-percent neosynephrin is instilled into the eye, preferably 12 or more hours after the last use of miotics. The patient is then instructed to dispense with the miotic for 24 hours if possible, after which the use of pilocarpine is resumed in moderate concentrations.

Dr. Posner said that the tension may be slightly increased by the neosynephrin, but that usually it is lowered. The increase in tension never amounts to more than 5 mm. Hg, thus the drug is safe to use in chronic simple glaucoma. Dr. Posner concluded by saying that it should not be used in a congestive type of glaucoma.

Discussion. Dr. James W. Smith said that it is a well-known fact that miotics used over a long period of time may lose their effectiveness. Clarke, in his report on carcholin (doryl) stated that if the use of pilocarpine and eserine would be discontinued and the patients allowed to use carcholin, better clinical results would be obtained when they resumed instillations of pilocarpine and eserine.

Dr. Posner mentioned the variations in tonometric readings in the hands of competent observers. Dr. Smith said that it is known that many tonometers are not calibrated properly. For this reason the tendency in some clinics of using a tonometric recording to establish a rapid diagnosis of glaucoma is to be deplored. The accuracy of the instrument on repeated trials, the mental attitude of the patient, and conditions under which the pressure is recorded are factors that may raise a normal reading to an apparently increased level.

If the perimetric field and visual acuity are unchanged, Dr. Smith said that he would view with reservations a tonometric recording of 5 to 10 mm. Hg above normal unless verified repeatedly on different days.

Dr. Benjamin Friedman said that successive readings with the tonometer frequently produce variations up to 5 mm. Hg either way, so that small discrepancies are no definite evidence of glaucoma.

Dr. Paul Levatin remarked that he had used 10-percent neosynephrin in a few cases of glaucoma, secondary to cataract extraction or to discission, in which 2-percent pilocarpine was ineffective. In each case it brought the tension down to normal very rapidly, although the effect was not permanent. When it was used on one occasion in a youth with a secondary glaucoma after an iridocyclitis, it produced a rapid painful rise in tension to 50-mm. Hg. The tension could not be brought down to normal by 2-percent pilocarpine every 15 minutes for 3 hours. Since that incident, Dr. Levatin said that he has confined its use to glaucoma, secondary to cataract extraction or discission, in which atropine had been used.

Dr. Joseph Igersheimer said that the fact that neosynephrin causes, in rare instances, an acute attack of glaucoma is very unfortunate, but cannot be generalized. He said that the same experience had occurred with the use of glaucosan. Dr. Igersheimer stressed the importance of seeing that the anterior chamber is not shallow because any dilatation of the pupil when the chamber is shallow may cause an increase of intraocular pressure.

In reply to Dr. Smith, Dr. Posner said that he agreed with Dr. Smith in regard to the use of the tonometer. He felt, however, that because the tonometer is not a perfect instrument, we should not do away with it. He stated that fields should be used as a follow up. Sometimes, however, field changes develop only after a long period of time.

To Dr. Friedman, Dr. Posner said that as for variations in readings, he trys to eliminate these by taking repeated readings on each eye, and then going back to the first eye, and if there is any difference between the first and second readings of the same eye, then he said he would wait

one minute or so and repeat again until consistently lower readings are obtained.

Intraepithelial epithelioma

Dr. Benjamin Esterman, Dr. Joseph Laval, and Dr. Clara Okrainetz presented a paper on Bowen's disease of the cornea and conjunctiva treated by radiation which was published in the Journal, 30:1537-1540 (Dec.) 1947.

Discussion. Dr. Ludwig von Sallmann said that he had had no personal experience with the X-ray treatment of Bowen's tumor. He mentioned a report by Kumer and him, in 1929, on 12 cases of epibulbar epithelioma, which were treated postoperatively with beta rays. Six of the cases, with an average observation time of five years, were considered cured.

Cataracts following maternal rubella

Dr. Leon H. Ehrlich described a girl born November, 1943, with congenital cataracts. The mother had had rubella during the first month of pregnancy. Aside from dense complete cataracts, the examination, ocular and general, was negative, although subsequently it was found that the child was deaf. Esotropia and nystagmus also developed. The lenses gradually became thinner and a red fundus reflex could be visualized. Eventually the lenses absorbed completely leaving only thin membranes, which, however, were sufficiently dense to require discission. The right membrane divided easily with no evidence of the presence of any lens substance; the left membrane tore loose and formed a small ball in the anterior chamber. The visual acuity could not be determined but the parents state that the child obviously has useful vision.

Dr. Ehrlich said that this type of transformation of congenital cataracts was well described as early as 1811 by Saunders, but that modern textbooks give it little or scant attention. Three cases were found in the recent literature on congenital rubella cataracts in which empty capsules, with no lens substance, were found at operation, but in none of them had there been a loss of lens substance while under observation. In two cases there was some presumptive evidence of such loss.

Discussion. Dr. Benjamin Friedman said that in children that are difficult to examine without general anesthesia, the condition is frequently overlooked. He said that, when one sees a membranous cataract, one assumes it represents the anterior portion of the lens. Unless one uses the slitlamp or a similar method of examination, this condition is overlooked.

Epidermoid cysts of the caruncle

Dr. Daniel M. Rolett presented two cases of epidermoid cysts—one located in the caruncle and one of the lacrimal gland. His paper was published in the Journal, 30:1577-1580 (Dec.) 1947.

Keratitis associated with lichen planus

Dr. Jacob Goldsmith reported the only known case of deep keratitis associated with atypical lichen planus. This new dermatologic entity was first observed during World War II. The corneal involvement appeared during the height of the skin malady and closely paralleled the course of the skin affection. The pathologic process commenced in the central portion of the posterior layers of the cornea and progressed anteriorly to involve the epithelium. The disease process on regression receded in the opposite direction. Vascularization was absent throughout the keratitis. The patient eventually regained 20/20 vision.

Dr. Goldsmith said that recent studies show that there is a close relationship between prolonged atabrine ingestion and the development of atypical lichen planus. Dr. Goldsmith expressed the opinion that

both the atabrine medication and the severe destructive skin lesions played an important role in the production of the deep keratitis. Circumcorneal pigmentation following long-continued use of atabrine was demonstrated as a yellowish-green limbal glow by sclerotic scatter.

Bernard Kronenberg,
Secretary.

CHICAGO OPHTHALMOLOGICAL SOCIETY

December 16, 1946

DR. WILLIAM A. MANN, *president*

CLINICAL PROGRAM

(Presented by the staff of the Illinois Eye and Ear Infirmary)

BILATERAL CATARACTS DUE TO LATENT TETANY

DR. HARRY I. WEINER presented a 32-year-old white women who entered the hospital on October 21, 1946, with complaint of impaired vision getting progressively worse following a thyroidectomy five years previously. The patient reported that following surgery and while still in the hospital she experienced several attacks of muscle cramps with carpopedal spasm but that she had no convulsions. During the five years following the thyroidectomy, the patient stated she enjoyed good health except that her teeth became carious and had to be extracted, her hair and nails became brittle and that she noticed progressive failing vision bilaterally until at the time of hospital admission she was unable to get around by herself.

Physical examination revealed a congenital shortening, contracture, and atrophy of the right thigh and leg, brittleness of the hair and nails, and edentulousness.

The neurologic examination disclosed the following: Chvostek's sign, positive bilaterally; von Bornsdorff's phenomenon, positive; and Erb's sign, positive. Laboratory findings were: serum calcium, 6.8 mg. per 100 cc.; serum inorganic phosphorous, 7.4 mg. per 100 cc.

Ophthalmologic examination revealed a visual acuity of finger counting at 18 inches, with good light perception and projection in each eye—noncorrectible. The anterior segments were normal. The pupils were round, equal, concentric and measured 3 mm. each. They reacted to light briskly. The anterior chambers were deep and optically inactive. The lens changes were identical in both eyes and consisted of a ground-glass appearance of the capsule with an occasional punctate opacity. There was a clear zone immediately behind the capsule. The deeper layers of the cortex, particularly at the posterior pole, revealed a number of gray and white opacities, punctate and flaky in configuration. The nucleus in each lens was surrounded by a large homogeneous opacity. The media and fundi were not visualized because of lens density.

The lens of the left eye was extracted intracapsularly on October 22, 1946, with no attendant complications. The anterior chamber did not reform completely until the fifth postoperative day. A small amount of bleeding was noted from the lips of the section, but it was resorbed without treatment. The remainder of the hospital tenure was uneventful. The patient was discharged on the 14th postoperative day. Vision was 20/40, with a +11D. sph. $\frown$ +2D. cyl. ax. 45°.

On readmission to the hospital, the patient's vision was 20/30, with +10.75D. sph. $\frown$ +1.00D. cyl. ax. 180°. The lens of the right eye was as previously noted. The extraction was delayed because of an intercurrent polyarthritis of unknown origin.

This patient was presented as a typical case of hypoparathyroid cataracts following a thyroidectomy after which latent tetany, with attendant dental decay, brittleness of

hair and nails, and carpopedal spasm, was experienced.

Chorioretinitis sclopetaria

Dr. William R. Eubank presented a colored woman, aged 33 years, who was seen for the first time on June 3, 1946. She stated that 11 years previously she had been shot through the head, the bullet emerging below the left eye. Except for eight hours of unconsciousness and difficulty in swallowing for two weeks afterward, there had been no sequelae. She said that her visual acuity had been checked and found to be equally good in each eye. Recently she happened to notice that the sight in the left eye was much worse than that in the right.

Examination showed that, two inches inferoposteriorly to the right mastoid process, there was a quarter-inch circular scar, evidently the bullet's point of entry. Immediately above the left orbital rim, in its inner third, was a stellate-shaped scar, one-fourth inch in diameter, apparently the point of exit. Unaided visual acuity was: R.E., 20/20; L.E., 20/200, uncorrectible. Externally the eyes appeared normal. No abnormalities of the extraocular muscles were found. The right fundus was a normal negroid type The left optic disc was normal in appearance. The retina immediately surrounding the macular area had an increased pigmentation and light reflex. It appeared to have a slight elevation in the center of which was a round, sharply punched-out hole one-half disc diameter in size. On the temporal rim of the crater were several other very small holes. Beginning three disc diameters inferiorly from the disc, the retina appeared to be disorganized and uneven, with large areas of heavy pigmentation and white scar tissue. A few retinal vessels were seen to course over portions of this. The striking retinal lesion extended from the 3- to 7-o'clock positions and to the extreme periphery. The remainder of the fundus was normal.

General physical and neurologic examinations were normal. Blood Wassermann and urinalysis were negative. X-ray findings were as follows: "Films of the skull show an irregular distribution of metallic densities extending from the atlas anteriorly to the inferior orbital plate. The path of these metallic bodies apparently crosses from right to left along the base of the skull. There is a suggestion of a radiolucent area in the posterior-inferior orbital plate on the left side, which could be secondary to a penetrating wound."

A diagnosis of hole in the macula, and chorioretinitis sclopetaria (from new Latin, sclopetum, a gun) was made. No treatment was considered to be indicated.

Adie's syndrome

Dr. William R. Eubank presented a white man, aged 40 years, who was first seen on December 3, 1946, at which time he complained only of blurring of vision and fatigue after close work of one year's duration. This condition was relieved somewhat by the glasses he had worn for three years. The patient stated that his mother had noticed that his right pupil was larger than the left from the time of his birth. Other pertinent history included a left facial paralysis, thought to be caused by infected tonsils. of six months' duration and followed by complete recovery. In 1941, he had had a moderate hypertension for which he had received intermittent treatment ever since.

Examination showed vision to be: R.E., 20/30—2; L.E., 20/40. This was improved to 20/20 in each eye by a low compound-myopic astigmatic correction. Accommodation was +2.25D. in each eye. Except for a moderate convergence insufficiency and the pupillary abnormalities, eye findings were normal. Both pupils were slightly irregular, the right measuring 4 mm. and the left, 2½ mm. The right pupil did not react appreciably to light, directly or consensually. Following binocular occlusion of 45 minutes, it dilated to 5½ mm., then slowly contracted

to 4 mm. again. Convergence caused a slow constriction to 1.5 mm., equalling that of the left pupil. Relaxation of convergence caused the right pupil to dilate slowly to 4 mm., while the left pupil dilated more rapidly to 2.5 mm. The left pupil reacted to light and convergence both directly and consensually. No subjective lag in accommodation was found in either eye. Instillation of 2-percent homatropine hydrobromide dilated both pupils widely and equally. Neither pupil constricted following instillation of three drops of 5-percent mecholyl.

Other pertinent findings were as follows: Blood pressure was 200/100 mm. Hg. Patellar reflexes were present and equal but diminished. Achilles reflexes were not elicited. Romberg's sign negative. Blood Wassermann and urinalysis were negative.

From the above findings a diagnosis of Adie's syndrome was made. This condition differs from the Argyll-Robertson pupil which has the following characteristics: (1) pupils are miotic; (2) bilateral in 90 percent of cases; (3) pupils react promptly and fully to convergence; and (4) they dilate slowly and imperfectly to mydriatics.

Except for correction of the refractive error and of the presbyopia, no treatment was given because Adie's syndrome is of no pathologic significance and is usually symptomless.

Response to D.F.P.

Because of the current interest in di-isopropyl fluorophosphate, Dr. Joseph S. Haas presented three cases which have successfully responded to its administration. In an attempt to evaluate its usefulness 35 patients were treated with D.F.P. in the past five months. Its use has been confined principally to the patients that are refractory or sensitive to the common miotics. A 0.05-percent concentration has been used almost entirely for this concentration seems to be tolerated better and to produce fewer objectionable symptoms. It also seems to have been equally effective. It has also been noted that an increase in dosage beyond three times a day does not cause further decrease in tension.

The first patient was a 70-year-old white man with glaucoma capsulare. Field studies showed: R.E., 10 degrees for 3/300 white; L.E., 10 degrees for 2/1,000 white. Corrected vision was: R.E., 20/250, L.E., 20/90. Gonioscopy showed the characteristic picture of glaucoma capsulare. The patient did not respond to 2-percent pilocarpine, six times a day, or to 0.25-percent eserine, four times a day. On 1-percent carcholin, four times a day, ocular tension averaged 33 mm. Hg (Schiøtz). In July, 1946, the patient was placed on 0.05-percent D.F.P., twice a day, and the average tension reading since then has been 26 mm. Hg, with no record of the tension going above 28 mm. Hg.

The second patient was a 64-year-old white woman who had had bilateral cataract extractions with delayed reformation of the anterior chamber. Gonioscopic examination revealed many peripheral anterior synechias, most pronounced in the right eye. Corrected vision was 20/25 in both eyes, and the central fields were normal to 2/1,000 white. On 2-percent pilocarpine, six times a day, and 0.25-percent eserine, four times daily, tension in the right eye remained poorly controlled reaching 40 mm. Hg on several occasions. The patient was then placed on 0.05-percent D.F.P., twice a day, in the right eye and the tension fell to soft. When the 0.05-percent D.F.P. was cut to once a day, tension rose to a range of 20 to 26 mm. Hg and has remained there since.

The third patient was a 72-year-old white woman with chronic compensated glaucoma and fields at 10 degrees for 2/1,000 white. When she was first seen, tension was 29/45 mm. Hg (Schiøtz). The tension in the left eye did not fall below 35 mm. Hg on 2-percent pilocarpine nitrate, six times daily, 0.25-percent eserine, four times daily, or 1-percent carcholin, four times daily. The patient was then placed on 0.05-percent D.F.P., for the left eye, one time daily, and the tension

fell to 19 mm. Hg, where it has remained since.

In order not to convey a fallacious impression, it is necessary to present some of the disconcerting factors about this new and promising miotic. The above patients have been selected, and it is only right to state that in many cases D.F.P. has caused no reduction in tension. There are also objectionable features. Many patients complain of pain and blurring due, presumably, to the intense ciliary spasm caused by D.F.P. For this reason the aphakic patient seems happiest on the drug. More important than the above symptoms, however, is the fact that in one group of glaucoma patients the drug may actually be harmful. One of our patients, a 72-year-old white woman with chronic incompensated glaucoma, had her left eye fairly well controlled between 21 and 33 mm. Hg on pilocarpine, six times a day. Her gonioscopic picture showed a very shallow angle with the second portion of the trabeculum visible in areas. Corrected vision was 20/19 with a +2.25D. sph. ⊂ +0.75D. cyl. ax. 120°. Her fields were normal. On October 19, 1946, she was placed on D.F.P. once a day, and tension rose to 45 mm. Hg even though the miosis was maximal. The angle details were obscured to gonioscopy, and the patient was blurred with her glasses, but could read 20/19 unaided. The patient was maintained on pilocarpine, and her tension gradually fell to the range of 27 to 31 mm. Hg, but only after seven days did she require her glasses to read 20/19.

In this case it would seem that the D.F.P., either by its intense ciliary spasm or its action on the blood vessels, produced a narrowing of the angle which, coupled with the pre-existing narrow angle, produced a mechanical blockage of the trabeculum. We may conclude, therefore, that although D.F.P. is a useful weapon in the wide-angle group of the glaucomas, it should be used only with extreme caution in the narrow-angle glaucomas, since it may throw an additional burden on an already handicapped angle.

Posterior lenticonus

Dr. Lester Mermell presented a white child, aged 12 years, who came to the Infirmary in November, 1946, with the complaint that she could not see the pictures clearly at the theatre. Her uncorrected vision was: R.E., 20/70; L.E., 20/30. There were no gross findings, and her extraocular muscles apparently functioned normally.

Under atropine cycloplegia her correction was: R.E., 20/70 with a +1.25D. sph. ⊂ +0.75D. cyl. ax. 90°; L.E., 20/20 with a +1.00D. sph. ⊂ +0.50D. cyl. ax. 90°. A pinhole disc in front of the right eye improved the vision to 20/40—2.

At the time of retinoscopy there was a bright shining droplet in the center of the reflex. On slitlamp examination, it was found that the posterior pole of the lens bulged backward into the vitreous in a conical fashion. There was a small opacity at the apex of the cone and another at the center of the posterior Y. This was a case of what Prof. Ida Mann calls a rare lenticular anomaly, posterior lenticonus. This condition is not quite as rare, however, as internal lenticonus or as anterior lenticonus of which, according to Parsons, there have been only two cases reported.

As is the rule with this anomaly, the remainder of the eye is normal, the other eye is unaffected, and there is no familial history.

About 80 percent of recorded cases have a capsular opacity, as seen in this case, and many show a retained hyaloid membrane adherent to the cone. This finding is absent in this case. The exact etiology has not been determined.

Intermittent iris bombé

Dr. S. W. Penn presented a case of a 56-year-old white man, who, 26 years after an injury to his right eye, developed a very rapid failing of vision in his left eye. The sight in his right eye was lost at the time of the injury. The right eye was enucleated,

following which vision in the left eye returned to normal. The histologic diagnosis of the specimen was not obtained. The patient had no ocular difficulties until 28 years later when he developed an attack of acute iritis. In the following year, there were two similar recurrences, all of which responded to treatment. During the last episode the intraocular pressure became slightly elevated and remained so after the eye had become quiet. At this time it was noted that the pupil was 2 mm. in size and was partially occluded by a membrane which bulged slightly into the anterior chamber. There were a few fine keratic precipitates. Gonioscopy revealed marked iris bulging with no angle detail visible except at the 2-o'clock position where the scleral spur could be seen. The lens, vitreous, and fundus could not be seen.

Because of the persistent elevation of tension in a quiet eye, 2-percent pilocarpine was administered. Shortly afterward the eye developed an iris bombé with an acute further rise in tension, edema of the cornea, ciliary injection, and a heavy beam in the anterior chamber. The pupil was still 2 to 3 mm. in diameter. The eye again became quiet after the instillation of atropine, although the tension remained about 40 mm. Hg, with the anterior chamber returning to an average depth. Two similar reactions to miotics were cleared by administration of atropine.

The patient's vision has been 20/90 (Snellen) for the past three months. There is a central field of about 2 to 3 degrees with a small peripheral island temporally. There has been no fall in the tension below 40 mm. Hg except when seen two months ago. The most recent gonioscopic examinations reveal an angle closed by peripheral anterior synechias except at the 2-o'clock position where the scleral spur can be seen.

This case was presented as a secondary glaucoma due to chronic iridocyclitis, possibly a sympathetic ophthalmia, with an intermittent iris bombé following the use of miotics.

Successful cyclodiathermy in seeing eyes

Dr. J. David Stratton presented two cases in which cyclodiathermy had successfully reduced the intraocular pressure below 30 mm. Hg (Schiøtz) in eyes with useful vision.

Cyclodiathermy has been advised for relief of ocular tension in high degrees of rise due to absolute glaucoma and to closure of the central retinal vein. Its use in the seeing eye has not yet been wholly accepted.

The first case was that of B. L., a white woman, aged 58 years, who was first seen in the Clinic in December, 1945, with acute narrow-angle glaucoma of the right eye of five days' duration. An iridencleisis was performed, followed four days later by a posterior fistulizing operation of Lindner. These procedures were only temporarily effective, so that one month later a cyclodialysis was done at the 10-o'clock meridian. This was effective only temporarily, and a regime of pilocarpine miosis was instituted for one month. It, too, was ineffective. Cyclodiathermy was performed on February 25, 1940, two rows of coagulation being made over the entire lower half of the globe, 4 and 6 mm. from the limbus. Corrected vision before this was: R.E., 20/200; L.E., 20/20. Tension was: R.E., 43 mm. Hg; L.E., 20 mm. When the patient was discharged, vision was: R.E., 20/200−1; L.E., 20/20. Tension was: R.E., 31 mm. Hg; L.E., 20 mm. On April 5, 1946, tension was 23 mm. Hg, soft. From that time until October, 1946, the tension ranged around 40 mm. Hg in the right eye, so that a second cyclodiathermy was advised. This was performed on October 7, 1946. Vision at that time was: R.E., 10/400; L.E., 20/40. Tension was: R.E., 39 mm. Hg; L.E., 23 mm. The operation consisted of surface coagulation of seven spots over the lower half of the globe. Vision on November 15, 1946, was: R.E., 10/500; L.E., 20/32. Tension was: R.E., 27 mm. Hg; L.E., 24 mm.

The second case was that of M. B., a

white woman, aged 66 years, who was first seen in the Clinic in April, 1946, at which time she had narrow-angle glaucoma in the right eye with neovascularization of the iris. There was a history of four months' duration of failing vision and pain in the eye. Vision was: R.E., 20/70; L.E., 20/30. Tension was: R.E., 61 mm. Hg; L.E., 20 mm. Miotic therapy failed; so, in view of the neovascularization, cyclodiathermy was performed. On April 8, 1946, two rows of 12 diathermy punctures were laid down over the lower half of the globe. This reduced the tension only temporarily. On May 6, 1946, vision in the right eye was 20/130; tension was 69 mm. Hg. Cyclodiathermy was repeated, five applications being made over the upper globe from the 11- to the 2-o'clock positions. Tension has remained soft in the right eye, and vision is 20/250. Fasting blood sugar and repeated urinalyses have failed to reveal diabetes.

Double perforation of globe with BB shot

Dr. John Thompson presented a man, aged 29 years, who was seen for the first time at the Infirmary on November 5, 1946, and complained that a BB shot had penetrated his left eye accidentally on October 12, 1946. He was seen by a downstate ophthalmologist who hospitalized and treated him with penicillin and sulfonamides for three days. X-ray pictures were taken. No surgery was performed.

When admitted to the Infirmary, examination revealed a small, circular, depressed area, 1½ mm. in diameter, at the 11-o'clock position, approximately 5 mm. from the limbus. The base of this depression was discolored with uveal pigment. There was a one-plus beam in the anterior chamber but no cells were detected. The pupil was irregular due to posterior synechias, and a massive hemorrhage was seen in the posterior segment. The eye was soft to tactile tension. Vision was light perception and faulty projection.

X-ray studies with a Comberg contact lens showed a metallic foreign body in the orbit, posterior to the globe.

Scientific program

Dr. Justin M. Donegan and Dr. William R. Thomas (by invitation) presented a paper on "Capillary Fragility, Retinal and General: Rutin Therapy." Dr. Jack Fields (by invitation) read a paper on "Ocular Complications of Mumps," which was published in the Journal, 30:591 (May) 1947.

Richard C. Gamble,
Secretary.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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THE THIRD PAN-AMERICAN CONGRESS OF OPHTHALMOLOGY

The third congress of the Pan-American Association of Ophthalmology was held in Havana, Cuba, from January 4 to 10, 1948. The stage setting for the congress was one of great beauty and charm. The weather was kind, the occasion cheerful, the social activities were exquisite, and the scientific program was of high excellence. The experience is an unforgettable one to all of those who were fortunate to attend. The local committee, serving under the presidency of Dr. Tomas R. Yanes and the director general, Dr. Gilberto Cepero, had labored hard and long and at great expense to make the meeting a success from every viewpoint. In an endeavor of this size and importance, errors and delays are inevitable. It is evidence of the great skill and hard work of the committee that such errors were remarkably few and unimportant.

The total enrollment was 1,371. This included guests and "adherents," many of whom were beautiful, and at least 50 percent of those who attended were from the United

States. In addition to delegates from the Western Hemisphere, representatives of countries from all over the world were present and took active parts in the program.

Forty-eight courses of instruction, similar to those given during the meetings of the American Academy of Ophthalmology and Otolaryngology, were presented. Twenty-nine of these were given in English, the others in Spanish and Portuguese. A total of 144 hours of instruction was given by experienced teachers in their respective fields, and the courses were well attended. Approximately 45 scientific addresses were offered, and there were 35 "free" papers presented in addition. About 50 percent of the total were given in English and the others in French, Spanish, and Portuguese, the official languages of the congress. Many of the contributions were of great significance and value, and it is hoped that the majority of these will become available in the necessary translations to all members of the association.

The last day of the congress was designated as "Prevention of Blindness Day," and appropriate addresses were given during the morning under the able and charming presidencies of Mrs. Eleanor Brown Merrill of New York and Señora Doña Adela Formoso de Obregón Santacilia of Mexico. The medal of the National Society for the Prevention of Blindness in conjunction with the Pan-American Association of Ophthalmology was presented by Dr. Bandilio Courtis of Buenos Aires to Dr. Harry S. Gradle, formerly of Chicago, in recognition of his great service to the cause of prevention of blindness. Dr. Gradle, the president of the Pan-American Association, was regretfully unable to be present because of physical disability, and the medal was accepted in proxy by Dr. Frederick C. Cordes of San Francisco. The round medal, approximately the size of a silver dollar, is made of bronze and attached to a navy blue ribbon. On one side it reveals a figure of hands gracefully holding the sun, designed by Rockwell Kent, surrounded by the words, "National Society for the Prevention of Blindness, U. S. A." On the reverse side is a map of the Western Hemisphere and across it a scroll bearing the name of Harry S. Gradle, M.D., 1948. On the periphery is the wording, "For service in advancing eye health."

There were approximately 20 scientific exhibits displayed, each of excellent quality and a center of interest to crowds of observers. The physical arrangement of the exhibits was most attractive and satisfactory. A splendid scientific motion-picture program of some 35 titles was arranged. It was highly popular with the members and their guests. A commercial exhibit of considerable size was in evidence in front of the registration desk and included books, artificial eyes, drugs, instruments, and pieces of ophthalmic equipment, as well as the ubiquitous Coca-Cola man, whose refreshing wares slaked a thirst stimulated by excessive numbers of Daiquiri cocktails.

In a graceful ceremony on January 8th, Mrs. Helenor Wilder, representing the U. S. Army Medical Museum, presented its fine exhibit on "Unusual Tumors of the Eye" to the Department of Ophthalmology of the School of Medicine of Havana University. Likewise, the New York Eye and Ear Infirmary, through its representative, Dr. Edward Burchell, gave a collection of 100 microscopic slides, illustrative of ophthalmic pathology, to the university.

The above activities took place in the beautiful, modern Escuela de Medicina de la Universidad de La Habana. The facilities were adequate for all purposes and the arrangements were happy and spacious. Language difficulties were, of course, encountered, and many times were insurmountable. This was the only discordant note in the entire session. In justice to the local committee members, who had gone to so much expense and trouble to overcome the handicap of language difficulties, it must be said that arrangements had been made to translate the addresses and discussions onto lantern slides

through microfilm. The necessary projection apparatus did not arrive on time and their efforts and funds were wasted, which is a great pity. Much of the scientific value was thus, temporarily, lost to the members of the association.

On Sunday evening, January 4th, the formal opening of the congress took place in the beautiful National Capitol Building. His Eminence Manuel, Cardinal Arteaga y Betancourt, Archbishop of Havana, gave the invocation. The Honorable President of the Republic of Cuba, Prof. Ramon Grau San Martin, gave the official opening address to the congress. Among other addresses was that of Dr. Gilberto Cepero who introduced the official delegates from all countries to the congress. The ceremony was most colorful and impressive.

On Monday evening, January 5th, the honorary members of the association gave scientific addresses at the University of Havana. Among them were Bailliart of Paris, A. Fuchs and Lindner of Vienna, Arruga of Spain, Thiel of Germany, and Marquez of Mexico. The president of the University of Havana, Dr. Clemente Inclán Costa, opened the session; and Dr. Angel Vieta Barahona, dean of the Faculty of Medicine, closed it.

On Tuesday evening, the mayor of Havana, Dr. Nicolás Castellanos, held a gracious reception for the members and their guests in the lovely old town hall, or Municipal Palace, of Havana.

On Wednesday evening, in the impressive hall of the Academy of Sciences, a formal session was held, presided over by Dr. Jose A. Presno, the president of the Academy of Sciences. Dr. Derrick Vail of Chicago had the honor of giving the Harry S. Gradle Lecture. His assigned subject was "The Teaching of Ophthalmology," peculiarly appropriate for the first Gradle Lecture, named after that great teacher. Dr. Tomas R. Yanes presented the Pan-American Ophthalmological gold medals to Dr. William H. Crisp of Denver, and Dr. M. Uribe Troncoso of New York, for their scientific work and activities that are so important to ophthalmology of the Western Hemisphere.

In a surprise ceremony, Dr. Tomas Yanes was decorated with the flight surgeon's wings of the American Air Force, by Col. Victor A. Byrnes (MC), U. S. A., in recognition of his successful completion of the course in the U. S. School of Aviation, in 1930.

Dr. Gilberto Cepero, in an impassioned address, discussed the life of Carlos Finlay, former president of Cuba, ophthalmologist and discoverer, in 1881, of the cause of the transmission of yellow fever by Stegomyia fasciata. He pointed out in eloquent terms the fact that certain elements in North America have tended to forget Finlay's great contribution in favoring that of Reed, Carroll, Lazear, and Agramonte, who confirmed Finlay's discovery in 1900. It is just and right that this error be brought to our attention, for the name of Carlos Finlay, as a great benefactor to man, must not be forgotten or belittled. For his labor on behalf of Finlay, Dr. Cepero was decorated with the cordon of the order, Vasco Núñez de Balboa, by the government of Panama, in a colorful ceremony preceding his address.

On Thursday evening, January 8th, the National Medical College and the Medical Circle of Cuba gave a splendid buffet reception to the members and guests of the association. There was music and dancing and cheer.

On Saturday afternoon, the members enjoyed a luncheon on the terrace of the Jockey Club at the Oriental Race Track. It was an unusual sight to see so many distinguished ophthalmic surgeons thumbing through their pesos for wagers on their fancies, some of whom, surprisingly enough, won in the "Prevention of Blindness" and "Pan-American Congress of Ophthalmology" handicaps. However, as one member remarked: "It is easier to make money doing ophthalmology, but not nearly as much fun."

The final and most thrilling event that

closed a most outstanding congress was the fiesta held in the square of the cathedral flanked by old palaces of the Dons which retain, in spite of their commercial uses, the beautiful traditions of the past. In the balmy open air was set up a dancing platform and bandstand surrounded by tables. Floodlights illuminated the entire scene in unbelievable background, like a Hollywood motion picture. Many of the guests came in the colorful costumes of their countries. In the romantic atmosphere of the place, the ladies never looked lovelier nor the men more gallant, one's appetite for food and drink was sharpened, and the lavish entertainment of singing, dancing, and pantomime never could be more thoroughly appreciated nor enjoyed.

The next meeting of the association will be held in Mexico City in 1952. Dr. Conrad Berens of New York was elected president of the association. Vice-presidents were chosen from 12 of the participating countries. Dr. Thomas D. Allen (North America) and Dr. Moacyr Alvaro (South America) were elected secretaries. The president of the congress for 1952 will be chosen by his Mexican colleagues.

One's impressions of the Third Pan-American Congress of Ophthalmology are kaleidoscopic. It will take a very long time for them to be sorted out and catalogued, but the overall impression is one of great beauty, much truth, and considerable good will and pleasure.

Derrick Vail.

CORRESPONDENCE

Tracer-substance study of eye: Correction of discussion

In the December, 1947, issue of the Journal (30:1525-1526 (Dec.) 1947), there appears a discussion of the paper, "Studies on the Physiology of the Eye Using Tracer Substances," delivered at the 16th scientific meeting of the Association for Research in Ophthalmology.

Unfortunately this discussion was very poorly recorded by the stenographer, so much so that I shall have to ask for publication of the corrected text.

(Correct text of discussion, 30:1525-1526 (Dec.) 1947, Paragraphs 1 and 2.)

Dr. Vesey (New York): I would like to ask the speakers if they made any efforts to observe the route of outflow of the aqueous tracer substances from the anterior chamber.

It is today generally accepted that the route of outflow of the aqueous is through the system of Schlemm's canal via the trabecular tissue of the angle of the anterior chamber. Many arguments could be brought up against this theory, which cannot be discussed now.

Dr. Troncoso has beautifully shown that the lower animals, on which the experiments are usually carried out, do not have a structure resembling the canal of Schlemm. He showed that the Rodentia, the Ungulata, and the Carnivora do not have the canal of Schlemm, but that they have a ringlike spongy tissue in their ciliary body, which he termed the scleral sinus. He believes that this is the organ that carries the outflow of the aqueous in these animals. But, as I mentioned, many arguments could be brought up against the theory of filtration in the human eye, as it is accepted today. The experiments, however, should be carried out on Primate, whose eyes are built similarly to the human eye. If able research workers, like the ones who presented this paper, will make good efforts to observe the route of outflow, I believe our knowledge of the physiology of this very important subject would be quite a bit enhanced. I would like to hear something about that from the speakers.

Frank A. Vesey,
New York.

Predilection of left eyes for glaucoma

It was with great satisfaction that I read the comprehensive paper by J. C. Holst in the October issue of the Journal. His ap-

parently dry statistics are most stimulating and, due to the large amount of patients observed, really conclusive.

For me, the most interesting facts were those mentioned in the chapter "The first eye to be attacked." Among 1,040 glaucoma patients, Holst found 390 whose disease began in the right eye, while he found that it started in the left eye of 484; among 189 eyes presenting absolute or nearly absolute glaucoma not subjected to any operation, 87 were right eyes and 102 left eyes; among 109 patients with unilateral glaucoma, the left eye was involved in 119 cases, and the right in 77. According to Holst's cautious statement, these figures seem to indicate that the left eye is more prone to glaucoma than the right eye; for these striking differences, a tentative explanation might be suggested.

While the right innominate vein is shorter and straighter, the left one makes a longer and more bending way to reach the vena-cava-superior union. Therefore, we may expect differences in blood pressure and resistance inside the right and left jugular veins, as well as in their tributaries. Most probably, intravascular venous pressure in the left orbital veins may also be higher than in the corresponding vessels of the right side. And that may well be a contributing factor to the predilection for glaucoma in left eyes.

Similar considerations are valid for the explanation of unilateral glaucoma connected with unilateral nevus flammeus of the face, and with arteriovenous aneurysm. These facts fall well in line with an unconfirmed but interesting observation by Colomba (1938) who found increased venous-pressure values in patients suffering from primary glaucoma, and with the experimental intraocular-pressure increase following the provocative neck-compression test.

K. W. Ascher,
Cincinnati, Ohio.

BOOK REVIEWS

PRINCIPLES OF THE CONTACT LENS. By H. Treissman, M.B., B.S., F.R.C.S. (Eng.), D.O.M.S., and E. A. Plaice. St. Louis, C. V. Mosby Co. 1947. Clothbound, 88 pages, 40 illustrations. Price, not listed.

A description of the purpose and mode of action of contact lenses is adequately presented. Various types are discussed. The relative optical merits of spectacles and contact lenses are given. A resume of eye conditions in which contact glasses may possibly be used to advantage is presented optimistically. It is scarcely to be believed that all of the conditions mentioned would be suitable. Many seem rather bizarre; for example, symblepharon, pemphigus, ptosis with a crutch type of excrescence on the glass, neuroparalytic keratitis, and lagophthalmos.

A considerable part of this book is devoted to the method of testing by the ophthalmologist for a contact glass that may be used as a basis for constructing the final product. The method of making molds of such substances as Negocoll as models for contact lenses is dismissed as being inferior to that of using the contact trial case. Since molding is the method generally used in America, most United-States ophthalmologists may not be deeply interested. The now generally used plastic contact glasses, after being evaluated, are dismissed without strong recommendation.

On the whole it is questionable whether the book will be of great importance to American ophthalmologists.

Lawrence T. Post.

A SCIENTIFIC METHOD OF FITTING CONTACT LENSES. By Philip Salvatori. New York, N.Y., Philip Salvatori, 1947. 170 pages, index, and 88 illustrations. Price, not listed.

This book is an elaborate and detailed manual on the technique of the mold method

of fitting contact lenses. It should be a welcome edition to the ophthalmologist's and technician's library. The author is certain of his subject and has brought it completely up to date. The writing is concise and lucid, and the text is well illustrated. The book is not cluttered with descriptions of outmoded methods. Illustrations and descriptions of molding and final adjustment are detailed enough so that, if followed, unsatisfactory fits will be reduced to a minimum.

One criticism can be made. Encouraging technicians to mark loose or tight areas in the hope that the manufacturer can accurately relieve them is certainly misleading.

The subject of contact lenses needs continued investigation. There is further need of public education as to their usefulness. It is stressed that contact lenses will continue to be fitted but the extent to which this will be done is questioned.

Indication for contact lenses at the present time is quite definite, and many misconceptions held by the public stem from ignorance. Poor technical fittings have discouraged potential users. Those patients, who obtained contact lenses as a fad, are also a source of adverse publicity. Few from this group are willing to expend the effort required to develop a tolerance to their lenses or to try numerous solutions in order to find a suitable one.

Francis W. Parker.

CONTACT LENSES. By Theodore E. Obrig. Philadelphia, The Chilton Company, 2nd edition, 1947. 546 pages. 180 figures, bibliography, and index. Price, not listed.

The author is a recognized authority on contact lenses. He has developed many innovations and techniques and, through his teachings, has done much to popularize the use of these devices, particularly the plastic type of contact lens. His work shows evidence of much scholarship, research, and study.

Contact lenses are still in the process of evolution. It is not inconceivable that in the near future these lenses will be developed so that they can be easily fitted and comfortably worn, for as long as the individual may desire, without harm. At the present time this ideal has not been reached, although closely approached. The struggle to obtain a satisfactory solution for the "liquid lens"; that is, the part between the cornea and contact lens, is an example of the difficulties encountered. The author ably writes of these difficulties and gives an interesting history of his efforts to obtain such a liquid.

The problem of whether to use plastic material, glass, or part glass and plastic is another controversial one that is being worked over. The subject is in a healthy state of flux and has not yet settled to the bottom. Although he is the prime advocate of the molded method of manufacturing contact lenses, the author fairly discusses the contributions of other workers and their methods of fitting. This temperate and considered writing is attractive and scientific, and is quite in contrast with other volumes on the subject that have recently appeared.

The indications for contact-lens use are perhaps unduly comprehensive and enthusiastic, in view of the present state of the development. There is, however, little to quarrel about here, provided no injury to the eye will result from wearing the lens. Should the problem be solved and the ideal reached, it will make nearly obsolete, and overnight, the wearing of spectacles. The glitter, gleam, and sparkle of the human eye will be enhanced with unforeseen biologic results; and the entire male population, insofar as its eyes are concerned, will be available to destroy each other with greater efficiency in warfare.

Mr. Obrig has written an entertaining and instructive book.

Derrick Vail.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Amsler, M. **Liquids of the eye as part of the body lacunary system.** Ann. d'ocul. 180:418-429, July, 1947.

The body space units which form the lacunary system have much in common. The interstitial tissues of the subconjunctiva and the subchoroid as well as the anterior chamber form parts of this system. These spaces contain very little protein, but carry nourishment, especially in mineral salts, to almost all parts of the body. The liquid in these spaces represents about 20 percent of the body weight and in composition is between the blood plasma and the cellular protoplasm. This lacunar fluid is especially important in the nourishment of the avascular ocular tissues, the cornea and the lens. It is an important factors in uveitis, primary glaucoma, hypertensive and diabetic retinopathies and retinal periphlebitis. In perforating wounds, ciliary permeability is tremendously increased. Eczema, bronchial asthma, epidemic hepatitis, gastric ulcer, and rheumatoid polyarthritis are among the bodily diseases in which the permeability of the blood barrier is affected.

The Tyndall phenomenon is present in the normal aqueous which demonstrates that the blood barrier is permeable to some proteins of the blood plasma. Through the intravenous injection of fluorescein, the ciliary body has been found to be the principal source of the lacunar liquid of the eye. Normally impermeable to large protein molecules, the ciliary blood barrier may permit these to pass into the aqueous under certain conditions. When ciliary permeability is altered the change is usually primarily toward augmentation. The normal albumin content of the aqueous (0.3 to 0.5 percent may be increased to 6 percent in inflammations of the anterior uvea. The aqueous closely resembles the cerebrospinal fluid in its normal composition and also in its reactions to inflammation. The cytolytic properties of the aqueous are illustrated by the frequent rapid disappearance of hypopyon. The reactions of Besredka, Bordet-Wassermann, and Chediak have repeatedly been found positive in the aqueous. The aqueous may contain: 1. blood cells, polymorphonuclear leuco-

cytes, lymphocytes, and red blood cells; 2. desquamated tissue cells of the parts surrounding the aqueous, including corneal endothelium and iris epithelium; 3. reticuloendothelial cells; 4. cells of uncertain origin, probably interstitial tissue elements including cellular debris of different sorts. All of these cells are involved in the local defense mechanism of the interior of the eye. In 20 percent of a series of cases of chronic uveitis, large reticulo-endothelial cells were found in the aqueous. Bacterial cultures of the aqueous are rarely positive. With the ultra microscope, affording a magnification of 1300 diameters, colloid particles in suspension were easily seen and an intense Brownian movement and the Tyndall reaction were observed.

Chas. A. Bahn.

Leplat, G. **Ocular reticulo-endothelial tissue.** Ann. d'ocul. 180:385-391, July, 1947.

The reticulo-endothelial system plays an important part in the action of sulphonamids, choline and atropine as well as some infectious diseases such as tuberculosis. Among the rarer diseases which involve the eyes and in which it plays an important part are hemophilia, familial angiomotosis, and some purpuras, lymphogranuloma benign, (Besnier-Boeck-Schumann), Gaucher's disease and the syndromes of Niemann-Pick, and Hand-Schiller-Christian.

The reticulo-endothelial system includes: 1. the histiocytes which ordinarily live in loose connective tissue and include macrophages which are rarely increased in acute inflammations; 2. monocytes of the blood which can live in the vessels and become histiocytes; 3. the lining cells of the endothelial sinuses especially in the spleen and the bone-marrow; 4. reticular cells which with the reticular fibers form the reticular tissue which is found especially in the spleen, bone-marrow, and lymphatic organs; 5. the cells of Kupfer in the liver; 6. fatty histiocytes which become fat cells: 7. adventitial cells of the blood and lymph vessels; 8. other histiocytic cells located in different parts of the body which include the alveolar cells of the lung and the microglia of the nervous system.

The reticulo-endothelial system is also called the histiocytic system and the active mesenchyme. In the eye its cells are most numerous in the bulbar conjunctiva, and uvea, especially the ciliary processes, are rare in the sclerotic, and absent in the cornea, lens, retina and optic nerve. The cells may take the form of endothelial and giant cells. Their power of mobility is less important than their ability to accumulate in their cytoplasm many and varied substances including solutions and fine suspensions among which are senescent red and other cells. Histiocytic cells contain a relatively high lactic fermentative power or glycolysis which gives them an energy capacity greater than most other cells and enables them to survive in abnormal media. They play an important part in the metabolism of iron, lipids, cholesterol and vitamins C and D. Chas. A. Bahn.

Oggioni, Gianfilippo. **Chronaximetric studies in ophthalmology.** Riv. oto-neuro-oftal. 26:333-352, Sept.-Dec., 1946.

The writer reviews the literature on chronaxia and gives an integrated account of its significance in the understanding of ophthalmologic physiology and pathology. Melchiore Lombardo.

Vidal, F., Brodsky, M., and Travi, O. C. **Carbaminoylcholine and ophthalmotonus.** Arch. de oftal. de Buenos Aires 21:328, Oct.-Nov., 1946.

The authors studied the action of carbaminoylcholine on the tension of eyes with retinal angiosclerosis. The instillation of one drop of 0.33-percent solution

of carbaminoylcholine chloride preceded by two drops of desiccated ox bile in 1-percent solution bring about changes in the intraocular pressure characterized mainly by a retardation of the capillary venous drainage and a decrease or absence of the secondary fall in pressure of the veins of distribution. (Charts, bibliography.)

Plinio Montalván.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Boström, C. G., and Kugelberg, I. **The official methods of testing color sense in Sweden.** Ophthalmologica 114:95-99, Aug., 1947.

As the result of actions taken by the Swedish State Department of Health, the methods of testing color sense in Sweden have become farily well standardized. All routine tests are made with two different sets of pseudo-isochromatic plates, namely the internationally known plates designed by Göthlin and Boström and a new set of plates designed by Boström and Kugelberg in 1944. This new series consists of 20 plates. Three of these show no pattern of any kind and are intended for the diagnosis of dissimulation. The other 17 plates show numbers or letters made up of two confusion colors appearing in three different brightnesses. Because of the rare occurrence and the practical insignificance of tritanomaly or tritanopia, the recognition of these conditions is not attempted. The plates are to be viewed in good daylight. Each pattern must be recognized in less than 15 seconds. The plates do not seem to fade. They are available from the Kirugiska Instrument Fabriks Aktiebolaget KIFA Stockholm.

Questionable cases are tested with an apparatus which permits the production of accurate mixtures of spectral colors.

Peter C. Kronfeld.

Carreras Matas, Marcelo. **Subjective optometry.** Arch. Soc. oft. hisp.-amer. 7: 710-718, July, 1947.

An easy, accurate and rapid method for measuring astigmatism is described. The author's device only consists of a bicylindrical lens and a linear object test.

J. Wesley McKinney.

Esteban, Mario. **Semiologic value of the abnormal chromatic sensations.** Arch. Soc. oft. hisp.-amer. 7:687-702, July, 1947.

The normality of the chromatic sense depends upon a perfect relation between the stimulus which comes from outside and the sensation created by it within the brain. Many times this relation is either not exact or erroneous. For a better understanding the author divides this study into three parts. (1) Imperfect chromatic perception. (2) False and erroneous chromatic perception. (3) Imaginary chromatic sensations. Each one of these divisions is illustrated with examples which make the subject more clear.

J. Wesley McKinney.

Hildreth, H. R., Meinberg, W. H., Milder, B., Post, L. T., and Sanders, T. E. **The effect of visual training on existing myopia.** Am. J. Ophth. 30:1563-1576, Dec., 1947. (3 tables, 1 chart, 3 references.)

Paufique, Bonamour, and Cavalieri. **Black light in the fitting of contact glasses.** Ann. d'ocul. 180:416-418, July, 1947.

After the instillation of a 2-percent fluorescein solution, the eye with the contact lens is exposed to the radiation of black light in a dark room. If the contact glass does not adhere locally no black spot is visible. If, however, there are points of pressure contact, the fluorescent film is locally interrupted, and a black spot is visible.

The lamp used is a Mazda MA 300

mercury type with a suitable transformer. The waves transmitted are between 2900 and 3200 AU and the use of this light is without danger to the eye. (4 figures.)

Chas. A. Bahn.

Sal Lence, J. **Axone communication between the centripetal and centrifugal fibers of the retina and intimate phenomena of vision.** Arch. Soc. oft. hisp.-amer. 7:683-686, July, 1947.

Among the changes produced in the retina by light stimuli are the following: visual purple is blanched, the rods become shorter and narrower and the cells of the pigment epithelium send protoplasmic processes around the rods and cones. According to the author's concept this process is a physiologic allergy. The changed visual purple is looked upon as a sensitizer which acts upon the sensory endorgans of the retina and initiates the nervous impulse which is carried to the brain over the ascending fibers of the optic nerve. In turn impulses are sent back to the retina by way of the centripetal or retinomotor fibers and these impulses produce the secondary changes in the pigment epithelium and visual cells as an allergic response.

J. Wesley McKinney.

Van Wien, Stefan. **The sodium-vapor lamp and its use for refraction.** Am. J. Ophth. 30:1527-1535, Dec., 1947. (1 figure, 2 tables, 18 references.)

5

DIAGNOSIS AND THERAPY

Bellows, J. G., and Farmer, C. J. **Streptomycin in ocular infections.** J.A.M.A. 135:491-495, Oct. 25, 1947.

The literature on the use of this drug in ocular infections is still very scanty. Though not substantiated by sufficient laboratory data those reporting their results feel that streptomycin should be added to the usual treatment because of the shorter healing time following its use. In experimental animals huge systemic doses are required to make the antibiotic detectable and even then the concentration probably is at a therapeutically inadequate level. Neurotoxic disturbances might occur if such doses were used in man. High concentrations of streptomycin in the conjunctival sac are obtainable instantaneously by instillation. Adequate concentrations in the aqueous follow the use of a wetting agent or iontophoresis in cases of abraded, infected, and even normal corneas.

Bacillus pyocyaneus was rubbed against the abraded cornea of rabbits. Streptomycin, 10,000 micrograms per cc. in isontonic salt solution was instilled three times at two-hour intervals in different rabbits two, four, six, eight, and twenty-four hours after the innoculation. When the antibiotic was used in the first six hours the infection was prevented in all animals in which the control corneas became destroyed. Streptomycin was considered unexcelled as a therapeutic agent in this type of infection.

Rabbits in which streptomycin used systemically after the vitreous had been inoculated with staphylococcus aureus were unaffected. Vitreous abscess did not form when intravitreous injections were given within six to eight hours after inoculation.

In acute and chronic conjunctivitis where known organisms were found before treatment the sacs became sterile after a few days of instillation therapy. A case of acute meningococcus conjunctivitis responded very well.

Organisms disappear rapidly in most cases of acute and chronic infections of the conjunctiva and cornea; healing generally is prompt if complicating factors are absent.

F. M. Crage.

Camera, J. A. de C. **A new ocular fixation forceps.** Arq. brasil. de oftal. 10:64-66, 1947.

The instrument, well illustrated in the author's article, is designed to obtain episcleral or scleral fixation in such a way as to avoid rotation of the eye. It has three blades, a T-shaped central blade with two sharp points, and two lateral pointed blades which are approximated so as to grasp the central blade. All points coöperate in the grasp of the sclera.

W. H. Crisp.

Cibis, P., and Kimmig, J. **Alloplastics in ophthalmology with Supramid.** Klin. Monatsbl. f. Augenh. 112:75-79, May, 1947.

The superpolyamid Supramid is a new thermoplastic synthetic material which has a certain resemblance to the protein molecule in chemical structure but which is resistant to protein splitting ferments. The authors used this material in 74 plastic operations in the ocular and facial region and found that in 71 cases there was healing without complications. In two-thirds of the patients the material was used for making a plastic stump after enucleation of the eye with attachment of the four recti muscles to the stump. Substitution for bony defects around the orbital rim, substitution for the zygomatic bone, support of the lower lid, and a ptosis operation comprise another third of the reported cases.

Max Hirschfelder.

Milletti, M., and Di Luca, G. **Arterial pressure of the retina and compression of common carotid artery.** Riv. oto-neuro-oftal. 22:1-31, Jan.-Feb., 1947.

Experiments were performed by the writers on 42 subjects whose age ranged from 15 to 75 years, in order to establish the diastolic pressure in the retinal artery on compression of the ipsolateral common carotid artery. This behavior is considered a measure of the adequacy of the collateral blood supply of the brain. The writers established the retinal index of cerebral compensation according to a formula in which the normal diastolic pressure and the diastolic retinal pressure after compression for two minutes are factors. This index is applied in the prognosis of ligature of the common carotid or the choice of a method for this surgical procedure. If the index is not above 20 the cerebral compensation is good and ligature by any method is permissible. If the index varies from 20 to 50 cerebral compensation is not as good and preference should be given to those methods of ligature which cause the gradual occlusion of the vessel; if the index is above 50 the ligature may be dangerous. (Bibliography.)

Melchiore Lombardo.

Missiroli, Giuseppe. **Diagnosic and prognostic investigation with allergometry in ocular tuberculosis.** Boll. d'ocul. 26:31-42, Jan., 1947.

Tuberculin tests were given to 309 patients with a preparation called M.D.C. terr. Instituto Carlo Forlanini, similar to our PPD. Intradermal injections were performed, using dilutions between 1:100 and 1:10,000,000. If a papule measuring more than 8 mm. in diameter was found 48 hours after the injection the reaction was considered to be positive. The diagnoses of the patients were: two Parinaud conjunctivitis, three ulcerative conjunctivitis, four deep keratitis, 14 episcleritis and scleritis, 22 choriorentinitis or choroiditis, 264 iridocyclitis and uveitis. Two tables describe the reactions grouped according to diagnosis and dilution of the tuberculin used and the course of the eye disease compared with the degree of intradermal reaction. Most of the positive reactions were found in tests with dilutions between 1:100,000 and 1:2,000,000:

some of the patients with uveitis gave positive reactions with dilutions up to 1:10,000,000. During the protracted observation, clinically improved patients showed diminishing reactivity sixteen times and stationary readings three times; those with clinical deterioration had stationary readings three times and increase of reactivity five times. In stationary cases there was no change in reactivity eight times, increase four times, and decrease of reactivity five times. K. W. Ascher.

Missiroli, Giuseppe. **Therapeutic study of ocular tuberculosis using allergometry.** Boll. d'ocul. 26:43-53, Jan., 1947.

Thirty-two patients suffering from ocular tuberculosis were desensitized with tuberculin injections of increasing strength. The brand used was "M.D.C. terr., Instituto Carlo Forlanini." The diagnosis was uveitis in 23 patients, choroiditis in 4, episcleritis and keratitis in 2, recurrent vitreous hemorrhages in 2, and keratitis in one. The treatment was continued for 6 to 29 months. Three patients with uveitis and one with keratitis were considered to be cured; four with uveitis, one with choroiditis, one with episcleritis and keratitis, and one with vitreous hemorrhages were not; all others showed some improvement. In the favorable cases, the clinical improvement was seen to coincide with the decrease of cutaneous tuberculin reactivity; the unfavorable cases demonstrated lack of desensitization to tuberculin. (Table). K. W. Ascher.

Muhlman, V., and Lachman, R. **The methyl antigen in ophthalmology.** Arch. de oftal. de Buenos Aires 21:334, Oct.-Nov., 1946.

After briefly describing the method of preparation of the methyl antigen, the authors discuss the frequency of ocular tuberculosis and the specific action of the antigen. It is an innocuous form of medication which produces no untoward general, local, or focal reactions and whose beneficial effects are apparent after a few injections. The treatment, however, must be carried out over a long period of time because of the transient effect of the antigen. (Bibliography.)

Plinio Montalván.

Vidal, F., Brodsky, M., and Travi, O. C. **Influence of emotion on the neurocapillary test.** Arch. de oftal. de Buenos Aires 21: 348, Oct.-Nov., 1946.

Emotion interferes with the neurocapillary test by producing arteriolar constriction, secondary capillary activation and slight functional retardation in the venous system. (1 chart, bibliography.)

Plinio Montalván.

6

OCULAR MOTILITY

Argañaraz, Raúl. **Convergent and divergent strabismus. Esotropia and exotropia. Medical and surgical consideration.** Arch. de oftal. de Buenos Aires 21:67, April-June, 1946.

The author discusses the different types of strabismus. Functional divergent strabismus usually begins in infancy and is accompanied by myopia in most of the cases. The anatomical factors involved make the surgical correction rather difficult. The mechanism of divergent strabismus that results from amblyopia is briefly discussed. Divergent postoperative strabismus generally appears some time after a tenotomy of the internal rectus and results from the retraction of the cut muscle. This type of strabismus is difficult to correct. Spasmodic divergent strabismus is due to spasm of the inferior oblique, and tenotomy of this muscle is the only operative procedure for correcting it. Paralytic strabismus is frequently the result of obstetrical trauma in instrumental delivery. All convergent strabismus that appears at birth is paralytic

and the external rectus is the muscle most commonly affected. In the surgical treatment the different operative procedures and their indications and contra-indications are discussed. The medical and surgical treatment of functional convergent strabismus in infancy, including the pharmacologic, optical, orthoptic and operative treatment is summarized. (Illustrations.) Plinio Montalván.

Braun-Vallon, S. **The non-operative treatment of concomitant strabismus.** Ann. d'ocul. 180:391-403, July, 1947.

An evaluation of British and American methods are presented, based on observations by the author in both countries. Non-operative treatment is indicated in deviations of less than 25 degrees in intelligent young persons. If the amount is greater, surgical treatment may be performed either before or after nonoperative treatment which becomes an important adjunct. Generally speaking, orthoptic treatment does not justify itself if binocular vision cannot be reasonably developed in two months. Ametropia should be fully and accurately corrected. In hypermetropia with exotropia, refractive correction has but little effect on the muscular imbalance. If the accommodative factor is predominant, bifocals may be of value to the very young with alternating esotropia. Occlusion of the better seeing eye with a cover or bandage often is of value if vision is subnormal after refraction. Its value is limited especially in the very young with central scotomas which are frequently not easy to detect. Visual acuity should be observed approximately every ten days if a monocular cover is used continuously, because of functional or structural amblyopia in the covered eye. Abnormal retinal correspondence is detected preferably with the after-image test of Bielschowsky though the amblyoscope may be used. The amblyoscope's big brother is the synoptophore. Favorable cases of abnormal retinal correspondence may be greatly improved after approximately 12 treatments which require about a month. Binocular visual education includes the exercises to develop simultaneous macular perception, prolonged simultaneous macular projection, and stereoscopic fixation.

Chas. A. Bahn.

Cross, A. G. **Neuromuscular aspects in ocular sequelae of head injuries.** Tr. Ophth. Soc. U. Kingdom 65:20-33, 1945.

The most important sign in head injury is the pupil which, having been normal immediately after the injury is found to become dilated and fixed within a short period. This is probably due to pressure on the third nerve center in the midbrain or to traction on the nerve trunk occurring on the same side of the injury at first and later on the opposite side. The Argyll-Robertson pupillary reaction may be associated with injuries which involve the base of the brain. Defects of convergence and accommodation were found frequently and were considered to be due to a lesion in the brain stem or third nerve but frequently no organic cause was present. Recovery was hastened by orthoptic treatments after the stage of fatigability was over. Abnormality of the extraocular muscles was the commonest of the sequelae. The lesion was a paralysis or paresis of one or more of the oculomotor muscles and resulted in double vision. Vertically acting muscles were found to be more commonly affected than the lateral rectus. The superior rectus was involved in 24 percent, the superior oblique in 21 percent and the lateral rectus in 11 percent of the patients with isolated muscle defects. A surgical procedure is indicated if diplopia persists for more than four months and proves a disability to the patient. (33 figures.)

Beulah Cushman.

McGuire, W. P.: **The surgical correction of paresis of the superior oblique.** Tr. Am. Ophth. Soc. 44:527-549, 1946.

The author discusses thoroughly the anatomy, physiology, pathologic physiology, and the etiology of paresis of the superior oblique muscle. He describes an operation that is essentially a modification of Wheeler's advancement operation for paresis of the superior oblique muscle in which he resects the desired amount of the tendon, and then reattaches the cut end of the tendon to the original insertion. With adequate exposure by means of a traction suture pulling the eye down and in, the difficulties of access to the tendon are minimized. Instead of applying surgical maneuvers to opposing muscles, one should logically attack the paretic muscle itself. C. D. F. Jensen.

de Vega y Fernandez-Crespo, R. **Ocular paralysis following spinal anesthesia.** Bol. Inst. path. med. 11:140-143, July, 1947.

A case of this unfortunate association is presented which occurred in a 24-year-old man. About a year previously a painful area developed and later a mass appeared which was diagnosed as a cyst of the internal lateral ligament of the right knee. It was readily removed under spinal anesthesia. The convalescence was without incident. Fifteen days later a sudden convergence of the left eye developed, due to a paralysis of the externus. Intensive vitamin medication, especially of the B complex was given and after two weeks recovery was complete.

Although several hundred similar cases have been reported, this complication is comparatively infrequent in the widespread use of spinal anesthesia. Novacain was employed, and its toxic action seems to have been exerted upon both the substance and central nucleus of the abducens nerve. Vitamin treatment is suggested because of its action in other types of neuritis. The dosage should be high and preferably by injection, even when no other evidences of vitamin deficiency can be discovered.

A. G. Wilde.

Weil, H. **Krecke and Donders on prisms in orthoptics.** Optician 114:247-253, Oct. 10, 1947.

Krecke is credited with being the first to suggest prisms in orthoptic treatment. The paper, published in 1847, has never been published in English. It is in two parts—Krecke's original suggestion and a postscript by Donders.

W. Krecke. A new prismatic lens for squinters.

Squinting occurs because the eye is unable to see for lack of exercise. If the eye could be stimulated and became accustomed after adequate training to refract light rays onto corresponding points of the retina so that the visual axes approach their natural position; if one could proceed in a step by step procedure until the axes revert to their natural position; and if by use of a prism this means could be used for the adjustment of the visual axis in strabismus, then it may be expected that in time the axis will move permanently and will retain a natural position.

The squinting eye should be trained to see by covering the other eye. When sufficiently trained, the angle of squint may be measured by having the patient look at a disc placed midway between the eyes and at the greatest distance in which the patient is able to see. Prisms are then placed before the squinting eye. The lens can be mounted in a spectacle frame and worn with a plano lens for the other eye. The power of the prism is gradually reduced, until a plano lens is used and the patient is cured. The prismatic correction may be devided between both eyes to reduce chromatic aberration.

Donders, F. C. The application of

prismatic lenses to the cure of squinting physiologically tested.

When prisms are used to refract images on to nearly corresponding points on both retinas, the squinting eye will change the direction of the visual axes and merge the double images into one. There must be no paralysis, severe amblyopia or rapid fatigue of the retina. There must be good ocular motility. If one places small prisms before the eyes, the double images will merge. The prism is a means of increasing muscle activity in the opposite direction to that of the squint, for ocular gymnastics after myotomy and as an aid in proper muscle development.

Irwin E. Gaynon.

7

CONJUNCTIVA, CORNEA, SCLERA

Cuntz-Schuessler, E. **Two families with an unusual hereditary corneal dystrophy.** Klin. Monatsbl. f. Augenh. 112:70-75, May, 1947.

The author discusses the German literature on the subject of corneal dystrophy. She then discusses two patients belonging to different families who exhibited a corneal dystrophy with pathologic changes in all layers of the cornea. Other members of these two families who had a lesser degree of dystrophy had only mild changes of the endothelium, whereas the young patients described had also opacities in the interstitial parts and epithelial defects. The cases are related to the juvenile epithelial dystrophy of Kraupa and the bullous endothelial dystrophy of Schlichting.

Max Hirschfelder.

Doggart, J. H. **Modern views on and treatment of phlyctenular conjunctivitis.** Medical Press 218:275-276, Sept. 24, 1947.

Regardless of what relationship this disease has with tuberculosis, and there is much disagreement on this subject, the incidence of this form of keratitis has declined rapidly and progressively. The disease and its clinical diagnosis are described in detail. About 65 percent of the patients are girls. Relapses are the rule in neglected cases. The discussion of the etiology is concerned chiefly with tuberculosis. There is doubt in crediting the decline in the prevalence of the disease to higher nutritional standards. The ocular disease is probably an allergic manifestation of tuberculosis. Local treatment is limited to atropine, dark glasses and mercury oxycyanide. Penicillin, because of its sensitizing effect, is contraindicated. The importance of the character of food and surroundings is stressed.

Francis M. Crage.

Esterman, B., Laval, J., and Okrainetz, C. **Intraepithelial epithelioma of the cornea and conjunctiva. (Bowen's disease).** Am. J. Ophth. 30:1537-1540, Dec., 1947. (4 figures, 6 references.)

Hogan, M. J. **Conjunctivitis with membrane formation.** Am. J. Ophth. 30:1495-1510, Dec., 1947. (12 figures, 1 table, 58 references, discussion.)

Mata, Pedro. **Penicillin in the treatment of serpiginous corneal ulcer.** Arch. Soc. oft. hisp.-amer. 7:641-660, July, 1947.

The author reports in detail 30 cases of serpiginous corneal ulcer successfully treated by means of penicillin. Pure penicillin was used in instillations containing 1,000 to 10,000 units per cc. The drops were put in every half hour until the ulcer was healed and many times they were continued for three or more days afterwards. In severe cases, for instance those which were complicated with hypopyon, penicillin was given by means of iontophoresis and subconjunctival injection in doses of 2,500 to 6,000 units per cc. The iontophoresis took two to four minutes

and was repeated when necessary. At the same time large doses of vitamin C were given because of its beneficial effect upon the infection and especially the hypopyon.

J. Wesley McKinney.

Pasca, Giacomo. **Further contribution to knowledge about the so called epidemic keratoconjunctivitis, concerning a thousand more cases observed in Sassari in 1943-1944.** Boll. d'ocul. 26:54-64, Jan., 1947.

Pasca reported previously about some cases of epidemic keratoconjunctivitis observed in Sassari, Sardinia. The present paper is a continuation and completion of this report. A much larger material (1000 patients) is used. (A graph shows the distribution of morbidity with a peak that occurred in September, October and November of 1943). Treatment consisted of the application of 2-percent solution of silver nitrate to the conjunctiva and the administration of urotropine (hexamethylentetramine) orally or parenterally. The silver salt was used every other day and in the intervals 5-percent solutions of silver protein were instilled three times a day. Conjunctival discharge disappeared within three to six days. Corneal lesions seemed to be inhibited. Where lesions showed fluorescein stain, Pasca used an eye dressing which he also recommends when there is marked chemosis but no discharge. Corneal involvement is more common in adults; of 274 patients aged less than 10 years, only 49 had corneal lesions whereas 83 of 182 patients older than 40 years had corneal lesions in 83 cases. Pasca stresses the occasional appearance of phlyctenule-like perilimbal nodules and of subconjunctival hemorrhages. Sometimes the preauricular gland was enlarged.

K. W. Ascher.

Sédan, J. **Fistulas of the cornea.** Ann. d'ocul. 180:404-416, July, 1947.

Secondary glaucoma is the cause and not the result of obstruction to corneal fistula. Quantitative and qualitative changes in the aqueous which follow prolonged fistulization result primarily from a mild hypertensive form of uveitis. The aqueous in passing through the cornea produces a form of corneal edema in which the adjoining corneal tissue is poisoned. This predisposes to secondary glaucoma both by way of the hypertensive form of uveitis and the keratitis surrounding the fistula. The stage is thus set for actual secondary glaucoma of varying severity by any interference with the normal intraocular secretion or exit of the fluid from the eye. The same predisposition frequently results in secondary endogenous or exogenous infectious inflammations. The practical application of this concept is that all corneal tissues diseased in the above sense, must be removed to make normal, if possible, the uveal secretion and its exit from the eyeball. Four illustrative cases are cited in one of which treatment was successful. In this case all the diseased tissue surrounding the fistula was destroyed by cauterization, and the area was covered with a conjunctival flap. The author has had no experience, with keratoplasty, though he believes the same principles would apply. (4 figures.)

Chas. A. Bahn.

Vancea, P. **Role of nasopharyngeal infections in the resistance to treatment of certain cases of conjunctivitis.** Arch. d'opht. 7:277-280, 1947.

Vancea calls attention to the problem of conjunctivitis which is either unaffected or made worse by ordinary therapeutic measures. He notes that this type of conjunctivitis is usually associated with nasopharyngeal infection; in 27 such conjunctivitides he found nasal abnormalities present in all. Appropriate treatment of the nose and nasopharynx, along with conjunctival instillations of 1-percent

resorcin or 2-percent ephedrine, led to healing in from one to four weeks. Vancea speculates on the etiological connection between the conjunctival and nasopharyngeal infections and considers bacterial allergy the probable mechanism.

Phillips Thygeson.

Walsh, F. B., and Howard, J. E. **Conjunctival and corneal lesions in hypercalcemia.** J. Clin. Endocrin. 7:644-652, Sept., 1947.

About one-half the cases of hypercalcemia examined have shown conjunctival and corneal lesions seen only with the aid of the slitlamp. The conjunctival lesions are small glasslike crystal particles seen within the bulbar conjunctiva in the region of the palpebral fissure. Redness and irritation may occur, the latter may even be the patients' most annoying symptom. In one case of hyperparathyroidism the particles were probably calcium phosphate.

The corneal changes are grayish granular epithelial and subepithelial opacities concentric with the limbus on nasal or temporal sides or both. The opacity is densest at the periphery but may faintly involve the whole cornea. Unlike band opacity which it may sometimes resemble, these lesions of hypercalcemia have clear areas within the area of opacity. Some of these cases may have been erroneously reported as "primary" band keratitis. Arcus senilis is deeper and manifests the white limbus girdle described by Vogt.

Conjunctival deposits were seen associated only with hyperparathyroidism and vitamin D poisoning in eight out of twenty patients with hypercalcemia. Associated keratitic lesions were seen in four patients with vitamin D poisoning and renal insufficiency. Combined with the author's report is that of seven similiar findings in cases reported by Cogan and his associates. Except for the hypercalcemia the metabolism was undisturbed. Two patients with sarcoid had corneal lesions. The conjunctival lesions cleared in two cases after the hypercalcemia was corrected. The corneal lesions have been permanent. F. M. Crage.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Focosi, M. **An interesting case of chorioretinitis Jensen associated with interstitial keratitis.** Boll. d'ocul. 26:1-6, Jan., 1947.

Different etiologic factors were assumed in the pathogenesis of juxtapapillary chorioretinitis (Jensen), among them tuberculosis, multiple sclerosis, unknown virus, influenza and syphilis. Focosi reports the case of a 25-year-old male patient who, during the course of a bilateral interstitial keratitis, developed a unilateral juxtapapillary retinochoroiditis. Serologically positive, the patient was considered to be a congenitally luetic individual and this disease was assumed to be the etiological factor for both the keratitis and the fundus lesion.

K. W. Ascher.

Garbino, Carlos. **Uveitis and Nicolas-Favre's disease.** Arch. de oftal. de Buenos Aires 21:88, April-June, 1946.

In four cases of uveitis, in three of which the usual treatments were of no avail, the patients showed a positive Frei test, were treated with tartar emetic intravenously, and improved markedly. The authors, because of the Frei test, consider lymphogranuloma the etiologic agent. (Bibliography.) Plinio Montalván.

Lachman, R., and Pérez Chacón, E. **Penicillin therapy. Endogenous bilateral uveitis.** Arch. de oftal. de Buenos Aires 21:94, April-June, 1946.

A case of bilateral uveitis with hypopion following an attack of grippe was

treated with massive doses of penicillin hypodermically. The ocular picture cleared up in a very short time. (Bibliography.)

Plinio Montalván.

Safar, K. **Iridodialysis after cataract extraction repaired by electrocoagulation.** Ophthalmologica 114:77-80, Aug., 1947.

During a cataract operation performed (apparently in Vienna) in September, 1945, the lights went out right after the incision. As the lens capsule was grasped "in the dark," a severe hemorrhage occurred into the chamber. The surgeon let go of what he had caught with the capsule forceps and completed the extraction by performing a total iridectomy, capsulotomy with the cystotome, and expression of the nucleus. Examination of the eye three weeks later revealed an iridodialysis of 120 degrees. Five months later the iridodialysis was repaired surgically. With a small Graefe knife introduced from below through the limbus and parallel with it, a horizontal slit was made in the secondary membrane whereby a good optical opening and freeing of the dialyzed iris was accomplished. The peripheral edge of the latter was secured with a blunt iris hook, pulled into the incision and fastened there by electrocoagulation, applying the active electrode to the iris hook which at that moment was also touching the sclera. The postoperative course was uneventful. The final result was satisfactory, the corrected vision 6/24 and the dialysis only visible as a narrow, very peripheral slit on one side of the operative iris incarceration. A case of traumatic iridodialysis after contusion was treated by the same method and with the same satisfactory result. The author believes that fastening of the dialyzed iris by electrocoagulation is preferable to B. W. Key's method of fastening the iris by sutures because the former method is faster and less conducive to loss of vitreous.

Peter C. Kronfeld.

9

GLAUCOMA AND OCULAR TENSION

Goldmann, H. **The outflow pressure of the aqueous in man.** Ophthalmologica 114:81-94, Aug., 1947.

The advent of gonioscopy and the discovery of the aqueous vein have provided a valid foundation for the old hypothesis that there is a steady flow of aqueous from the anterior chamber through certain channels of exit into the anterior ciliary veins. Such a flow is dependent upon a pressure gradient between anterior chamber and anterior ciliary veins. For this pressure gradient Goldmann proposes the term outflow pressure and estimates its magnitude by exerting graduated pressure against the center of the cornea (by means of a spring dynamometer similar to the tonometer of Baillart) until an aqueous vein which is being watched under the slitlamp, shows visible dilation. In normal eyes this phenomenon occurs at dynamometer pressures from 5 to 12 grams. On one human eye with tumor but with normal anterior segment the relationship between dynamometer pressure and resulting rise in intraocular pressure was found to be linear, 1 gram of external pressure causing a rise in intraocular pressure of 1.3 mm. Hg (Schiøtz). A dynamometer pressure of 8 grams which in a given eye brings on the first visible dilation of the clear core of an aqueous vein, would then correspond to a rise of intraocular pressure of 10.4 mm. Hg. Goldmann believes that the actual outflow pressure in the normal human eye is one-half to one-fourth of the value obtained with his method and therefore uses the term "apparent" outflow pressure for the latter.

In eyes with chronic simple glaucoma with high or medically normalized tension the apparent outflow pressure is increased. In eyes with acute (narrow-angle) glaucoma in which the tension has

been normalized with miotics, the apparent outflow pressure is within normal limits. Since aqueous veins can be found in 90 percent of all human eyes, determination of the apparent outflow pressure may prove to be a quick and convenient method to diagnose early chronic simple (wide-angle) glaucoma.

Peter C. Kronfeld.

Longhena, Luisa. **Vogt's cyclodiathermy for glaucoma.** Boll.d'ocul. 26:7-30, Jan., 1947.

Cyclodiathermypunctures were performed on 30 glaucomatous patients; on 26 on one eye each, and four on both eyes. First operations were performed in 7 cases of secondary glaucoma, 7 of absolute glaucoma, 7 of chronic simple glaucomas, 4 of chronic congestive glaucomas, 2 of hemorrhagic glaucomas, 1 of aphacic glaucoma, and 1 of glaucoma associated with nevus flammeus. As second operation, cyclodiathermy, was used on 1 eye with absolute glaucoma, 3 with chronic simple and 1 with chronic congestive glaucoma. Procedure and complications are described. Among 7 eyes suffering from secondary glaucoma, 1 showed normalization of intraocular pressure, 2 eyes maintained tolerable pressure readings with the help of miotics, and in 4 eyes surgery was repeated (two iridectomies, two enucleations). Among seven patients with absolute glaucoma normal tension was reestablished with miotics in two, some had a transient improvement of their tension, others none. The chronic simple glaucomas responded better: four eyes had normal tension with the use of miotics postoperatively, two others a lower tension than before the operation. In one eye the tension was normal for one year after operation and remained good after a second cyclodiathermy for one month only. In chronic congestive glaucoma tension became normal in only one eye. Transient ameliorations of short duration occurred in others. In hemorrhagic glaucoma the tension became normal in one eye suffering from thrombosis of the central retinal vein, and another was relieved of pain. An aphacic eye maintained normal tension after the operation. No improvement was obtained in the eye suffering from nevus-flammeus glaucoma. In three eyes previously subjected to the Lagrange operation, intraocular pressure became normal and stayed so; in one of these eyes, the cyclodiathermy had to be repeated. The author characterizes her operative results as favorable and encouraging. K. W. Ascher.

Torres Estrada, Antonio. **Syndrome of ocular hypertension.** An. Soc. mex. de oftal. 5:213-219, July-Sept., 1947.

The author expresses the opinion that myopia, in the course of its development, is accompanied by a more or less marked degree of ocular hypertension. He regards it as desirable to use miotics and has applied to the general ocular condition of such patients the term "ocular hypertensive syndrome." In the course of discussion, Manuel Márquez declared that he had never seen in childhood the ocular hypertensive syndrome as described by Torres Estrada, but on the contrary that hypotension rather than hypertension was practically always present in myopia. (1 diagram.) W. H. Crisp.

Vidal, F., and Daniel, C. S. **Glaucoma and neuroarteriolar test.** Arch. de oftal. de Buenos Aires 21:111, April-June, 1946.

In 31 patients with glaucoma, the neuroarteriolar test was positive in 27 percent, negative in 39 percent and inverted in 34 percent. This shows a manifest functional disturbance of the venous system of distribution in glaucoma. (Bibliography.) Plinio Montalván.

Vidal, F., and Brodsky, M. **Glaucomatous iridoplegia and Argyll-Robertson**

miosis. Arch. de oftal. de Buenos Aires 21: 123, April-June, 1946.

The authors hold that local metabolic disturbances of the smooth muscle cells of the iris give rise to changes in the size of the pupil according to the type of cells affected: miosis in Argyll-Robertson syndrome and mydriasis in acute glaucoma. (Bibliography.) Plinio Montalván.

10

CRYSTALLINE LENS

Paras, Chavero, Enrique. **Alloxanic diabetes. Experimental production of cataract.** An. Soc. mex. de oftal. 5:225-230, July-Sept., 1947.

The present author summarizes the reports of 26 writers on the experimental production of cataract by means of alloxan, a product of uric acid which, injected into the general circulation of animals, produces a hyperglycemia of short duration followed by a more or less marked hypoglycemia. The experimental animal may also show polyuria, polydypsia, and loss of weight, and may further develop acidosis, with hypercholesterinemia, acetonemia, and reduced content of carbon dioxide. In rats, changes toward the formation of diabetic cataract can be recognized two months after administration of the drug, and complete blindness may develop by the end of four months. (References.) W. H. Crisp.

Sack, S. Senior. **Atopic cataract.** Ann. Allergy 5:353-363, July-Aug., 1947.

The occurrence of cataract in patients afflicted with skin disorders has been known for a long time. The earliest cases were the Rothmund and Werner syndromes. In the first type, skin lesions appeared in the early months of life and cataracts between the fourth and sixth years. The skin disease was called poikiloderma atrophicans. The latter type, a scleroderma, was associated with endocrine disturbances and cataracts.

The skin lesions of these syndromes differ greatly from disseminated neurodermatitis. It is generally agreed that the latter disease belongs with atopy which is characterized by a hereditary influence on the transmission of hypersensitivity. There is often a high degree of polyvalent hypersensitiveness. The author feels that since the skin and lens are both ectodermal tissue it is believable that the lenticular tissue participates in the disease after there has been a prolonged, extensive, and hypersensitive skin inflammation. This type of lens opacity is classified as atopic cataract.

A description of theories of the mechanism of atopic cataract formation, immunology of lens protein, and the lenticular capsule follow.

The case of a girl aged 17 years is presented. She had had an extensive neurodermatitis since she was two years old and bilateral cataracts, one mature. The cataract in the eye operated upon was probably in existence for only about seven months. F. M. Crage.

Sánchez Borroto, Pedro. **Senile cataract and antireticular serum.** Rev. del Col. med. de Cienfuegos. 2: 547-558, July-Aug., 1947.

The author has treated with antireticular serum eleven patients who had senile cataracts. Only seven were examined after the treatment. The author found no changes in the total opacifications and in the incipient cases there was some improvement. He did not arrive at any conclusions on account of the short time of observation after the treatment.

José Sáenz Canales.

Sédan, J., and Sédan-Bauby, S. **Micropuncture of hypermature cataracts not seizable with forceps.** Ophthalmologica 114:65-67, Aug., 1947.

To make possible the grasping with for-

ceps of the capsule of swollen cataracts, the authors recommend punctures of the lens with a fine sewing needle introduced through the peripheral iridectomy. One such micropuncture relieves the pressure within the lens sufficiently to permit grasping of the capsule. With this method the authors have performed intracapsular, complete extractions in 58 percent of all their swollen intumescent or hypermature cataracts. Peter C. Kronfeld.

11

RETINA AND VITREOUS

Culler, A. M. **The etiology of hemorrhage in the ocular fundus.** J. Iowa M. Soc. 37:486-492, Nov., 1947.

The majority of retinal hemorrhages are arteriosclerotic in origin. Arterial hemorrhages ocur in atheromatous changes and septicemia. Venous hemorrhages occur in mechanical or inflammatory obstruction. Capillary hemorrhages occur in toxic states, venous obstruction, and anemias. Irwin E. Gaynon.

Doucet, M. **Surgical repair of a retinal detachment resulting from a macular hole.** Arch. d'opht. 7:284-293, 1947.

The author describes the case of a 63-year-old woman with incipient cataract, a mopia of eleven diopters, and a flat detachment of the macula with macular hole. After the external rectus had been detached the sclera was exposed at the posterior pole and a single diathermy puncture at 15 milliamperes made over the area of the hole. Reattachment of the retina was obtained.

Doucet discusses the diagnosis of central detachment and stresses the difficulties involved in closing a macular hole without damaging too extensively the macular elements. Exposure is usually obtainable by detaching one or more muscles. For orientation, Doucet believes that the limbus offers the best guide, and as to technic he cites the various methods which have been used such as the undermining operation of Lindner after scleral trepanation, surface diathermy as described by Sohby Bey, catholysis after Vogt, and penetrating diathermy. He concludes that no one method is eminently superior. Phillips Thygeson.

Fleischer, Felix. **When should one fixate the retina prophylactically?** Klin. Monatsbl. f. Augenh. 112:20-29, May, 1947.

Retinal tears can be found in the presence of an attached retina. The visual disturbances may be minimal and may only be those of "mouches volantes" or light flashes. Sometimes one does not find a tear, but can observe a spot which looks as though it might become the site of an eventual tear. This is especially the case in patients with high myopia. After a short review of the literature the author presents 18 cases of his own. In 12 of them a retinal detachment had been present or operated on in the other eye. The second eye which showed tears without detachment was operated in every case with good success. The author states that it is urgently indicated to operate on every patient who had a previous detachment in one or both eyes and who presents the picture of a tear or suspected tear without actual detachment. In other patients who have no previous history of detachment and who present a so called "latent" tear he demands close and continued observation. A prophylactic operation is indicated when subjective complaints increase the threat of an imminent detachment. These cases can be operated on with surface cautery without paracentesis which entails no risk to the eye.
Max Hirschfelder.

Galíndez Iglesias, F. **A case of Eales' disease.** Bol. Inst. path. med. 11:158-165, Aug., 1947.

A case of recurrent vitreous hemorrhage is reported. This usually occurs in males between the ages of 15 and 30 years, although it has been seen as late as 55. When it occurs late it may be associated with a thyroid disturbance. Hemorrhages of this type occur on an average of 1 in 5,000 ophthalmic patients. While the general health may appear fair, or even excellent, detailed examination will usually uncover some form of cardiovascular renal disturbance, or more often a mild type of tuberculosis. This last is shown by glandular enlargements or excessive calcification of the hilus glands. The intradermal tuberculin reaction of Mantoux will show an erythematous papule after 48 hours.

After a hemorrhage, the eye itself shows nothing beyond a diffusely stained hemorrhagic vitreous. In time the blood may be largely or completely absorbed. Then, strands characteristic of retinitis proliferans, which result from the organization of former hemorrhages can often be seen. These, if attached to the retina, can by their contraction bring about partial or even complete retinal separation.

In the case reported absorption was practically at a standstill at the end of five months. Roentgen therapy was applied over the cervical sympathetic and the eye and the exudate then became absorbed with the exception of a few strands, and the vision returned to normal. The various possible causes are discussed; the two that seem most likely are periphlebitis of the retinal vessels, and endocrine disturbances.

A. G. Wilde.

Jaeger, A. **The retinal vessels during low atmospheric pressure.** Klin. Monatsbl. f. Augenh. 112:44-48, May, 1947.

Experimental studies were made in a low pressure chamber simulating altitudes up to 20,000 feet. At 10,000 feet one observes an enlargement of the arteries and veins, mild cyanosis of the arteries and a narrowing of the bright central light reflex on the arterial vessels. In some cases a pulsation of the veins was noted at 10,000 feet. Near the macula a broadening of the branching points of the vessels seemed to exist after reaching an altitude of 10,000 feet. No explanation for this phenomenon can be given. Some persons exhibited a spasm of accommodation under the lack of oxygen in high altitudes.

Max Hirschfelder.

Kruemmel, H. **Clinical and pathologic changes in the fundus in panmyelophthisis, with a contribution to the pathogenesis of retinal detachment.** Klin. Monatsbl. f. Augenh. 112:30-44, May, 1947.

Panmyelophthisis is caused by a deterioration of the bone marrow and is characterized by an aregenerative, anhemolytic, normochrome anemia, necrotizing processes and an increased tendency to bleeding. The case history of a patient with severe fundus changes in the final stages of the disease is presented. The retina showed numerous grayish spots in its deeper layers, some of them slightly elevated. Several small individual hilly detached areas were found in the upper quadrant and necrotic areas were spread over the attached parts of the retina. Numerous hemorrhages were also present. Sections of tissue taken at autopsy showed that the detached areas were produced by a transudate between the pigment epithelium and the rod and cone layer. The large hemorrhages were in the outer and inner parts of the retina and the smaller, spot-like hemorrhages had their location in the Henle fiber layer. The present theories about the origin of retinal detachment by cystoid degeneration and subsequent rupture are critically discussed together with the subject of "detachment without tear." (18 photographs, bibliography.)

Max Hirschfelder.

Leopold, I. H., Wiley, M., and Dennis, R. **Vitreous infections and streptomycin.** Am. J. Ophth. 30:1345-1352, Nov., 1947. (6 tables, 27 references.)

Levrat, M., and Paufique, L. **The capillary fragility test in diabetic retinitis.** Presse Méd. p. 325, May 17, 1947.

This test is made by compressing the arm of the patient with a bloodpressure cuff inflated to a pressure equal to the systolic pressure minus 20 mm. Hg. The pressure is maintained for five minutes and the number and importance of petechiae present is then expressed in terms of +, ++, or +++. The test was found to be positive in a high percentage of hypertensive patients and in patients with certain other vascular conditions without hypertension. It may appear or disappear during the course of the hypertensive disease and may have a certain prognostic value.

In 14 cases of diabetic retinitis the authors found the test to be positive. In 12 of these cases the reaction was +++. Seven of the 14 were hypertensive but in the remaining seven the systolic pressure was less than 150 mm. The authors discuss the significance of the test in relation to vascular abnormalities and conclude that in diabetic retinitis there are not only profound local vascular disturbances but also systemic vascular lesions. They suggest that the demonstration of a positive test in a diabetic may indicate an impending retinitis. Phillips Thygeson.

Lloyd, R. I. **Pseudotumors of the macula.** Tr. Am. Ophth. Soc. 44:213-218, 1946.

The author describes various lesions he calls "pseudotumors" which characteristically affect the macular area. The initial lesion is a light colored mass of exudate in the macular area that levels out laterally and may not seem elevated unless the binocular ophthalmoscope is used. Cysts may form with clear or opaque contents. At times the initial mass may be filled with blood and resemble an angioma of the choroid. Although pseudotumor is not always the initial stage of Coats's disease, disciform degeneration of the macula or senile and presenile macular degeneration, it is probable that it often is. Hemorrhages beneath the retina are very common at some time or other during the course of the disease. The lesions may be accompanied by retinitis proliferans. High blood pressure does not seem to be a necessary part of the disease. Pseudotumors occur most commonly in older persons with marked temporal sclerosis but may occur in young patients. In the latter tuberculosis is the usual inciting cause. (5 illustrations.) C. D. F. Jensen.

Lowenstein, A. **Cushion cells in retinal pre-capillaries and capillaries.** Nature 160:229, Aug. 16, 1947.

The author has observed large cells of the intimal layer of retinal arterioles, capillaries and venules situated mostly at vessel branches. These cells reduce the lumen to a narrow slit or occlude it completely. The protoplasm of these cells is granular and gives them a different appearance from that of the other intimal cells. These cushion cells are best seen unstained in glycerine-cleared retina with reduced illumination. They have been stained with azo-eosin in bulk. The author was unable to discover them in stained parafin sections. The dehydrating process seems to cause shrinkage which makes the cushion cells indistinguishable from other intimal cells. The author states that it is probable that these cushion cells regulate the retinal blood stream within the fine branches according to need.

Theodore M. Shapira.

Lowenstein, A. **Intramural vessels in the retina (vasa vasorum).** Nature 160: 124, July 26, 1947.

In investigating ocular tissue of man

and animal by a clearing method during the past seven years, the author has found intramural vessels in retinal arteries and veins. They were discovered in uncut specimens and their existence was later proved by reconstruction of serial sections. Intramural vessels in the retinal wall may be parallel to the lumen, may encircle it or may be in spirals around it. They often branch and the twigs frequently reunite. So far they have not been found in the retinal vessels of young healthy human beings. Intramural vessels have been described in atheromatous coronary arteries of the heart. The purpose of these intramural retinal vessels in some cases may be to by pass an obstacle in the bloodstream, but in others the retinal arteries show hyaline sclerosis with preservation of the lumen. It is possible that in the latter case the intramural vessels act as vasa vasorum and improve the insufficient nourishment of the changed vessel wall. They are considered as part of the pattern of repair of the sclerotic process.

Theodore M. Shapira.

Puig Solanes, M. **Retinal angioscopy in essential arterial hypertension.** An. Soc. mex. de oftal. 5:137-213, July-Sept., 1947.

This 76-page article is based upon a study of 300 clinical cases. The work was carried on at the National Institute of Cardiology and the General Hospital of Mexico. A 26-page general discussion is followed by 43 graphs, 51 statistical summaries, 5 pages of references, and conclusions. The author's experiences do not differ essentially from those of previous writers. He calls especial attention to the fact that existence of retinal vascular sclerosis in a hypertensive patient does not imply aortic sclerosis, although statistical comparison indicates that it may suggest sclerosis of the coronary system.

W. H. Crisp.

Renard, G. **Concerning ocular tuberculosis. Retinitis of Jensen.** Presse Méd. p. 376, June 4, 1947.

The author discusses endogenous lesions, particularly tuberculosis, of the retina and choroid and notes that the French school has had the merit of calling attention to the important role of syphilis but has overemphasized the frequency of syphilitic lesions. He notes that almost all cases of ocular tuberculosis occur in persons free from active pulmonary tuberculosis. In some instances the tuberculous nature of the ocular lesion is probably due to the presence of tubercles of the iris but lesions of the posterior segment are notoriously difficult to diagnose etiologically. The tuberculin test should be used with caution because of the possibility of focal reactions. Diagnosis must be made on factors such as a history of exposure to active tuberculosis and on the clinical appearance and course.

The retinitis of Jensen is a clinical entity which the author states is almost always due to tuberculosis. The typical disease is described in detail and illustrated with case reports and colored drawings.

Phillips Thygeson.

Rowen, R. E. **Roentgenographic features of metastases of a retinoblastoma to the long bones. Report of a case.** J. Bone and Joint Surg. 29:805-806, July, 1947.

A six-year-old male Negro whose eye had been enucleated because of retinoblastoma, developed metastases in the humerus of each arm. Roentgenographic characteristics were similar to those of osteogenic sarcoma. Diagnosis was made by biopsy.

Irwin E. Gaynon.

Senà, J. A., and Cerboni, F. C. **Macular changes from observing solar eclipse.** La Semana Méd. 54:419-429, Sept. 11, 1947.

On May 20, 1947, an eclipse of the sun was visible over an extensive zone of Ar-

gentine, and resulted in the usual large number of individuals sustaining more or less ocular injury. The author reports nine clinical cases, and refers to six others. The early fundus changes consisted of an increase in size of the central reflex, with the appearance of a dirty-yellowish-white spot, with sharp edges, standing out upon the dark red of the surrounding fovea. These objective symptoms were accompanied by a fugitive positive scotoma, which then disappeared, leaving a central scotoma which, diagnosed with a test object of 2 mm. diameter on the tangent screen, at 2 meters, had approximately the size of an Argentine centavo coin (2 cm.).

Vitamin A appeared to have some therapeutic effect on these cases. In 30 percent the objective lesions and the subjective symptoms disappeared. In the remainder there had been an evident improvement up to the last examination, although the length of time was too short to draw final conclusions. Two thirds of the cases were bilateral. (8 illustrations, references.) W. H. Crisp.

Shanno, R. L., Griffith, J. Q. Jr., and LaMotte, W. O. Jr. **Capillary fragility and capillary permeability in relation to retinal hemorrhage.** Am. J. Ophth. 30:1556-1563, Dec., 1947. (2 tables, 7 references.)

Spaeth, E. B. **The fundus oculi in diagnosis and in prognosis.** J. Michigan St. Med. Soc. 46:799-804, July, 1947.

The author places the ophthalmoscope second in importance to the microscope in medical diagnosis.

He presents brief descriptions of the fundus findings in syphilis and tuberculosis of the choroid, retina and optic nerve, and in panophthalmitis, toxoplasmosis, endophthalmitis, ocular complications of bacterial endocarditis, and sympathetic ophthalmia. Francis M. Crage.

Vásquez Barrière, A. **Perimetric localization of lesions of the ocular fundus.** Arq. brasil. de oftal. 10:1-15, 1947.

The essay is devoted to localization of detachments of the retina, more particularly before operation, and largely upon the basis of Imre's calculations as modified by Stine. The latter's paper in 1930 devoted itself especially to making the necessary allowances for perspective displacement which would arise from a large protruding detachment. Vásquez Barrière particularly emphasizes the desirability of reducing the size of the retinal bleb before undertaking to localize the tear. Not only is the patient kept for some time in bed in the position which seems best suited to the particular case, but, if the settling due to rest in bed is inadequate, a small perforating diathermic puncture is made at the point corresponding to the greatest prominence of the detachment, after superficial coagulation in the same area. The author has had constructed a modification of the Schweigger hand perimeter, as used by Stine. The modified form is a tiny perimeter of 15 cm. radius, whose arc is formed by a delicate lamina 2 mm. thick by 7 mm. wide. In the center of the arc there is a small circular mirror in which, if the vision is adequate, the patient may maintain fixation by looking at his own eye. Where the vision is inadequate for this purpose, the patient looks at a lamp supplied by a dry cell contained in the handle. The author also uses an arcmeter consisting of a minute "rule" 2 mm. wide by 30 mm. long, curved so that its curvature is adapted to that of the sclerotic. (9 illustrations.) W. H. Crisp.

12

OPTIC NERVE AND CHIASM

Bartolozzi, Rafael, and Manzano, Toledo. **Anomalies of the sella turcica and**

its ophthalmologic importance. Arch. Soc. oft. hisp.-amer. 7:671-682, July, 1947.

The author is mainly interested in the study of the clinoid process of the sella turcica. The ossification of the ligaments that join the above mentioned process can produce some compression that ends in damage of the chiasm or optic nerve, which would give a fundus picture like that found in glaucoma. There is a defect of the visual field but no increased tension. Two suggestive cases are reported. (9 figures.) J. Wesley McKinney.

Eggert, W. A case of optic atrophy in osteopetrosis (Marmorknochenkrankheit Albers-Schoenberg). Klin. Monatsbl. f. Augenh. 112:66-70, May, 1947.

Osteopetrosis is characterized by extensive osteosclerosis and thickening of the bones which makes a differentiation into cortex and spongy portion impossible. The bones are more fragile, an anemia is present owing to the disturbance of the bone marrow. The condition is hereditary and recessive. Optic nerve atrophy is caused by a narrowing of the optic canal without externally visible deformation of the skull. The case of an almost two-year-old child is presented. The above named findings were present plus a slight protrusion of the bulbi and nystagmus. The prognosis is bad. The disease leads to complete blindness or a fatal anemia or septicimia. Parathyroid hormone has been recommended for treatment. (2 X-ray pictures, bibliography.)

Max Hirschfelder.

13

NEURO-OPHTHALMOLOGY

Goinard, P., Larmande, A., and Descuns, P. Reëvaluation of unilateral mydriasis as a localizing sign in head injuries. Presse Méd. pp. 281-282, April 26, 1947.

Unilateral mydriasis as a localizing sign has fallen into unjustifiable disrepute because of confusion with mydriasis due to purely local ocular lesions. Moreover, there is common neglect of transitory unilateral mydriasis and of unilateral mydriasis which later becomes bilateral. In a study of 40 cases in which the nature of the lesion was determined by operation or by autopsy the authors found unilateral mydriasis to be an accurate indication of homolateral disturbance of the brain due to a subdural hemorrhage, serous meningitis, or edema. Its occurrence, they conclude, even when only transitory, is an alarming sign although not by itself to be considered an indication for surgery. The article is documented with short case reports. Phillips Thygeson.

Govan, C. D. Jr., and Walsh, F. B. Symptomatology of subdural hematoma in infants and in adults. Arch. Ophth. 37: 701-715, June, 1947.

It is noteworthy that subdural hematoma occurs most frequently before two years of age and again in the third, fourth, fifth, sixth and seventh decades of life. This study is based on the findings in 36 infants and 54 adults. The symptoms of subdural hematoma in adults are quite different from those which occur in infants. Convulsions were present in 28 infants and only 2 adults. Vomiting was present in half of the infants and one third of the adults. Drowsiness and coma were common symptoms in both groups. In infants, when the fontanel was open, bulging almost always occurred and the spinal fluid invariably contained blood or was xanthochromic. In the great majority of adults, the spinal fluid was normal.

The eye findings are discussed in some detail. Papilledema was found in approximately 17 percent of both adults and infants. In infants, but not adults, the papilledema was almost invariably associated with subhyaloid retinal hemorrhages. Dilatation of the pupil on the side of the lesion is an important diagnostic sign.

The hematoma is usually bilateral in infants and results in bilateral pupillary dilatation. Visual field defects were observed in a majority of the patients.

Differences in the anatomic arrangement of the membranes of the brain in the infant and in the adult probably explain the differences in symptomatology and require further study. There is an important difference between the supporting structures of the pial veins of the infant and those of the adult. In sharp contrast to the condition seen in the infant, the dura and the arachnoid membrane of the adult are firmly bound together in the region of the longitudinal sinus.

John C. Long.

Jefferson, Geoffrey. **Isolated oculomotor palsy caused by intracranial aneurysm.** Proc. Roy. Soc. Med. 40:419-432, June, 1947.

Fifty-five of the author's own cases of "circle of Willis" aneurysm associated with isolated third nerve palsy are discussed. Two of them are described in considerable detail. The majority of the aneurysms arose from the internal carotid after the dura was pierced (suprachnoid). Subarachnoid bleeding had occurred in two-thirds of the cases.

The essential early signs and symptoms noted were ptosis, severe frontal and ocular pain, diplopia, and fixed dilatation of the pupil—all on the affected side. The changes in these manifestations during the course of the disease are described in detail. The cases are tabulated as to age, sex, subarachnoid hemorrhage, angiography, surgical treatment and present state.

The author differentiates the condition from palsies resulting from other causes by the fact that there is sudden, complete, uncomplicated third nerve palsy with severe pain involving the first division of the trigeminal nerve. He considers angiography as the best aid to diagnosis of the size, shape, position, and origin of the aneurysm. The most satisfactory, reasonably safe treatment is carotid ligature. Nineteen patients survived ligation; one of these died after seven years.

Francis M. Crage.

Just Tiscornia, Benito. **The neurocapillary test in a doubtful case of disturbance of the cerebral circulation.** Arch. de oftal. de Buenos Aires 21:339, Oct.-Nov., 1946.

The author presents a case of disturbance of the cerebral circulation due either to an intracranial aneurysm or to an angioma of the brain cortex in the area of the internal carotid artery. The neurocapillary test of Vidal and Malbrán revealed a marked metabolic disturbance of the eye which was not shown by other methods of examination and which improved after ligation of the carotid artery of the affected side. (Charts, bibliography.) Plinio Montalván.

Solnitzky, Otmar. **Oculomotor nerve paralysis.** Bull. Georgetown Univ. Med. Center 3:123-128, Oct.-Nov., 1947.

The oculomotor nerve, next to the abducens, is the most frequently involved of the nerves innervating the ocular muscles. Unlike the two other motor ocular nerves, the third supplies both the voluntary somatic muscles and smooth involuntary muscles.

The author gives a detailed description of the anatomy of the third nerve back to its origin in the brain and presents a case of complex third nerve paralysis. He also describes the etiology, signs, and the types of the disease. F. M. Crage.

Symonds, C. P. **Visuo-sensory aspects on the ocular sequelae of head injuries.** Tr. Ophth. Soc. U. Kingdom 65:3-19, 1945.

The author presents visual fields to depict the damage done in closed head injuries and gun shot wounds in anatomi-

cal order. Injuries to the optic nerve were found to have the force applied to the supraorbital region or the neighborhood of the external angular process on the side of the lesion. The force necessary to cause an optic nerve lesion is usually severe but it may be so directed that there is little disturbance of cerebral function. Complete loss of vision was usually reported at first in these cases, and later a partial but satisfactory recovery took place. Bitemporal field defects indicated injury to the optic chiasm in four cases. In each case violent force had been applied to the front of the head. All had had evidence of fracture involving the posterior wall of one frontal sinus and the roof of the orbit. All had anosmia. The visual fields showed bitemporal hemianopia with some macular sparing. The author concludes that the damage in both traumatic and neoplastic injury is to the vessels that supply the chiasm.

Injury to the optic tract was reported in one patient with visual field studies which afforded an example of a transient disturbance of vision which would have been dismissed as hysterical had the fields not been thoroughly examined.

Visual field study after injuries to the visual cortex in the occipital lobe supports the view that representation of macular vision is unilateral.

Visual disorientation was observed and reported in one patient. The patient sustained no loss of vision but he had difficulty in judging distance and ocular convergence was defective.

Beulah Cushman.

14

EYEBALL, ORBIT, SINUSES

Guyton, J. S., **Exophthalmos associated with endocrine dysfunction.** Texas St. J. Med. 43:280-282, Aug., 1947.

Exophthalmos occurs oftenest in Graves' disease, in about 65 percent of the cases of primary diffuse toxic goiter, and sometimes with "spontaneous" myxedema. It can occur but is rare without thyroid disturbance. It is seldom seen with secondary (nodular) toxic goiter. The primary cause is apparently a dysfunction of the anterior pituitary, probably overproduction of the thyroid-stimulating hormone, which may cause water storage in the orbits. The exophthalmos may be bilateral or unequal to the point of seeming to be unilateral. It persists after death. There is increased water storage, with progressive hypertrophy and degeneration of the extraocular muscles, scattered lymphocytic infiltration, and progressive (permanent) fibrosis of the orbital structures. The acute or progressive stage usually lasts 6 to 24 months and is followed by regression of the edema of the lids and conjunctiva and perhaps by a slight decrease of the exophthalmos. Prophylactic treatment of suspected malignant exophthalmos should be limited to iodine therapy, if possible, as subtotal thyroidectomy and thiouracil often cause an increase in the exophthalmos. If decompression is necessary, the subzygomatic or temporal fossa type, previously described by the author, is the least dangerous and leaves no scar or other cosmetic defect. (References.)

Bennett W. Muir.

Jaensch, P. A. **Pneumatocele of the orbit.** Klin. Monatsbl. f. Augenh. 112:62-65, May, 1947.

A bomb splinter injury produced, aside from a destructive vitreus hemorrhage, the clinical picture of proptosis, lid swelling, limited motion of the eyeball and high fever. This picture developed over a period of four weeks and a subperiosteal abscess was suspected. Incision was followed by escape of air and the exophthalmus disappeared only temporarily. Further investigation showed that a piece of mortar had made a communication be-

tween the frontal sinus and the orbit and had become lodged in the orbit behind the bulbus. The disturbance healed after evacuation of the frontal and ethmoid sinuses with subsequent splitting of the periorbit and removal of the foreign body. (4 Figures). Max Hirschfelder.

Joly, J. P. **Diagnosis and treatment of a varix of the angular vein.** Arch. d'opht. 7:281-283, 1947.

Joly describes the case of a 38-year-old woman whose initial complaint was of a swelling over the right lacrimal region. The swelling was found to increase when the patient inclined her head laterally, or laughed, cried, or indulged in strenuous effort of any kind. It never became red or painful and the swelling was soft and reducible with pressure. It had no connection with the lacrimal sac and was accentuated by pressure over the facial vein or over the jugular vein. There was no bruit such as would be present in arteriovenous aneurysm. The condition was diagnosed as varicosity of the angular vein and treated by ligation of the vein above the tumor. There was complete disappearance of all swelling.

Phillips Thygeson.

O'Brien, C. S., Allen, J. H., and Allen, L. **Evisceration with intrascleral implant.** Tr. Am. Ophth. Soc. 44:296-303, 1946.

Preliminary work on a new method of prosthesis insertion with intrascleral implantation following viscerations is presented. Several methods of utilizing a special lucite implant with a flanged hollow peg projecting from the anterior surface for attachment of a plastic prosthesis with a pin on its posterior surface have been discarded in favor of a new technique that permits retention of all of the corneal tissue except a small central disc which is removed by a trephine for passage of the implant peg. A long meridional incision that extends backward from the limbus in the area between the lateral and superior rectus muscles is made through the conjunctiva and sclera. Through this scleral opening the intraocular structures are expressed and the implant is inserted. The prosthesis fits securely on the implant peg. The authors believe that the operation is in its formative stage. The advantages of this method over the Ruedeman procedure are listed. C. D. F. Jensen.

Offret, G., and Meaux, J. **Pseudosinusitis of the newborn and infant.** Arch. d'opht. 7:250-276, 1947.

The authors describe the acute inflammatory rhinitis accompanied by ocular signs which appears as a sinusitis but is in reality an osteomyelitis of the maxillary bone. Two cases are reported. The first, in a child of 18 months, was characterized by an edema of one side of the face with a fever of 40° C. Later a fistula opened on the lower lid and two alveolar fistulas developed in the mouth. Sulfonamide therapy led to healing of the palpebral fistula but the alveolar fistulas persisted.

In the second case, an infant of six weeks when first seen had an intense edema of both lids on the left side which extended over the cheek. There was an ulcerative lesion of the upper lid and a slight exophthalmos. An alveolar fistula was also present and pus from this yielded streptococci on culture. A small sequestrum was removed from this fistula. On penicillin therapy the ocular signs disappeared but the osteomyelitis of the maxilla failed to heal.

The syndrome of pseudosinusitis is described as having a septicemic phase and a phase of localization. In the phase of localization the ocular signs dominate the clinical picture. The authors review the ocular, nasal, and buccal signs and symptoms in the light of their own two cases and a hundred cases recorded in the litera-

ture. They conclude that the prognosis is grave, death occurring in 70 to 80 percent of the patients. The differential diagnosis and pathogenesis are considered in detail. The embryology and anatomy of the infant's facial bones are considered in relation to this syndrome. The authors conclude that the alveolar surfaces of the maxilla are involved prior to nasal involvement and suggest that the condition is hematogenous in origin. They consider penicillin to be the treatment of choice.

Phyllips Thygeson.

Pentini, Gianfrancesco. **Chronic inflammation of the orbit simulating a neoplasm, pseudotumor of the optic nerve.** Riv. di oftal. 2:37-50, Jan.-Feb., 1947.

Birch-Hirschfeld distinguished two types of these pseudotumors, one without, and one with spontaneous reduction of the masses in the orbit. Tano classified them as uncharacteristic granulomas, lymphomas and plasmocytomas. A retrobulbar lymphocytic pseudotumor 2.5 cm. in diameter and the eyeball were removed from the orbit of a 56-year-old man. Pain was observed 11 months before admission, and diplopia appeared 8 months later. Finally, an unreducible exophthalmos of 9 mm., choked disk, and vision reduced to handmovements were found. (6 illustrations, 2 pages of bibliography.)

K. W. Ascher.

Sanchez Rodriquez, A., and Barthe Postrana, E. **A study of the inflammatory processes in the ethmoid sinuses and their relation to the orbit.** Arch. Soc. oft. hisp.-amer. 7:587-602, June, 1947.

This is an exhaustive review of the anatomy, physiology and pathologic processes of the paranasal sinuses, and of the newer concepts of the role of the sympathetic system in the pathogenesis of retrobulbar neuritis. It is emphasized that acute inflammations of the ethmoid always have orbito-ocular repercussions; that acute exacerbations of chronic ethmoiditis are associated with oculo-orbital symptoms; that chronic ethmoidal cellulitis and such processes as a mucocele are followed by signs of inflammation or compression of the orbit and its contents. The embryology, anatomy, pathology, and surgical experience justify the conclusion that with the exception of a dentigenous maxillary sinusitis the ethmoid sinuses are the primary site of all nasal infection, and the source of all orbital complications. It is hoped that further studies of morbid processes in the nasal mucosa will reveal the relation between latent ethmoiditis and retrobulbar neuritis. It is pointed out that orbital cellulitis and orbital abscess require a different therapeutic pattern. Orbital cellulitis may resolve under medical and physical therapy. Orbital abscess calls for prompt and radical surgical intervention. (9 figures.)

Ray K. Daily.

Simonelli, Mario. **Orbital apex syndrome and generalized neurofibromatosis.** Riv. oto-neuro-oftal. 21:245-257, Sept.-Dec., 1946.

Hysterectomy had been done on a single woman, 54 years of age, because of multiple uterine fibromata about a year before the examination. Ocular symptoms had started a few months later when diplopia developed and was followed by total right ophthalmoplegia, gradual blindness and symptoms of involvement of the ophthalmic branch of the right trigeminal nerve. Exophthalmos was present and excursion of the eyeball abolished. X-ray films showed the right optic foramen to be of normal form and size but there was clouding in the region corresponding to the upper sphenoidal fissure. When subcutaneous fibromatous nodules appeared a diagnosis of Recklinghausen's disease was made. The ocular symptoms

were ascribed to the localization of a nodule at the right orbital apex. The interpretation of the symptoms is discussed at length. (3 figures, bibliography.)

Melchiore Lombardo.

Šuster, Michal. **The treatment of rhinogenous orbital inflammations.** Bratislavské Lekárske Listy 27:674-691, Sept., 1947.

The author describes nine patients who had rhinogenous orbital inflammations. In four of these the process was chiefly subperiosteal and in five the retobulbar tissues were affected. Those of the first group improved after radical surgical operation and chemotherapy with sulfonamids and penicillin. One of them had an extradural abscess, the only intracranial complication in the series. Three of the patients with retobulbar inflammation lost vision, two because of retrobulbar neuritis and one from iridocyclitis.

In eight cases the radical operation was performed (six according to the method of Riedl, two external ethmoidectomy). All patients were given sulfonamids and penicillin and one who had orbital cellulitis recovered without the help of surgery. The results obtained from chemotherapy alone are no doubt remarkable, but early operation is recommended. (9 illustrations, bibliography.) F. H. Haessler.

Titche, L. L. **Metastatic fusospirochetal abscess of the orbit.** Am. J. Ophth. 30: 1427-1428, Nov., 1947.

15

EYELIDS, LACRIMAL APPARATUS

Beiras García, A. **Conjuctivitis sicca and filamentous keratitis in Sjögren's syndrome.** Arch. Soc. oft. hisp-amer. 7:541-552, June, 1947.

The author reports a case of Sjögren's syndrome, with conjunctivitis sicca and filamentous keratitis of many years duration, in a woman 58 years old, who had dryness of the throat and mouth, difficulty of deglutition, and dryness of the joints. The eye symptoms were completely relieved by closing the lacrimal canaliculi by diathermy-coagulation. The literature on both affections is reviewed, and it is believed that the filamentous keratitis is a direct result of the abolition of lacrimal secretion. Ray K. Daily.

Fox, S. A. **Some methods of lid repair and reconstruction. IV. Total reconstruction of the upper lid.** Am. J. Ophth. 30: 1413-1415, Nov., 1947. (6 figures.)

Gots, J. G., Thygeson, P., and Waisman, M. **Observations on Pityrosporum ovale in seborrheic blepharitis and conjunctivitis.** Am. J. Ophth. 30:1485-1494, Dec., 1947. (4 figures, 7 references.)

Jona, S. **Amyloid degeneration of the upper eyelids.** Rassegna ital. d'ottal. 16: 270-282, July-Aug., 1947.

Fifteen years ago a woman, now 68 years of age, noted slight ptosis, which eventually became almost complete. The skin of the upper eyelids became stiff and discolored. The affected tissue was removed, and areas of hyaloid, amyloid and colloid degeneration were microscopically demonstrable. The author suggests the name paraamyloidosis for the condition. (6 figures.) Eugene M. Blake.

Marín Amat, M. **Surgery of entropion of the upper lid.** Arch. Soc. oft. hisp.-amer. 7:603-610, June, 1947.

The author describes a modification of the Panas operation for entropion of the upper lid. An experience with five thousand operations convinced him of its effectiveness. The modification consists essentially in superimposing the lower lid margin over the upper half of the tarsus, and thus lifting the eyelashes away from

the cornea; in excising the exposed fibers of the orbicularis; and in thinning the upper half of the tarsus. The technique of the operation is well illustrated. In local anesthesia an incision of the skin and orbicularis is made 2 mm. from the palpebral border along the entire length of the lid, the presenting fibers of the orbicularis are resected, and the tarsus is incised 1.5 mm. from the palpebral border, through its entire length. The thickened tarsus is thinned by shaving off layers of it with a thin knife. The ciliary border is superimposed over the superior portion of the tarsus, and fastened in place with fine silk sutures. (7 illustrations.)

Ray K. Daily.

Rolett, D. M. **Epidermoid cysts of lacrimal gland and caruncle.** Am. J. Ophth. 30: 1577-1580, Dec., 1947. (1 table, 3 figures, 8 references.)

Semeraro, Edmundo. **Surgical treatment of entropion.** Rev. brasil. de oftal. 6:37-39, Sept., 1947.

The author illustrates, and briefly describes, the following technique. A fold of skin is grasped with forceps, sufficient to give the appearance of correcting the entropion, and the upper blade of the forceps is applied 6 mm. below the lid margin. Two curvilinear incisions are made in the skin. Their centers coincide with the positions at which the blades of the forceps were applied, and the ends of the two incisions come together so as to include an area of skin that resembles the cross section of a concave convex meniscus. After this area of skin has been removed, the area of skin between the upper incision and the lid margin is dissected free from the underlying tissue, and the lower edge of this marginal flap is sutured to the skin at the lower edge of the previously denuded area. (3 drawings.)

W. H. Crisp.

16

TUMORS

Santoni, A. **Further contribution to the study of the optic nerve tumors.** Riv. otoneuro-oftal. 21:258-277, Sept.-Dec., 1946.

Progressive protrusion of the right eye, straight forward with a slight deviation outward was noted in a girl, 13 years of age. The eye had been always blind, the pupil did not react to light and the disc was atrophic. On the X-ray film the right optic foramen appeared to be almost three times as large as the left one. An inferotemporal orbitotomy revealed a neoplasm, 9 to 12 mm. in diameter, connected with the optic nerve. The tumor was excised and found to be an astrocytoma. In about a year the tumor recurred. The orbit was exposed by a Krönlein operation and all neoplastic masses were removed. No relapse has been noted after two years. (4 figures, bibliography.)

Melchiore Lombardo.

17

INJURIES

Aranha de Azevedo, Paulo. **Ocular changes and pregnancy.** Arq. brasil. de oftal. 10:47-64, 1947.

The author summarizes the changes recorded and discussed by various writers as having occurred during pregnancy, at labor, and during the puerperium, including changes manifested directly in special ocular tissues, or through the function of vision as dependent upon the general circulation or the central nervous system. (References.)

W. H. Crisp.

Araujo, Helio de. **Ocular lesions from the stings of hymenoptera.** Arq. brazil. de oftal. 9: 140-143, 1946.

Thirteen cases are briefly reported. Except in cases arising from attacks by swarms, the symptoms were exclusively

local, chiefly, in the form of palpebral edema and reactions of the cornea or conjunctiva. Recovery was complete under various forms of treatment, and it may be concluded that the stings of hymenoptera are not malignant.

W. H. Crisp.

Arriaga Cantellera, José. **Craniofacial traumatism with keratitis neuroparalytica.** Arch. Soc. oft. hisp.-amer. 7 :661-670, July, 1947.

The patient suffered a traumatic injury on the left temporomalar region which produced fracture of the left malar and left superior maxillary bones. From the clinical standpoint a diagnosis of fracture of the base of the skull (greater wing of sphenoid) was made in spite of the fact that no X-ray pictures were taken. The right eye was normal; the left had light perception only. There was complete anesthesia of the cornea, the lower one-half of which was occupied by a large ulcer. Paralytic convergent squint and legophthalmos were noted. The injured nerves were found to be the left facial, the left abducens and the first and second branches of the left trigeminus.

J. Wesley McKinney.

Droegemueller, W. H. **The X-ray localization of intraocular foreign bodies.** Tr. Am. Acad. Ophth. 51 :601-603, July-Aug., 1947.

Among the potential causes of error in the Sweet method, Comberg contact lens technique, or sutured markers are differences in relationship between the foreign body and the orientation marking device. These differences may be due to slight head or eye movements as well as difficulties in transposing the charted data to the eyeball proper. The pin point localization of Struble is based on an X-ray plate taken after suturing a small shaving of lead to the eyeball near the site of the foreign body previously indicated in lateral as well as anteroposterior roentgengrams. Accurate localization makes possible minimum trauma during the extraction. Negative X-ray reports should never be taken as proof of the absence of intraocular foreign bodys when other clinical evidence indicates its presence. The Berman and other localizers do not indicate site as accurately as the X-ray. The bone-free method of Vogt, parallax air injection studies, as well as the use of stereoscopic plates are briefly discussed.

Chas. A. Bahn.

Gundersen, Trygve. **Surgery of intraocular foreign bodies.** Tr. Am. Acad. Ophth. 51 :604-613, July-Aug., 1947.

Ocular casualties are ten times more frequent than size of the ocular area leads one to suspect. The eyes expose only 0.2 percent of the body surface, yet ocular casualties constituted almost 3.5 percent of all battle casualties in the sixth General Hospital between March, 1943 and December, 1944. Very small high velocity fragments cause greater ocular damage than would be expected because of their explosive action within the tissues. Multiple foreign body injuries were surprisingly frequent and were observed with a single wound of entrance. Locators that are designed on the same principle as mine detectors frequently accurately indicate the nearest approach to intraocular foreign bodies. Locators give no information which cannot be obtained by precise X-ray examination. The weakest magnetic force possible should always be used in the removal of intraocular foreign bodies. In World War II, the Lancaster hand magnet was most generally used. Routine procedures in ophthalmic military surgery should be avoided because each case presents individual problems. Immediate enucleation should be performed only if it is a part of a general debride-

ment. Differentiation between hemorrhage in the vitreous and in the subchoroidal space is important and can be made by means of visual fields taken with point illumination of low intensity. Secondary foreign bodies such as paint and lashes were frequent and of practical importance. Generally speaking, the toxicity of metallic intraocular foreign bodies is inversely proportionate to their atomic weight. In the removal of intraocular foreign bodies, the trauma involved frequently determines the fate of the eye. Localization must often be of pin point accuracy to avoid calamity. Prompt sulfonamide administration has so reduced the risks of immediate infection that one can take time for accurate diagnosis. The advantages and disadvantages of the anterior and posterior routes are briefly reviewed. The former is less desirable for large foreign bodies which may damage the zonule. To avoid sympathetic ophthalmia necessary enucleations should be performed by the twelfth day.

Chas. A. Bahn.

Nüranen, J. V. **The Navy's plastic ocular restoration.** Military Surg. 100: 402-406, May, 1947.

The paper gives a short history of artificial eyes, the advantages and shortcomings of plastic restorations, the advantages of an individual prosthesis over the conventional stock type, and an explanation as to "why dentistry is the logical profession to undertake this individual prosthesis." Techniques are not described.

In preparing an ocular prosthesis a dental officer is the logical operator to take the impression because of the emphasis placed on the anatomy and physiology of the head and because of his understanding of the physiology, asepsis, and esthetics involved in the problem of dental prosthetics. Francis M. Crage.

Struble, G. C. **Experimental work on intraocular foreign bodies.** Tr. Am. Acad. Ophth. 51:594-600, July-Aug., 1947.

Steel shavings of different sizes, freshly killed pig's eyes and the blunt tip of the giant magnet were used in this experimental work to determine at what distances various sized particles can be drawn through vitreous and uvea and through a scleral incision. The success of the extraction on the first application of the magnet depends on the initial impact of the foreign body on the inner layers of the globe. In these experiments magnetic foreign bodies were in one of four positions: 1. free in the vitreous; 2. imbedded in the retina; 3. between the retina and the choroid; 4. between the choroid and sclera. In position 1 only particles larger than 1 mm. could be consistently brought forward; in position 2, only particles larger than 1 mm. could be disengaged and brought forward and delivered through the ciliary body and anterior chamber; and in position 3, only particles 1.5 mm. or larger could always be delivered. In position 4, 1.5 mm. objects produced choroidal separation and retinal elevation, but in no instance was the retina or choroid prolapsed when the foreign body was delivered. (5 tables.)

Chas. A. Bahn.

Wilder, H. C. **Intraocular foreign bodies in soldiers.** Tr. Am. Acad. Ophth. 51:585-593, July-Aug., 1947.

In military injuries, non-magnetic intraocular foreign bodies predominate by more than 25 percent. In this microscopic study of almost 4,000 enucleated eyes during World War II, more than 18 percent had retained foreign bodies. Among the non-magnetic substances found were copper, brass, lead, nickel, zinc alloys, glass, vegetable matter, eye lashes, shale and clay. Sympathetic uveitis was found in 0.1 percent. Glaucoma was comparatively rare and phthisis bulbi was frequent. The

figures excellently illustrate the basic pathologic process involved. (35 figures.)

Chas. A. Bahn.

18

SYSTEMIC DISEASE AND PARASITES

Alvarez, W. C. **Psychosomatic medicine that every physician should know.** J.A.M.A. 135:704-708, Nov. 15, 1947.

In an address which the ophthalmologist will read with pleasure and profit, Alvarez points out that every physician must know much about psychosomatic medicine if he is to avoid making many diagnostic mistakes. One should learn to recognize quickly those syndromes which are probably always functional in origin and learn when to suspect that a patient's main trouble is a nervous breakdown or fatigue state. One of the best signs is an inability to work comfortably, if at all. Another good sign is the inability to read. The patient says his eyes quickly tire; he gets tense, his head feels as if gripped in a tight band; he reads a paragraph over and over again and gets little out of it. Usually he cannot sleep, and he is irritable and overemotional.

F. H. Haessler.

Appelbaum, Alfred. **Human toxoplasmosis.** West. Med. and Surg. 1:323-331, Oct., 1947.

The author reviews the literature on toxoplasmosis and presents the record of an adult in whom the diagnosis of the disease was confirmed by a positive neutralizing antibody test. A classification of all types of toxoplasmosis is listed. Ocular defects have been observed in more than half the cases and the finding of bilateral central chorioretinitis suggested the proper diagnosis. The general pathological findings are presented and the laboratory procedures for diagnosis have been found to be quite accurate.

The symptoms in infants may include cranial anomalies, convulsions, cerebral calcification and mental retardation. Adults with acute febrile debilitating conditions with erruptions or atypical pneumonia may be found to have toxoplasmosis.

O. H. Ellis.

Carreras Durán, B. **Ocular manifestations in congenital porphyrinuria.** Arch. Soc. oft. hisp-amer. 7:459-468, May, 1947.

A case of congenital porphyrinuria is reported in which the ocular lesions were localized in the cornea, conjunctiva, sclera and episclera in a man, 49 years old. Since the age of 8 years he had had skin ulcerations especially in the ears, and on the hands and face where scars are still visible. He had bilateral conjunctivitis and conjunctival scars from an old ulceration, bilateral holes in the sclera about 2 mm. in diameter which are covered by the bulbar conjunctiva and a dense leukoma in the left cornea. There is a history of the same disease in two members of his family. Van der Hoeve called this disease scleromalacia perforans and reported nine cases. (2 illustrations.)

J. Wesley McKinney.

Cohen, Martin. **Ophthalmoscopic changes associated with hypertensive vascular disease as a guide to sympathectomy.** Arch. Ophth. 37:491-496, April, 1947.

In 82 patients with benign essential hypertension no progression of the retinal lesion was observed after sympathectomy. Of 60 patients with associated hypertension with mild or moderate retinal lesions, regression of the retinal hemorrhages, exudates and edema were observed in 22 after sympathectomy; but the basic underlying retinal arteriolar sclerosis remained unchanged in 48. Retinal angiospasm was relieved in 12 patients.

Patients with benign essential hypertension and eyegrounds that are normal or have moderate lesions are suitable for

sympathectomy if continued medical treatment is of no avail in alleviating the severe and persisting subjective symptoms. The advisability of sympathectomy is determined primarily by the internist, whose decision is based on the consideration of all clinical data in essential hypertension. John C. Long.

Cordes, F. C., and Aiken, S. D. **Ocular changes in acute disseminated lupus erythematosus. Report of a case with microscopic findings.** Am. J. Ophth. 30:1541-1555, Dec., 1947. (11 figures, 29 references.)

Edson Pinho. **Hysteric amaurosis.** Arq. brasil. de oftal. 10:16-19, 1947.

The patient was a white woman, aged 19 years, who had been married for ten months and had a healthy girl aged one month. The eyes were apparently normal, but no form of mental or physical treatment restored her vision until her husband returned from prison.

W. H. Crisp.

Givner, Isadore. **The eye in diabetes.** Am. J. Digest. Dis. 14:258-260, Aug., 1947.

The author discusses the views of many ophthalmologists on the hemorrhagic and exudative changes in the retina of the diabetic. Cataract is more prevalent in the diabetic patient but a true diabetic cataract exists only in the juvenile type and is manifested by subcapsular opacification. Capillary fragility has been seen to become worse after the administration of vitamin P, and hemorrhages continue despite the use of rutin. The author encourages a more thorough study of the conjunctival vessels since he found phlebosclerosis in an aqueous vein of a patient with retinal phlebosclerosis. The diabetes had existed for 17 years. Not infrequently the vessels of the plica are dilated when the remainder of the conjunctiva is normal.

A new classification for hemorrhages and one for exudates is suggested, also a record chart for diabetics. The author feels that newer instruments and newer interpretations of physiopathology in diabetes should help to harmonize the findings with the more modern concepts of the disease. F. M. Crage.

Grammatico, A. D. **Concerning a case of neurocirculatory asthenia of the eye.** Arch. de oft. de Buenos Aires 21:97, April-June, 1946.

Many cases of asthenopia, not improved by the correction of refractive errors or the removal of the foci of infection, are due to neurocirculatory asthenia of the eye, characterized by an altered arteriovenous relation, contraction of the visual field, low intraocular pressure, bradicoria, intolerance to parasympathomimetic drugs and somatic and hemotologic changes. A definite improvement is obtained by the instillation of L-alphaphenyl-betamethyl-aminopropanol sulphate in 5-percent solution, a diet rich in acid ash and thyroid therapy. The treatment is controlled by frequent examination of the visual fields, which show marked improvement. The intraocular pressure remains unchanged. (Bibliography.)

Plinio Montalván.

Hallum, A. V. **Changes in retinal arterioles associated with the hypertensions of pregnancy.** Arch. Ophth. 37:472-490, April, 1947. (See Section 11.)

Holden, F. A. **Migraine as seen by the ophthalmologist.** South. Med. J. 40:757-760, Sept., 1947.

Although the cause of migraine is unknown, the author favors an allergic (food) basis. In a series of over 50 patients who had ophthalmologic symptoms,

all had a protein sensitivity especially to meat and milk. When these were removed from the diet and green vegetables were substituted the patients improved. The main characteristic is periodic paroxysmal headache, preceded by visual disturbance. The headache is usually intense and relieved by sleep. The ophthalmic type can cause permanent eye defects, particularly scotomas. In treatment, all infections are eradicated. All the author's patients showed intoxication from the gastro-intestinal tract, and were constipated. Nicotinic acid and dihydro-ergotamine also have been recommended. (References.) Bennett W. Muir.

Leroy, J. **Ocular reactions during shock treatments in neuro-psychiatry especially electro-shock.** Ann. d'ocul. 180:342-359, June, 1947.

Five stages in the development of shock are recognized: (1) electro-spasm for several seconds; (2) a pre-convulsive phase of 10 seconds; (3) a convulsive phase of one minute; (4) a stertorous phase; (5) and a revival phase. The lid reactions include an intense contracture of the orbicularis, exophthalmos, relaxation, and lastly, lid closure without contraction. In more than 50 percent of the cases observed during the crisis, conjugate deviations of all types were observed, the corneal reflex was abolished and lacrimation increased. The pupillary diameter varied from 2 to 7 mm. and slight mydriasis existed in approximately 70 percent of the patients. Ocular tension was increased above 35 mm. Hg in 14 percent. The intravascular pressure of the retinal arteries was frequently increased temporarily by the treatment, as was the cerebrospinal pressure. Somewhat similar results were obtained with insulin and with cardiazol. Excitation of the neurovegetative centers in the hypothalamus is considered the basic process. (37 references.) Chas. A. Bahn.

Lorofi, H. **Treatment by intravenous novocaine of visual disturbances caused by tryparsamide.** Presse Méd. p. 435, (June 28) 1947.

Eleven observations are reported in which visual accidents that occurred in the course of tryparsamide therapy were treated with injections of novocaine. There were two failures, seven successes, and two improvements. In the seven cases in which the amaurosis was complete the treatment was successful in three and there was improvement in two. The injection of from six to ten cc. of 1-percent novocaine solution was reported from five to fifteen times. The first four or five injections were given daily and the remainder spaced irregularly according to the response of the patient. Positive results, when obtained, were almost immediately apparent.

Phillips Thygeson.

Pittman, H. W., Holt, L. B., and Harrell, G. T. **Effect of irradiation, immunity and other factors on vaccinial infection; a review illustrated by the report of a secondary ocular infection treated with roentgen rays.** Arch. Inter. Med. 80:61-67, July, 1947.

A case of vaccinial infection of the lid appeared five days after vaccination against smallpox. Roentgen treatment (220r) given in four days along with other treatment helped complete recovery.

Experiments on rabbits with primary and secondary vaccinial infection showed that Roentgen therapy diminished the residual corneal opacities, hastened regression of the acute lesions, and diminished the rate of spread of the virus through tissue. The partial immunity that develops as a result of the skin vaccination helps diminish the severity of the secondary lid and corneal infection. The use of immune serum and other methods of therapy are discussed. It is believed that the former inactivates the virus,

alters its virulence, increases the resistance of the host cell, or inhibits the spread of virus through tissue.

H. C. Weinberg.

Potter, L. C. **Industrial eye surgery and treatment; mechanical approach.** Indust. Med. 16:350-352, July, 1947.

A well organized safety department to instruct "lead men" in industrial and emergency work is paramount. The most improved fine mesh goggles with proper filter lenses are necessary. Close coöperation and coördination with the medical services and safety department to minimize injuries and accidents, and immediate treatments of the emergencies, pay big dividends in service to the employer and employee alike.

A total of 10,901 eye cases, treated according to these principles in one year was recorded by the safety department. A score of 99 percent success with no eventual loss of sight, annoying scar tissue, or chronic diseases, gives a measure of the value of the combined services. One point stands out clearer than others, namely: prompt and immediate attention to patients with accidents of the eyes and a careful and complete medical and surgical service, are a necessity.

Theodore M. Shapira.

Schnitker, M. T., and Schnitker M. A. **A clinical test for migraine.** J.A.M.A. 135:89, Sept. 13, 1947.

The authors have developed a technic for the differentiation of two types of headaches which are very similar clinically. It has been found specific in the precipitation of a migraine attack in those who are subject to that disorder. Migraine must be differentiated from the histamin cephalalgia which follows an injection of histamin base. In migraine the pain seems to arise from stretching the cranial arteries, especially the external carotid and its branches. Histamin cephalalgia and those headaches associated with fever are due to the dilatation of the cerebral branches of the internal carotid, especially the vertebral and basilar.

Actual migraine must not be present when the test is begun, and a careful neurologic examination must first exclude intracranial lesions. After the blood pressure and pulse rate in the reclining patient have been recorded, the patient is given two 1/100-grain nitroglycerin tablets. Two to four minutes later the pulse rate will rise, but the blood pressure will drop below the resting level, and the patient will note the first migraine symptoms. The patient is then asked to compare the sensation produced by the tablets with his usual complaint. When migraine is habitually localized in one area, that area will be the first to manifest the typical pain following the nitroglycerin. A more generalized headache will follow in a few minutes.

Relief can usually be given by firm compression of the homolateral carotid artery for one to two minutes, breathing oxygen for five minutes, or injecting a solution of 0.5 to 1 mg. ergotamine tartrate intravenously. Usually the pain disappears spontaneously.

If typical migraine is not produced by the nitroglycerin, the patient rests fifteen minutes, and is then given the subcutaneous histamin test. If this produces his usual symptoms, a diagnosis of histamin cephalalgia is made. He is then given two or three minims of 1:300,000 epinephrin intravenously, and later the usual histamin desensitization procedure is carried out.

This test for migraine has been found uniformly satisfactory in over 250 cases.

A. G. Wilde.

Wagener, H. P. **Progress of medical science: Ophthalmology: ocular lesions in brucellosis.** Am. J. M. Sc. 214:215-219, Aug., 1947.

Most cases of brucellosis reported occur in the acute stage of the disease. It may occur in the form of choked disc, optic neuritis, extraocular muscle paralysis, uveitis, retinitis, keratoiritis, and keratoconjunctivitis. History of recurrence in the chronic forms is important. A positive skin test and an agglutination in a dilution over 1:80 is important.

Irwin E. Gaynon.

Wilhelm, G. **The participation of the eye in typhus.** Klin. Monatsbl. f. Augenh. 112:48-60, May, 1947.

The basic pathological-histological finding in typhus is connected with a vascular cell infiltration in the skin and the organs, particularily the central nervous system. The author discusses the various theories and descriptions, as found in the literature. He then presents the eye findings consisting of a conjunctivitis due to a roseola of the palpebral and bulbar conjunctiva, of a uveitis and of a papillitis. Slides are presented illustrating the histologic findings of these conditions. The optic nerve shows a diffuse increase in cells in the endoneural septi and the optic nerve sheaths. Infiltrates are found in the choroid, especially in the form of nodules of the vesel wall in the layer of the larger arteries. Nodules may also be found in the iris. Sometimes (in one third of the author's material) these nodules can be seen with the ophthalmoscope as grayish white infiltrates close to the papilla near an artery. The retina shows secondary changes through edema or circumscribed detachment, but can also be involved by primary nodules in the wall of the retinal arteries. These retinal infiltrates near an artery are also ophthalmoscopically visible. Due to venous stasis from the papillitis or from venous thrombosis small hemorrhages may occur in the nerve fiber layer of the retina. (16 photographs.)

Max Hirschfelder.

Young, R. H., and McEwen, E. G. **Bacillary dysentery as the cause of Reiter's syndrome.** J.A.M.A. 134:1456-1459, Aug. 23, 1947.

Since 1916 the triad of symptoms that consists of arthritis, conjunctivitis and urethritis has been known as Reiter's disease. The study of 176 cases of bacillary dysentery observed in Algeria revealed 14 cases of post-dysenteric arthritis. In several of them there was also conjunctivitis and urethritis and these cases fulfil the clinical requirement both of Reiter and of Fiessuege and Leroy who independently described this syndrome. In four of the six cases in which the blood was tested significantly positive agglutination titers for Shigella organisms were obtained. The authors believe that Reiter's disease is a particular combination of three of the recognized complications of bacillary dysentery.

A. G. Wilde.

19

CONGENITAL DEFORMITIES, HEREDITY

Beauvieux, M. **Apparent blindness in the newborn. Gray pseudo-atrophy of the optic nerve.** Arch. d'opht. 7:241-249, 1947.

The author reports a syndrome of apparent blindness in the prematurely newborn characterized by incoordination, absence of photomotor reflex, dilated pupils, nystagmoid movements, and depigmented fundi with mottled gray nerve heads. Although the child appears blind he later is found to have vision commensurate with his refractive error. The clinical symptoms may be of short duration and return to normal may occur within a few months.

Beauvieux considers that there are two varieties of this syndrome. In the first the return of vision is rapid (from four to six months) and is complete. In the second the clinical evolution is less satisfactory and there are numerous sequelae

such as pigmentary changes in the retina, posterior polar cataract, strabismus, nystagmus, high myopia, Little's disease, and various cerebral changes. A certain return of visual acuity is always obtained, however. As to cause, Beauvieux considers that prematurity and abnormal gestation, leading to retarded myelinization of the optic nerve and cortical fibers, are important factors.

In a follow-up study of seven cases over periods of ten years or longer, three patients were found to have normal vision and four to have reduced vision varying from 3/10 to 5/10.

Phillips Thygeson.

Cavalcanti, L. R. **Ocular changes in heredo-degenerative diseases of the nervous system.** Rev. brasil. de oftal. 6:5-14, Sept., 1947.

This is a rather broadly generalized consideration of various diseases of the nervous system which may be represented in the eyes, with numerous brief references to the literature, but without any very precise classification or description.

W. H. Crisp.

Crespí, G. **Coloboma of the cornea.** Arch. Soc. oft. hisp.-amer. 7:577-586, June, 1947.

A man, 26 years old, with a negative family history had bilateral, symmetrical coloboma of the cornea and iris in the lower nasal segment. It appeared as though a cone of sclera invaded the cornea for 3 to 4 mm. The pupil was oval with its axis down and in. A portion of the pectinate ligament appeared to have entered the anterior chamber in this region. The pathogenesis of these disturbances is reviewed, with special reference to a differential diagnosis of malformations originating from interference in the development of the fissure of the optic cup, and those stemming from disturbances in the facial fissure. The author attributes the malformation in his case to a developmental disturbance at the end of the cleft in the optic cup, and it is pointed out that disturbances of either fissure may cause malformations in the anterior ocular segment. (7 illustrations.) Ray K. Daily.

Sala, Guido. **The so called "Hypertelorism" of Greig.** Riv. oto-neuro-oftal. 22:32-50, Jan.-Feb., 1947.

The writer reports two cases of Greig's hypertelorism characterized by an abnormal distance between the two eyes. This condition is frequently associated with other cranial malformations but in the Greig syndrome it is only a manifestation of an anomaly in the development of the sphenoid bone which consists in a disproportion in the growth of the great and small wings of the bone. The writer discusses briefly the probable factors in the development of the anomaly and suggests that the name be changed from hypertelorism to telophthalmus because the latter describes the clinical picture more accurately. (Bibliography.)

Melchiore Lombardo.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Apin, K. **The practice of trachoma control in Latvia.** Klin. Monatsbl. f. Augenh. 112:60-62, May, 1947.

This report summarizes statistically the effect of a recent Latvian edict forcing trachoma patients to undergo treatment. Admissions of trachoma patients to eye clinics increased over 100 percent. The early stages showed a more rapid healing and less reduction in visual acuity. The patients who lived close to oculists benefited in a much higher percentage. Close cooperation between oculists and public health doctors revealed the necessity of intensive special treatment like grattage in 18 percent, surgery in 9 percent and hospital admission for a serious stage in 5

percent of the patients during field surveys. Ten percent of all trachoma patients sooner or later had a pathologic condition of the lacrimal duct, but in only five percent of the patients this was present at the first examination. Max Hirschfelder.

Hallermann, W. **The geographic distribution of ocular tuberculosis.** Klin. Monatsbl. f. Augenh. 112:13-20, May, 1947.

In the Sanatorium Hoechenschwand 3,300 patients with clinically certain ocular tuberculosis were surveyed to determine if certain regions in Germany show a prevalence of ocular tuberculosis. It was found that the number of patients from various districts paralleled the general density of the population. Laborers and civil service workers predominated but this finding is not significant because the medical insurance plan embraces these occupations and does not cover the rural population to an equal extent. A prevalence of ocular tuberculosis in certain regions was not established.

Max Hirschfelder.

Hessberg, R. J. **Review of contributions and experiences of World War II to ophthalmology. 1. Injuries of the eyes and head.** Ophth. ibero amer. 8:1-44 and 2:119-175, 1946. (English and Portuguese).

This lengthy review is based on ophthalmic literature from 1939 to 1945 so far as available at the time of writing. The author reminds us that most observations were made in forward lines and in rear hospitals where the casualties could only remain for a limited time, so that the physician was rarely or never able to follow the development of the cases to the end or until complete clinical healing took place. The scope of the review may be gathered from the following section headings: statistics and first treatment, protection and prevention, special reports, perforating wounds, foreign bodies, the skeleton-free X ray, magnet tests, methods of localization, double perforation, magnets, methods of extraction and their results, contact lenses, enucleation and evisceration, stump formation, contracted socket, sympathetic ophthalmia, injuries by blasting, concussion and contusion, retinal angiopathy, orbit and sinus, pulsating exophthalmos, maxillo-facial injuries, head injuries, psychic disturbances, burns, and plastic surgery.

Most perforating injuries were due to explosions. It is generally concluded that all eye injuries should be sent to special eye departments as soon as possible, only cleaning and dressing being done at the first-aid station. Direct suture of corneal wounds is preferable. Widely gaping perforations need conjunctival flaps. Early enucleation of blind eyes is preferable to evisceration except in the presence of true panophthalmitis. The main objective in burns of the face, lids, and eyes is to prevent or limit infection as completely as possible, and grafting of the burned area is advisable at the earliest opportunity. Plastic surgery should be limited to ophthalmologists having special training for this work. (7-page bibliography.) W. H. Crisp.

Moron-Salas, José. **What can be expected from "radar" for the blind?** Arch. Soc. oft. hisp.-amer. 7:703-709, July, 1947.

With the hope that blind people can be taught how to recognize surrounding objects even to read text books the author briefly describes his experimental work with radar. He utilizes the photoelectric cell as a fundamental base of an apparatus, which would give sounds of different characteristics according to the shape of the objects placed before it.

J. Wesley McKinney.

De Roetth, Andrew. **Blackboard cornea for teaching.** Am. J. Ophth. 30:1299, Oct., 1947. (2 figures.)

Schepens, C. L. **Reflections on a stay in the U. S.** Ann. d'ocul. 180:292-307, May, 1947.

The author was a guest speaker at the 1946 Academy meeting. He spoke on several occasions and presented a binocular ophthalmoscope which has been reviewed in this journal. After a brief description of the Academy meeting, Dr. Schepens described in some detail the medical and surgical advances which he observed there and while on a tour of several American ophthalmological centers. These observations included the types of vertical muscle advancements and resections, tendon transplantations of paralytic muscles, the techniques of enucleation and evisceration as well as the different substances used as implants. The author preferred the implant technique of Cutler to that of Ruedeman. Among the newer drugs described are tyrothrycin, streptomycin, streptothrycin, and the anti-glaucomatous drugs, doryl and D.F.P. The author discusses in some detail the organization of the ophthalmological department of the Mayo Clinic, and the procedures of superficial keratectomy, the radio-therapeutic treatment of vascular corneal opacities before transplantation, and round and square corneal grafts which he observed in New York.

Chas. A. Bahn.

Velter, Edmond. **Ophthalmology in France from 1939 to 1945.** Arch. de oftal. de Buenos Aires. 21:63, April-June, 1946.

The author reviews French ophthalmology throughout the war years, emphasizing the considerable difficulties and hardships created by the dispersal of personnel and scarcity of instruments, chemicals and animals for experimental work. The restrictions on gas and electricity rendered impossible the use of apparatus and equipment. The resourcefulness, spirit of sacrifice and devotion to science of the French ophthalmologists made it possible for them to carry on to a remarkable degree clinical and experimental work under the adverse circumstances of this period. The author lists the most important papers and communications made during war years.

Plinio Montalván.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. Milton Julius Ballin, New York, New York, died September 12, 1947, aged 73 years.

Dr. Oscar Dodd, Evanston, Illinois, died October 15, 1947, aged 83 years.

Dr. Frank B. Kistner, Portland, Oregon, died September 25, 1947, aged 73 years.

Dr. Lawrence Cornelius Meredith, Elyria, Ohio, died September 29, 1947, aged 55 years.

Dr. Clarence Henry Smith, New York, New York, died October 6, 1947, aged 72 years.

ANNOUNCEMENTS

UNITED KINGDOM TRANSACTIONS AVAILABLE

The Ophthalmological Society of the United Kingdom holds a considerable stock of certain volumes of the *Transactions* since their first publication. The following years, however, are not available:

1897; 1898; 1899; 1900; 1901; 1902; 1905; 1906; 1907; 1908; 1909; 1911; 1917; 1918; 1919; 1920; 1921; 1922; 1923; 1924; 1926; 1927; 1928; 1929; 1930; 1931; 1932; 1933; 1934; 1935; 1937 (Part I).

The council feels that many libraries, both at home and abroad, may wish to complete their sets and will be glad to present to libraries, medical schools, and hospitals such available volumes as they may desire. No charge will be made other than the cost of postage.

Those interested are asked to communicate with the Bowman Librarian, The Royal Society of Medicine, 1, Wimpole Street, London, W.1.

PRIZE FOR RESEARCH WORK

An honorarium of $1,000 to promote research work in ophthalmology is offered through the American members of the staff of the International Association for the Prevention of Blindness. The jury will consist of the executive committee together with the president and the officers of the association.

The award will be made in connection with the XVIth Concilium Ophthalmologicum. Papers may be presented by any responsible research worker. The subject is to be "Simple Noninflammatory Glaucoma" and may include anything definitely related to the question. The matter must be new and of such value, in the judgement of the jury, as to merit this recognition. Papers may be written in English or French; they should be heretofore unpublished or published between this date and October 15, 1949. They should be in the hands of the secretary of the International Association for the Prevention of Blindness, 66 Boulevard St. Michel, Paris, through whom they will reach the members of the judicial committee, not later than October 15, 1949. The decision of the jury will be final.

PRELIMINARY ANNOUNCEMENT OF COURSE

The University of California is announcing a series of postgraduate courses for qualified physicians to be given during 1948. The course in ophthalmology will be given September 6th to 10th. Requests for completed programs and details should be addressed to Dr. Stacy R. Mettier, head of postgraduate instruction, Medical Extension, University of California Medical Center, San Francisco 22.

GILL HOSPITAL SPRING COURSE

From April 5th to 10th, the Gill Memorial Hospital, Roanoke, Virginia, will hold its 21st annual spring graduate course. Among the guests-of-honor who will appear on the program are: Rear Admiral Clifford A. Swanson, surgeon general of the United States Navy; Dr. H. J. Moersch, professor of medicine, Mayo Clinic; Dr. Bayard T. Horton, Mayo Clinic; Prof. Adalbert Fuchs, formerly of Vienna; and Dr. Conrad Berens, New York.

The first three days, Monday, Tuesday, and Wednesday, will be devoted primarily to instruction in otolaryngology. There will, however, be two clinics of interest to ophthalmologists. The first, at 10:45 on Tuesday morning, will be conducted by Dr. Conrad Berens on the subject, "The Relationship of Uveitis to Chronic Sinus Infection"; and the second, conducted by Dr. Bayard T. Horton, will be held at 2:30 Tuesday afternoon on the subject, "Diseases of the Eye, Including Retrobulbar Neuritis: Treatment with Histamine."

On Thursday, Friday, and Saturday, intensive instruction in ophthalmology will be offered. The complete program follows.

Thursday, April 8th

8:00 to 9:00 a.m. Clinic conducted by Dr. John M. McLean, professor of ophthalmology, Cornell University Medical School, New York.
Subject: "Intracapsular Cataract Surgery."

9:00 to 10:00 a.m. Clinic conducted by Dr. A. D. Ruedemann, professor of ophthalmology, Wayne University Medical School, Detroit, Michigan.
Subject: "Enucleation and Substitutes for the Removed Eye."

10:00 to 11:00 a.m. Clinic conducted by Dr. Edwin B. Dunphy, chief of ophthalmology, Massa-

chusetts Eye and Ear Infirmary, Boston, Massachusetts.
Subject: "An Evaluation of Miotics."

11:00 to 12:00 a.m. Clinic conducted by Dr. Trygve Gundersen, assistant professor of ophthalmology, Harvard Medical School, Boston, Massachusetts.
Subject: "Experiences with Ocular Complications of Herpes Zoster."

12:00 to 1:00 p.m. Clinic conducted by Professor Adalbert Fuchs, UNRRA-WHY, Nanking, Shanghai, China.
Subject: "Injuries of the Anterior Part of the Eye."

1:00 to 1:30 p.m. Luncheon at Hotel Patrick Henry.

1:30 to 2:30 p.m. Clinic conducted by Dr. John M. McLean.
Subject: "Detached Retina."

2:30 to 3:30 p.m. Clinic conducted by Dr. A. D. Ruedemann.
Subject: "The Place of Orthoptics in Ophthalmology and the Use of the Orthoptic Technician."

3:30 to 4:30 p.m. Clinic conducted by Dr. Edwin B. Dunphy.
Subject: "Evaluation of Chemotherapy in Ophthalmology."

4:30 to 5:30 p.m. Clinic conducted by Dr. Trygve Gundersen.
Subject: "The Diagnosis and Treatment of Common Diseases of the Cornea."

7:30 to 8:30 p.m. Clinic conducted by Professor Adalbert Fuchs.
Subject: "Endophthalmitis and Panophthalmitis."

Friday, April 9th

8:00 to 8:30 a.m. Surgical Clinic conducted by the Members of the Staff of the Hospital.

8:30 to 9:15 a.m. Clinic conducted by Dr. Donald J. Lyle, professor of ophthalmology, University of Cincinnati Medical School, Cincinnati, Ohio.
Subject: "The Effect of General Vascular Disorders upon the Brain and Eye."

9:15 to 10:00 a.m. Clinic conducted by Professor Adalbert Fuchs.
Subject: "Eye Operations."

10:00 to 11:00 a.m. Clinic conducted by Dr. A. D. Ruedemann.
Subject: "Early Diagnosis and Treatment of Cataract."

11:00 to 12:00 a.m. Clinic conducted by Dr. Alston Callahan, professor of ophthalmology, University of Alabama Medical School, Birmingham, Alabama.
Subject: "Repair of Ectropion."

12:00 to 1:00 p.m. Clinic conducted by Dr. Rudolph Aebli, professor of ophthalmology, New York Post Graduate Hospital and Medical School, New York.
Subject: "Anatomy and Physiology of the Extraocular Muscles. The Differential Diagnosis of the Heterophorias and Heterotropias."

1:00 to 1:30 p.m. Luncheon at Hotel Patrick Henry.

1:30 to 2:30 p.m. Presentation of Patients with Unusual Clinical Interest by the Staff of the Hospital.

2:30 to 3:15 p.m. Clinic conducted by Dr. Donald J. Lyle.
Subject: "The Effect of Increased Intracranial Pressure as it Concerns Ophthalmology."

3:15 to 4:00 p.m. Clinic conducted by Dr. A. D. Ruedemann.
Subject "The Use of the Beta Radiation Therapy in Ophthalmology."

4:00 to 4:45 p.m. Clinic conducted by Dr. Alston Callahan.
Subject: "Traumatic Blepharoptosis, and Reconstruction of Upper Lid."—Illustrated.

4:45 to 5:30 p.m. Clinic conducted by Professor Adalbert Fuchs.
Subject: "Glioma Retinae and Sarcoma Choroidea."

7:30 to 8:30 p.m. Clinic conducted by Dr. E. G. Gill, Roanoke, Virginia.
Subject: "Ophthalmic Surgery."

8:30 to 9:30 p.m. Clinic conducted by Dr. Rudolph Aebli.
Subject: "The Medical Management of the Phorias."

Saturday, April 10

8:00 to 9:00 a.m. Clinic conducted by Dr. Donald J. Lyle.
Subject: "Hereditary Eye Conditions."

9:00 to 10:00 a.m. Clinic conducted by Dr. Alston Callahan.
Subject: "Fascia Lata Repair of Retrotarsal Atrophy, and Removal of Orbital Tumor by Inferior Route."—Illustrated.

10:00 to 10:45 a.m. Clinic conducted by Professor Adalbert Fuchs.
Subject: "Diagnosis of Glaucoma."

10:45 to 11:15 a.m. Clinic conducted by Dr. Ralph O. Rychener, professor of ophthalmology, University of Tennessee, Memphis, Tennessee.
Subject: "Ocular Allergies."

11:15 to 12:00 a.m. Clinic conducted by Dr. Rudolph Aebli.
Subject: "Principles of Ocular Muscle Surgery."

12:00 to 1:00 p.m. Clinic conducted by Dr. Donald J. Lyle.
Subject: "The Autonomic Nervous System Relative to the Eye."

1:00 to 1:30 p.m. Luncheon at Hotel Patrick Henry.

1:30 to 2:30 p.m. Clinic conducted by Dr. Ralph O. Rychener.
Subject: "Treatment of Dacryocystitis."

2:30 to 3:30 p.m. Clinic conducted by Professor Adalbert Fuchs.
Subject: "Nonperforating Injuries of the Fundus."

3:30 to 4:30 p.m. Clinic conducted by Dr. Rudolph Aebli.
Subject: "Congenital Anomalies."

Miscellaneous

Holmes memorial lecture

Dr. E. V .L. Brown, Rush clinical professor

emeritus of ophthalmology, University of Illinois College of Medicine, delivered the first presentation under the gift of the Rudolph Wieser Holmes and Maria Baxter Holmes Fund in memorial to Edward Lorenzo Holmes at the Palmer House on Friday evening, January 30th, at a joint meeting of the Institute of Medicine of Chicago, the Chicago Ophthalmological Society, and the Society of Medical History of Chicago. His subject was, "Edward L. Holmes: Pioneer Chicago Eye Doctor."

Glaucoma clinic

Montefiore Hospital, New York, has established a glaucoma clinic in its ophthalmological service. Although cases in all stages of glaucoma that are eligible for clinic care will be accepted, the Hospital is especially interested in early cases.

Societies

Egyptian meeting

The annual meeting of the Ophthalmological Society of Egypt will be held at the Memorial Ophthalmic Laboratory, Giza, Egypt, on Friday and Saturday, March 12th and 13th.

AOS meeting announced

The 84th annual meeting of the American Ophthalmological Society will be held at the Homestead, Hot Springs, Virginia, on May 17th, 18th, and 19th. The members are requested to send the titles and brief abstracts of such papers as they desire to present at the meeting, to Dr. Frank B. Walsh, Johns Hopkins Hospital, Baltimore 5, Maryland, as soon as possible. All titles and abstracts must be forwarded to Dr. Walsh before April 1st to be incorporated in the call for the meeting to be sent out about April 15th.

Brooklyn Society program

On the program of the 102nd regular meeting of the Brooklyn Ophthalmological Society, December 18, 1947, were: Dr. Jesse M. Levitt, "Occlusion of the Cilioretinal Artery of the Left Eye"; Dr. Ludwig von Sallmann and Dr. W. C. Stone, "Clinical Experiences with Di-isopropyl Fluorophosphate in the Treatment of Glaucoma"; Dr. John M. McLean, "Soft Glaucoma."

Philadelphia officers

The Section on Ophthalmology, College of Physicians of Philadelphia, announces a change of officers. Dr. Perce DeLong, 37 South 20th Street, Philadelphia, is chairman; and Dr. M. Luther Kauffman, Medical Arts Building, Jenkintown, Pennsylvania, is clerk. Meetings are held the third Thursday of every month from October through April, at 8:15 p.m., in the College of Physicians Building.

Pennsylvania Academy meeting

The next regularly scheduled meeting of the Pennsylvania Academy of Ophthalmology and Otolaryngology will be held on April 23rd, 24th, and 25th, at the Hotel Penn-Harris, Harrisburg, Pennsylvania.

Utah society changes name

At a recent meeting of the Utah Ophthalmological Society, a new constitution was adopted. In this constitution, the name of the society was changed to the Inter-Mountain Oto-Ophthalmological Society. This was done to recognize the fact that the society was no longer comprised of local men, but included members from outside the state.

The officers of the new society are: Dr. James A. Cleary, 804 Boston Building, Salt Lake City, president; Dr. Earl H. Phillips, 224 Judge Building, Salt Lake City, vice-president; and Dr. Homer E. Smith, 1005 Medical Arts Building, Salt Lake City, secretary-treasurer.

Reading speaker

Dr. Frederick Willson addressed the 73rd meeting of the Reading Eye, Ear, Nose, and Throat Society. His subject was, "Visual Perception Other than Ocular."

Personals

Awarded Pan-American medal

Dr. Harry S. Gradle, for many years a leading ophthalmologist in Chicago, was awarded the first Pan-American Medal of the National Society for the Prevention of Blindness in the United States, at the recent meeting in Havana. The medal honors Dr. Gradle's contributions toward the prevention of blindness and his service to the establishment of friendly relations with Latin-American countries. Dr. Gradle, now retired, is living in California.

New associate

Dr. Samuel V. Abraham of Los Angeles and Beverly Hills, California, announces that Dr. Philip D. Shanedling is now associated with him in the practice of ophthalmology.

Opens offices

Dr. Barbara Spiro, formerly of the Billings Hospital and The University of Chicago Clinics, announces the opening of offices at the Medical and Dental Arts Building, 7449 Cottage Grove Avenue, Chicago 19.

Receives Snyder grant

Dr. K. W. Ascher, Cincinnati, has received a $2,000 grant from the Snyder Ophthalmologic Foundation to further his research on the aqueous veins.

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 31 MARCH, 1948 NUMBER 3

EARLY DEVELOPMENT OF THE FILTRATION OPERATIONS FOR GLAUCOMA

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The problem of glaucoma is far from solved, and this disease is still the most frequent cause of incurable blindness among persons past middle age. But it can at least be said that the prospect of surgical relief from this disorder, or group of disorders, has vastly improved in the last half century.

It is now nine decades since Albrecht Graefe[1] first announced that he had found in surgical iridectomy a cure for many cases of glaucoma, especially acute glaucoma. He himself was prompt to admit that the operation was not always successful even in acute cases, and that its success, or at least its complete success, was rather the exception than the rule in the chronic type of the disease. Conjectures and observations arising out of this fact played a considerable part in the later invention of operations which have proved much more reliable for the chronic cases.

In earlier editions of de Schweinitz's *Diseases of the Eye,* that author[2] remarked that one of the complications following the operation of iridectomy in glaucoma was the formation, at the seat of the incision, of a bulging scar sometimes called a cystoid cicatrix; and that on the other hand, in severe cases, this very cystoid cicatrix, by permitting a filtering of the liquids, had sometimes been described as a favorable condition; but that to this view of a cystoid scar the author could not subscribe.

William Campbell Posey,[3] writing on glaucoma in the *American Encyclopedia of Ophthalmology,* regarded Graefe's discovery of iridectomy for glaucoma as "the greatest contribution which has been made to ophthalmic science." Yet, within relatively few years after Graefe's introduction of this operation, various authors proposed other surgical methods of treatment.

Thus de Wecker,[4] in 1867, put forward the operation which he termed anterior sclerotomy, by which it was hoped to establish at the angle of the anterior chamber a cicatrix through which the intraocular fluids might filter out of the eye. Four years later the same author announced a modification of his original operation, in order to avoid prolapse of the iris. This he sought to accomplish by carrying the cutting edge of the knife slowly through the limbal structures until only a 2-mm. bridge of undivided tissue remained.

Panas[5] made an incision with the Graefe knife below and to the outer side, and plunged the knife through the iris for 8 to 10 mm., cutting both iris and sclera in association with a 2- or 3-mm. wound of exit from the anterior chamber. De Wecker[6] later tried the effect of iridodialysis made by pulling the iris toward the pupil after a keratome incision at the limbus. In England, Bader,[7] more or less upon the basis of de Wecker's method, made the corneal puncture and counterpuncture as near as possible to the insertion of the iris, but tried to leave a large bridge of conjunctiva reaching across the scleral incision, dividing an extent of sclera

equal to nearly a third of the circumference of the cornea.

In Graefe's own brief though brilliant career (he died of tuberculosis at the age of 42 years), his use of iridectomy for acute glaucoma was rather vigorously condemned by eye surgeons of great eminence, men who are given high praise whenever the history of ophthalmology in the second half of the 19th century is under discussion. *The Medical Times and Gazette* of London, England, for many years an outstanding example of medical journalism of the 19th century, contained, in 1858, as many as eight original papers dealing with iridectomy. In the first of these, by Hulke[8] of King's College Hospital, reference is made to a fact which today sounds strange, namely that Graefe at first tried atropine in the treatment of acute glaucoma, for which locally the previous operative treatment had practically been limited to paracentesis of the anterior chamber. Although iridectomy was welcomed enthusiastically by Hulke,[8] Bowman,[9] and Critchett,[9] two other surgical writers, whose names are still familiar to many of us, questioned both Graefe's ability as an ophthalmologist and the efficacy of the operation for glaucoma. These were T. Wharton Jones, professor of ophthalmic medicine and surgery in University College, London, and William Mackenzie, surgeon-oculist to Queen Victoria and lecturer on the eye in the University of Glasgow. Jones and Mackenzie[10] condemned Graefe's practice of iridectomy as "opposed to the plainest principles of surgery and common sense," and they had no doubt that in a short time iridectomy as a means of treating glaucoma would be abandoned in favor of "the practice . . . of more frequently puncturing the cornea and sclerotica in this disease."

In the same medical journal Graefe[11] took up the cudgels in his own defense, remarking that he had doubted "whether the article merited an answer or not, for the esteemed authors confess that they are without any personal experience on the questionable point," but he undertook a reply "as a tribute . . . to their earlier merits." He pointed out that the inadequacy of paracentesis had been clearly demonstrated for years in his own large practice. In conclusion he says "I willingly pardon older, and so highly deserving men, for their want of that elasticity requisite for the immediate reception of new views; . . . but I should indeed have expected more moderation from the Nestor of English ophthalmology."

A fact which seems worth mentioning here, although perhaps of picturesque rather than practical significance, is that in 1874 that famous Scot, D. Argyll Robertson,[12] published a paper under the title "Trephining the sclerotic—a new operation for glaucoma." Argyll Robertson thought that the increase of tension was due in some cases to increased secretion of vitreous humor, in others to serous transudation into the chamber of the vitreous humor. He expressed the opinion that all measures undertaken for the cure of the disease should have for their object the reduction of the intraocular pressure. He had therefore undertaken to drill a circular aperture through the sclerotic at or about the junction of the ciliary processes with the choroid, "so as to avoid as far as possible the more anterior parts of the ciliary processes." The instrument used was the "corneal trephine devised by Mr. Bowman for operating on cases of conical cornea," or subsequently a modification of this instrument which Argyll Robertson himself devised. The operation had been used on only four eyes, in very advanced glaucomatous condition. The results were inconclusive.

The most striking period of development in the surgery of chronic glaucoma appears to have been the first decade of the present century, although of course much preliminary investigation went on before the resulting publications appeared in the literature.

Herbert's subconjunctival fistula

As early as 1903, writing under the title of "Subconjunctival fistula formation in the

treatment of primary chronic glaucoma," Herbert[13] remarked that in a large proportion of the eyes operated upon in his work in India, typical iridectomy failed to relieve tension or even destroyed sight through various complications. In his own work, as well as that of other operators, success was much more generally obtained when the iris had by chance healed in the wound. He had also observed that proplapse of the iris following cataract extraction, when not covered by conjunctiva, was often associated with iritis from the beginning, whereas a similar prolapse, mainly or entirely covered by a conjunctival flap, did not exhibit this tendency, and he added that the evil repute of cystoid cicatrices in rendering eyes permanently liable to infection had been earned mainly, at any rate in the cases following cataract extraction, by prolapses and incarcerations which were left partly or completely uncovered by conjunctiva. It was this line of observation and reasoning which had caused him to leave prolapsed iris—in nearly all cases purposely—in 130 operations for primary glaucoma. The relief of tension provided by a fistulous cicatrix appeared, he said, to be certain and permanent. Herbert concluded that the perspective in our views upon the operative treatment of chronic glaucoma needed correction, and that too much had been made of the fear of late infection, and too little of the fact that fistulous scars provided the only certain means of permanently relieving some cases of glaucoma.

Holth's iridencleisis

A model of clear thinking and patient observation is contained in the communication read by Holth[14] before the Medical Society of Christiania (now Oslo), on September 26, 1906, and which was also presented in condensed form in the same year to the French Ophthalmological Society and to the meeting of the German Ophthalmological Society in Heidelberg, and was published in full (in French translation) in *Annales d'Oculistique,* May, 1907. It is proper to regard this paper as one of the classics of ophthalmic literature, by virtue of its logical study of scientific facts and the clarity of its argument.

Except as to iridectomy, proposed by Graefe for the relief of glaucoma 50 years earlier, previous operations for glaucoma had aimed to establish a new channel of drainage of aqueous humor by excision of sclera beneath a conjunctival flap. Holth's operation, generally speaking, excised no tissue; and it depended for success upon the formation of a new drainage channel associated with incarceration of the pigmented iris between the lips of the scleral wound.

It is necessary to keep in mind how important a step in the study of the glaucoma problem, for now nearly a half century, has been the successful tonometer of Schiötz, another Christiania leader. Holth tested with the tonometer a series of glaucomatous eyes which had been subjected to iridectomy. Except within the first few weeks after the operation, he found the intraocular pressure generally above normal. Strangely enough, and in spite of the dread of iris prolapse as a dangerous complication following any intraocular operation, Holth discovered that the iridectomized eyes which had been relieved of their hypertension were usually eyes in which the technique of the operation had in the first instance been regarded as defective, because iris tissue had been left in the scleral wound.

Holth therefore made an intentional experiment upon the two equally hypertensive eyes of a single patient, doing an ordinary iridectomy upon the blind eye, and upon the other eye an iridectomy with incarceration of the iris beneath the conjunctival flap. The tension had previously been 54 mm. in each eye. In the former eye the tension fell to 43 mm., and in the latter to 24 mm. Holth further compared other cases in which iridectomy had been complicated by accidental incarceration of the iris with those cases in which the iridectomy had been classically

performed, and this further study supported his conclusion that the subconjunctival incarceration was beneficial instead of harmful. In a number of cases, therefore, Holth proceeded to perform iridectomy with intentional incarceration, and the paper which he read before the Christiania Society in 1906 reported a goodly series of excellent results from such procedure.

It is only natural that the technique of iridencleisis has undergone modifications at the hands of various surgeons. Holth himself preferred a keratome incision, picking up an 8- or 10-mm. conjunctival flap, pushing the keratome along the sclera to within a millimeter of the limbus, and then drawing the iris sphincter into the scleral wound and making a meridional cut to one side of the forceps. Other surgeons have made the incision with the Graefe knife, although Holth himself had tried this method and did not favor it. Other operators have dissected a conjunctival flap from the limbus peripherally, making use, that is, of a Van Lint flap. Some have performed the usual type of iridectomy, but have left iris tissue in each angle of the scleral wound. Others, for example Greenwood,[15] have combined iris incarceration with excision of sclera as recommended by Lagrange.

Borthen,[16] also a Norwegian (practicing at Bergen), after performing a number of operations more or less according to the technique of Holth, raised the question whether it was necessary to cut the iris sphincter. He therefore proceeded to modify Holth's technique by merely seizing the iris sphincter and drawing it out under the conjunctival flap, but without cutting it; and he had excellent results with this modification.

From many sides the proposal to leave iris tissue outside the eyeball was criticized as in conflict with sound surgical principle. From a large mass of statistical material, however, it seems probable that iris tissue remaining between the sclera and a thick conjunctival flap does not endanger the eye. Where the operation is performed according to this principle, postoperative reaction is almost nonexistent in the vast majority of cases. However, an excellent example of this not unnatural prejudice against iridencleisis is the fact that throughout several editions Meller's well-known *Ophthalmic Surgery* refrained from even mentioning Holth's operation.

Herbert's "wedge isolation" and Lagrange's "sclero-iridectomy"

Also in the first decade of this century, Herbert[17] continued and Lagrange[18] began to urge the desirability of creating a filtration scar, and both aimed to accomplish this by excision of a strip of sclera. Herbert and Lagrange both associated the scleral excision with iridectomy. Herbert's procedure was entitled the "wedge-isolation" operation, while Lagrange used the name "sclero-iridectomy." The Lagrange operation was described by the author as consisting of three steps: (1) Puncture and counterpuncture one millimeter from the limbus, the knife emerging at the iridocorneal angle; turning the cutting edge of the knife backward during emergence from the sclera, so as to cut the sclera obliquely in the shape of the mouthpiece of a flute; and continuing the knife beneath the conjunctiva so as to cut a large conjunctival flap, such as had been made by Graefe in his linear extraction. (2) Lifting the conjunctival flap with fine mouse-tooth forceps and with sharp scissors resecting a fairly large fragment of the anterior lip of the scleral incision, without damage to the conjunctival flap. (3) Iridectomy in the usual manner and replacement of the conjunctival flap.

While it was the general tendency to decry incarceration of the iris in the lips of the wound, as occurred in the procedure which was frankly recommended and advantageously employed by Holth, it is probable that more or less incarceration of the iris occurred in many of the successful results obtained by various methods.

In 1909, writing from the Clinic of Ernst Fuchs in Vienna, Meller[19] was able to discuss the interpretation of 27 cases with regard to the effectivenes of Lagrange's operation. His 51-page review led him to the conclusions that the action of sclerectomy differed from that of iridectomy, and that sclerectomy created a safety valve which protected against an excess of intraocular fluid, but that it was undecided whether the question of the pathology of glaucoma coincided with the question of a filtering scar; and finally that there was distinct evidence that the most dangerous symptom of glaucoma, namely hypertension, could be relieved by this operation without danger for the eye and that the operation should therefore be included among the surgical armamentarium of the ophthalmologist, for use in appropriate cases.

Another essay by Meller,[20] based upon microscopic study of 11 eyes enucleated for various reasons after the Lagrange operation, reported that in cases in which the uveal tissue had remained in its normal position, and had not become caught in the wound, the process of repair of the scleral wound proceeded with great rapidity, and led to the formation of dense and entirely impermeable tissue; but that when the iris prolapsed between the lips of the scleral incision the sclera did not share in the process of repair, which was undertaken in part by the subconjunctival tissue.

Heine's cyclodialysis

The proposal made by Heine[21] for treatment of chronic glaucoma by means of the operation to which he at once attached, and which has continued to be known by, the name of "cyclodialysis," approached the problem from a point of view which had little or nothing to do with Graefe's operation of iridectomy. In his short but well-reasoned contribution, the author, then Privat-Dozent and First Assistant at Uhthoff's Clinic in Breslau, recalled Graefe's early misconception of glaucoma as depending entirely upon hypersecretion of fluid within the eye, and de Wecker's later replacement of this idea with the conception that glaucoma was due not to hypersecretion but to inadequacy of drainage. (This change of outlook had an important bearing upon subsequent discussion as to the general topic of secretion and drainage of the aqueous.) In 1876, Knies and Weber (quoted by Heine) had demonstrated displacement of the chamber angle in many cases of glaucoma, and the idea of liberating the angle assumed dominance. Related to this physiologic concept is the supposed favorable influence of near work upon the glaucomatous eye. In 1900 Fuchs (quoted by Heine) had shown for the first time the frequency with which detachment of the choroid occurred after ordinary cataract extraction, and Axenfeld (quoted by Heine) proceeded to call attention to the same phenomenon occurring after sclerectomy or incision at the chamber angle as well as after iridectomy. The latter author raised the question whether such choroidal detachment had anything to do with the curative effect of iridectomy in glaucoma. Fuchs's interpretation of the process by which choroidal detachment occurred in such cases was that under the influence of traction on the eyeball during passage of the keratome or knife through the ocular tissues the pectinate ligament became torn, so that the aqueous humor was able to flow through the tear into the suprachoroidal space. Demaria (quoted by Heine) gave histologic demonstration of such a tear having occurred after iridectomy for glaucoma.

Heine was therefore induced to try experimentally whether communication established artificially between the anterior chamber and the suprachoroidal space had a definitely decompressive influence. This he did in blind human eyes, after studying the operation on the pig's eye. Heine's original operation consisted of making a small subconjunctival incision through the sclera 4 or 5 mm. from the limbus, and then carrying a lens repositor or similar instrument

beneath and close to the sclera, through the pectinate ligament, and into the anterior chamber, and sweeping this instrument 2 or 3 mm. upward and downward so as to separate the ciliary body from the sclera. In his first description Heine spoke of allowing little or no aqueous humor to flow out through the scleral wound, and he indicated that immediately after the operation the tension was unaltered, and that only two or three days later did reduction of tension occur. At the time of publishing the original article, Heine had performed the operation only on blind or almost blind eyes.

Meller[22] wrote from the Fuchs Clinic with regard to the benefit to be derived from cyclodialysis, which had been employed in 42 cases. He declared that, while cyclodialysis could be successfully employed to reduce the tension in primary glaucoma, the operation was not to be regarded as of nearly equal value with iridectomy, since cyclodialysis was in many cases followed by relapse.

Papers evaluating and criticizing the various operations have naturally been extremely numerous, and few of them can be mentioned here. With regard to cyclodialysis, much valuable discussion was contributed by Elschnig, whose mature judgment with regard to cyclodialysis, after ample experience, was expressed in 1909[23] with an analysis of 20 cases in which the operation had been performed. Admitting that the essential factor in the working of this operation was not clearly understood, he declared that this consideration did not increase or decrease the value of cyclodialysis. He reminded his readers that the iridectomy operation had been performed for glaucoma without any satisfactory explanation of its effect having been established. He regarded cyclodialysis as superior to iridectomy in the treatment of compensated glaucoma, and as especially valuable in its freedom from harmful effect upon the eye.

Many surgeons have attributed to cyclodialysis the distinct advantage that it may be performed in an eye in which iridectomy or one of the filtration methods has already been used unsuccessfully. The same is to some extent true of the filtration operations as regards a previously performed and unsuccessful, or only partially successful, iridectomy. The present writer has several times done an iridencleisis operation, although using incarceration without incision of the iris, in an eye which had had a classical iridectomy long previously. One edge of the iris coloboma was picked up and incarcerated in a small scleral incision. The results were excellent. It must be admitted, however, that these were cases in which the original iridectomy had been performed apparently without a conjunctival flap, so that there was no disturbing amount of subconjunctival scar tissue.

Like other modern glaucoma operations, cyclodialysis has had its critics as well as its enthusiastic advocates. The chief objection to it, by many writers, has been that its action was not sufficiently lasting. Many surgeons now perform the operation so as to separate a much larger part of the ciliary body than was at first proposed by Heine. Torres Estrada[24] (Mexico City), who is strongly opposed to any form of fistulizing operation at the limbus, almost always performs the operation which he calls "hemicyclodialysis," in which approximately one half of the ciliary body is separated from its adhesion to the sclera.

Elliot's trephining operation

In 1909, Elliot,[25] then superintendent of the great Government Ophthalmic Hospital at Madras, India (where he had succeeded to Herbert), put forward his preliminary note on the establishment of a filtering cicatrix by means of a trephine opening at the sclerocorneal junction. Elliot had performed both Herbert's and Lagrange's operation a number of times, and had satisfied himself of the soundness of the contentions of these authors (1) that it was possible to form a permanent filtering cicatrix between the anterior chamber and the subconjunctival

space, and (2) that the permanent establishment of such a condition did reduce elevated intraocular pressure. But he criticized Herbert's operation as too complicated, and regarded Lagrange's operation as presenting excessive risk, in that the scleral section had to be made on an opened eye and often on an inflamed eye, it being difficult in these circumstances to graduate the exact amount of scleral tissue removed or to avoid escape of vitreous.

Elliot insisted on the importance of working beneath a triangular conjunctival flap, curetting thoroughly down beneath all episcleral tissue, and setting the guard of the 2-mm. trephine at such a depth as just to allow penetration of the sclera, cutting the trephined disc out slowly. Iridectomy had been performed in 21 out of 50 cases, usually only a tiny peripheral button of iris being removed. The chief danger to be avoided was that of making the trephine hole so far out as to tap the suprachoroidal space instead of the anterior chamber. It was therefore essential to "hug the limbus."

A later paper by Elliot[26] emphasized certain technical details of the trephining operation, in the light of experience in teaching its technique to 15 surgeons at the Government Ophthalmic Hospital, Madras, in a total of 400 cases. The principal points mentioned were that in a troublesome patient who looked obstinately upward, especially during performance of the operation on the second eye, it was often a great convenience to do the trephining below; that an upward flap rarely required a stitch, whereas a flap made downward more often required a suture; that a large flap had been found a great safeguard against infection of the eye and less likely to produce marked astigmatism, as well as favoring free filtration. Later conjunctival flaps had been made without carrying the incision completely to the limbus at either end, as this permitted filtration to occur into the subconjunctival space outside the limits of the incision.

Controversy as to the relative value and safety of the different filtration operations has given particular attention to the danger of producing sympathetic ophthalmia. Allowing for the influence of slight variations in individual technique in producing such a complication, the literature does not substantially support the belief that this danger exists in greater degree in one filtration operation than in another, and it may be considered that iridencleisis, the Lagrange operation, and Elliot's trephining are approximately of equal safety in this regard, while cyclodialysis may perhaps be slightly freer from such a risk. In the hands of the average surgeon, there appears to have been an appreciably greater frequency of recurrent hypertension after cyclodialysis than after the fistulizing operations. On the other hand, cyclodialysis has some advantage as to the possibility of its being repeated after failure from a first attempt.

As regards the surgical and historical status of the Lagrange as compared with the Elliot operation, Rochon Duvigneaud[27] has rather epigrammatically summed up the matter by saying that Elliot's trephining technique is "the best means of executing the Lagrange operation."

Combination of several surgical procedures has frequently been advocated. Cyclodialysis has at times been modified by inclusion of uveal tissue in the operative wound; and Sallmann[28] performed in a considerable number of cases a modified form of cyclodialysis in which preliminary incision of the sclera with the lance keratome was replaced by scleral trephining.

An interesting example of the variations in opinion which keen and catholic minds are apt to experience in the course of years is the fact that Wilmer[29] of the Johns Hopkins Clinic, speaking some 20 years ago at the Oxford Congress, said that he had shrunk from performing the iridencleisis operation because of the possibility of sympathetic ophthalmia and the danger of detached retina occurring much later; although in after years he became a definite

advocate of the iridencleisis operation. Such experiences suggest that it would be an instructive field of investigation to discover how largely choice of surgical technique depends upon geography, and upon the extent to which the worker has come under the influence of a given surgical leader and his writings.

Subject to the limitations still imposed, although in diminishing degree, by time and space, science knows no national boundaries.* The progress of research concerning surgical procedures against glaucoma is one more example of this agreeable and stimulating truth. Side by side, the medical scientists of many countries have moved forward in the utilization of reason and empiricism toward a common goal, the prevention and relief of blindness.

The enormous problem still presented clinically by glaucoma has been materially advanced by the various filtration operations and by cyclodialysis, and many patients to whom, in spite of the long record established by iridectomy, blindness would have been inevitable a half century ago, are now afforded complete relief from the further progress of this disease.†

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* The political implications of modern knowledge concerning atomic structure tend to contradict this age-long principle, and threaten to set bounds to intercommunication between the scientists of different nations, thus actually retarding scientific progress.

† The title of this paper is probably sufficient explanation for the author's failure to mention either Otto Barkan's procedure or the diathermy operation.

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RETINAL DETACHMENT*

A SURVEY OF THE ETIOLOGY AND RESULTS OF TREATMENTS ON PHAKICS AND APHAKICS

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The basis of all modern perforating diathermy treatment of retinal detachment is Gonin's historic cautery puncture in 1916 when he attempted by one procedure to evacuate the subretinal fluid, seal off the hole, and cause adhesive choroiditis to hold the retina in place. This was followed by the Guist-Lindner method of multiple trephines with chemical cauterization of the choroid, claiming two advances: namely, a greater possibility of sealing off the hole, and eliminating the possibility of choroidal hemorrhage. The next major step forward was the insertion of Safar or Walker pins by means of diathermy current, whereby more accurate sealing off of the holes and better control of the degree of reaction was accomplished. Numerous modifications of this technique have followed, largely consisting of new types of pins or needles and variations in the technique of application.

The present study was undertaken (1) to compare the various etiologic factors in the production of retinal detachments in phakic and aphakic eyes; (2) to determine the preoperative clinical findings which influence the operative result so cases may be divided into favorable and unfavorable regarding prognosis; and, (3) to compare the results of various operative techniques.

MATERIAL

The material on which this survey is based consists of 304 consecutive cases of retinal detachments operated upon in the Wilmer Ophthalmological Institute between 1927 and 1944. There were 246 phakic eyes and 58 aphakic eyes.

TABLE 1
AGE INCIDENCE IN RETINAL DETACHMENTS

Age	Phakic		Aphakic	
	Number and Percentage of Cases		Number and Percentage of Cases	
	Number	Percentage	Number	Percentage
Under 10	3	1.2	1	1.7
10 to 19	18	8.2	0	0
20 to 29	31	12.7	7	12.1
30 to 39	33	13.5	6	10.3
40 to 49	55	22.4	6	10.3
50 to 59	54	22.0	16	27.6
60 to 69	45	14.3	17	29.3
70 to 79	6	2.4	5	8.6

The age incidence for retinal detachments shows a small rise to a maximum between the ages of 40 and 60 years (table 1). Only 11 Negroes were operated upon, and a slight

*From the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital.

TABLE 1A

RACE AND SEX IN RETINAL DETACHMENTS

	Phakic	Aphakic
	Percentage of Cases	Percentage of Cases
White male	55.7	65.5
White female	39.8	24.2
Colored male	3.9	6.9
Colored female	0.8	3.4

preponderance of males over females was found (table 1A).

This series includes all cases both favorable and unfavorable operated upon between these dates. Sixty-eight patients had detachments of at least three quadrants; 25 had detachments of the entire retina; and in 53 patients the duration of the detachment was over six months before operation. Most of such cases were operated upon with full realization that prognosis was extremely poor but that, nevertheless, the patient was entitled to his "day in court." As will hereafter be pointed out, various operative techniques were employed in these patients, the technique varying as advances were made in our knowledge of the treatment of retinal detachment.

COMPARISON OF THE ETIOLOGIC FACTORS IN PHAKICS AND APHAKICS

The importance of myopia in the etiology of idiopathic detachment of the retina has been well established by many observers, including Phelps,[1] Borley,[2] McKeown,[3] and Holst,[4] who found a slight majority of such cases was myopic. In this series 40 percent of the phakic detachments were myopic, but myopia did not seem to be a significant factor in the aphakic detachments (table 2).

TABLE 2

INCIDENCE OF REFRACTIVE ERROR IN PHAKIC DETACHMENTS

Refraction	Percentage of Cases
Emmetropic	41.7
Myopic 1 to 3 D.	11.5
Myopic 4 to 9 D.	16.6
Myopic 10 D. and over	6.9
"Nearsighted"—unknown refraction	4.6
Total myopics	39.6
Hyperopic	18.8

Degenerative changes in the vitreous with the formation of floating opacities and traction bands have been considered by many to be a potent factor in the etiology of simple retinal detachments of both phakic and aphakic eyes. In the present series vitreous opacities were found to be more prevalent in phakic than aphakic eyes, (45.5 percent vs. 10.3 percent). The etiologic importance of disturbances of vitreous structure during extraction of a cataract has been emphasized by many observers. Johnson[5] declared that it is not the loss of a small amount of vitreous that does the real damage, but changes set up through disturbance of the vitreous structure. Shapland,[6] studying 651 cases of retinal detachment in the United Kingdom from 1930 to 1933, also noted the importance of vitreous disturbance. He expressed the theory that vitreous becomes incarcerated in the section and contracts as healing takes place, drawing the retina upward, thus forming a detachment in the lower half of the fundus. He remarked that 10 percent represents with fair accuracy the proportion of retinal detachments occurring in aphakic subjects. Hughes and Owens,[7] in a paper including many of the cases studied here, found that the degree of vitreous

TABLE 3

RELATION OF VITREOUS LOSS TO THE DEVELOPMENT OF POSTOPERATIVE RETINAL DETACHMENT AFTER CATARACT EXTRACTION*

Loss of Vitreous	Number of Cases	Percentage of Retinal Detachment
None	1,720	0.9
Presentation	154	1.3
Moderate	141	5.7
Severe	46	10.9

* Table from article by Hughes and Owens.[7]

loss at the time of the cataract extraction was directly related to the incidence of postoperative simple detachment of the retina (table 3). No difference was found between the intracapsular and extracapsular extractions in respect to this complication. Associated with increased vitreous loss were persistent vitreous opacities, due partly to vitreous hemorrhage and probably in part to disorganization of the normal vitreous structure.

The onset of simple detachments after cataract extraction was longer than six months postoperatively in 55 percent of the cases and longer than two years in 36 percent. This relatively late onset after the extraction of the cataract suggests that degenerative changes in the vitreous were probably taking place in the intervening period. (table 4).

TABLE 4

TIME OF ONSET OF RETINAL DETACHMENT FOLLOWING CATARACT EXTRACTION

Onset after Cataract Extraction	Number of Cases	Percentage of Cases
Less than 2 weeks	4	6.9
2 weeks to 2 months	6	10.3
3 to 6 months	16	27.6
7 to 12 months	1	1.7
1 to 2 years	10	17.2
2 to 5 years	7	12.1
5 to 10 years	3	5.2
Over 10 years	11	18.9

Trauma is somewhat more common in phakic eyes than in aphakic eyes (table 5).

Retinal perforations in aphakics were observed more infrequently than in phakics (table 6). Jeandelize, Bandot, and Gault[8] showed that, in myopia, the degeneration frequently takes the form of peripheral choroiditis with defective vitreous. Vogt considered that cystic degeneration of the retina was one of the most important single factors in retinal separations. In the present series the incidence of degenerative changes in the eye was somewhat more frequent in phakics than in aphakics (table 6). This evidence lends some support to the views quoted above, that degenerative changes in the retina precede retinal perforations and subsequent detachments—an etiologic factor which appears in this series to be more important in phakic eyes.

Practically no cases with undisputed evidence of uveitis are included in this series of operative cases. The discouraging prognosis of detachments associated with uveitis and glial bands in the vitreous is well known. However, 5 percent of the phakic and 10 percent of the aphakic cases had a positive aqueous ray at the time of operation. The operative prognosis appears to be greatly affected by the presence of a positive aqueous

TABLE 5

INCIDENCE OF TRAUMA IN INDIVIDUALS DEVELOPING RETINAL DETACHMENT

	Number of Cases	No Trauma (Percentage)	Indirect to Body (Percentage)	Indirect to Head (Percentage)	Direct To Eye (Percentage)
Phakics	246	79.5	3.7	6.9	9.8
Aphakics	58	87.9	1.7	5.2	3.4

TABLE 6

INCIDENCE OF RETINAL PERFORATIONS AND DEGENERATION IN DETACHMENTS

	Number of Cases	Retinal Perforations (Percentage)	Cystic Degeneration (Percentage)	Myopic Degeneration (Percentage)
Phakics	246	61.8	11.0	6.9
Aphakics	58	38.4	5.2	0

flare, suggesting that this sign may indicate more serious retinal or vitreous pathology.

Preoperative clinical findings determining favorable and unfavorable prognosis

1. Age. In phakics, a significantly poorer prognosis for obtaining mechanical reattachment of the retina after operation occurred after the age of 60 years (table 7). Of 51 cases in the older age group, only 35 percent obtained reattachment in comparison to 60 percent of 191 cases between the ages of 10 and 60 years. No significant difference was found in the results of operation in various age groups of aphakics.

2. Refraction. Myopia, listed high as a contributory cause of retinal detachment, also rated as a factor against operative recovery (table 8). Excluding those eyes of uncertain refraction, designated as "nearsighted," increasing amounts of myopia were directly related to progressively poorer operative results. Hyperopia of over one diopter also appeared to influence adversely the reattachment of the retina. In line with these findings, Phelps[1] cured only 21 percent of those cases in which the myopia was 15

TABLE 7

Importance of age, race, and sex on the operative prognosis of retinal detachments

Age	Phakic			Aphakic		
	Number of Cases	Number and Percentage Reattached		Number of Cases	Number and Percentage Reattached	
		Number	Percentage		Number	Percentage
Under 10	3	1	33.3	1	0	0
10 to 19	18	13	72.2	0	0	0
20 to 29	31	18	54.8	7	2	28.6
30 to 39	33	15	45.5	6	1	16.7
40 to 49	55	26	47.3	6	1	16.7
50 to 59	54	34	62.9	16	8	50.0
60 to 69	45	17	37.8	17	6	35.3
70 to 79	6	1	16.7	5	2	40.0
Total	245	125	51.0	58	20	34.5
Race and sex	Number of Cases	Percentage Reattached		Number of Cases	Percentage Reattached	
White male	137	51.8		38	31.6	
White female	98	52.0		14	30.0	
Colored male	9	22.2		4	0	
Colored female	2	0		2	50.0	

TABLE 8

Influence of refractive error on postoperative results in phakic detachments

Refraction	Number of Cases	Percentage Successful Reattachment	Average Follow-up (Months)
Emmetropic	91	61.5	25
Myopic 1 to 3 D.	25	56.0	26
Myopic 4 to 9 D.	36	44.4	22
Myopic 10 D. and over	15	26.7	18
"Nearsighted"—unknown refraction	10	70.0	17
All myopic (total)	86	47.7	22
Hyperopic	41	39.0	21

diopters or more. Holst,[4] reporting on a series of myopes and hyperopes with trauma, noted only 9 successes out of 19 operations. Samuels,[9] discussing retinal detachment in connection with iritis and glaucoma, added further that myopic eyes developed more complications, and more frequently had to be enucleated.

3. Aphakia. The literature on aphakic detachments is relatively scanty. Shapland[6] remarked, in 1934, of the scant reference in the literature to the disappointing operative results in aphakic detachments. He reported his results on 16 aphakic detachments as disappointing, with only three permanent successes. Gradle and Meyer,[10] reporting on 29 phakic eyes, announced

TABLE 9

INFLUENCE OF VITREOUS DISTURBANCES ON POSTOPERATIVE RESULTS

Aphakics Only	Number of Cases	Mechanically Successful (Percentage)
Vitreous loss at time of cataract extraction	12	16.7
No vitreous loss	40	37.5
Vitreous opacities	5	20.0
No vitreous opacities	53	35.8

cures for 13, while in discussing five aphakic cases, it was noted the percentage of "cures" was far less. The figures collected here showed 35 percent of 58 detachments in aphakic eyes were mechanically successful after operation, contrasting with 51 percent mechanically successful re-attachments in phakic eyes. The causes for discrepancy between the success to be expected after operation for detachment in phakia and aphakia are uncertain. In addition to the fact that the removal of the lens might weaken the supporting structure of the vitreous and retina, are other possible factors; such as, previous loss of vitreous, low-grade postoperative uveitis, and the fact that fewer retinal perforations were detected preoperatively and properly sealed off.

TABLE 10

INFLUENCE OF A POSITIVE AQUEOUS RAY ON POSTOPERATIVE RESULTS

Phakics	Number of Cases	Mechanically Successful (Percentage)
Positive aqueous ray	12	8.3
Negative aqueous ray	231	52.3
Aphakics (at time of detachment operation)		
Positive aqueous ray	6	33.3
Negative aqueous ray	52	34.6

4. Vitreous Disturbances. In aphakics, vitreous loss at the time of the previous cataract extraction and persistent vitreous opacities have a suggestively detrimental effect against subsequent reattachment by operation (table 9).

5. Positive Aqueous Ray. There is no information in the literature on the influence of a positive aqueous ray on successful reattachment by operation. In phakic eyes with positive aqueous ray, there were 11 failures out of 12 operative attempts, sharply contrasting with 52 percent of successful reattachments in 231 cases with a negative aqueous ray (table 10). Such a relationship does not hold in the smaller number of aphakics.

6. Duration of Detachment Before Operation. The time interval between detachment and operation vitally affects the prognosis. This was strikingly illustrated by Arrizonis[11] in Switzerland who recorded 74 percent success when less than three weeks had intervened between retinal separation and operation, whereas between three weeks and three months the ratio dropped to 53 percent; and after three months, only 6.7 percent of the retinas reattached. In the present series the importance of early operation is manifested most clearly in the aphakics where, after two months, only one reattachment in 11 attempts resulted, and in that patient the vision failed to improve (table 11). This contrasts significantly with 37-percent successful reattachments in 43 cases

operated within two months of the onset of the detachment, and visual improvement of at least two lines in the Snellen chart was exhibited in 28 percent. Delay in operations for detachment in phakics is apparently of less concern except for the danger of more extensive areas being involved.

7. Location of Detachment. A review of the literature shows that the great majority of detachments are in the temporal half, and a smaller preponderance is noted for the upper as against the lower half. It happens that in this series more detachments were observed in the lower than in the upper half, but as in other series they preponderate on the temporal side (table 12). It can be seen, at least in the case of phakics, that it makes little difference in the eventual result

TABLE 11

INFLUENCE OF DURATION OF DETACHMENT ON POSTOPERATIVE RESULTS

Duration of Detachment	Number of Cases	Mechanically Successful		Vision* (Percentage of Cases)		
		Number of Cases	Percentage of Cases	Improved	Same	Worse
Aphakics						
1 to 6 days	9	3	33.3	11.1	77.8	0
7 to 13 days	15	4	26.7	20.0	60.0	6.7
14 to 20 days	6	3	50.0	33.3	66.6	0
21 to 28 days	4	3	75.0	100.0	0	0
1 to 2 months	9	3	33.3	22.2	55.6	22.2
3 to 5 months	4	0	0	0	75.0	25.0
6 to 9 months	3	1	33.3	0	100.0	0
10 to 12 months	1	0	0	0	100.0	0
1 to 2 years	1	0	0	0	0	100.0
Over 2 years	2	0	0	0	100.0	0
Phakics						
1 to 6 days	13	7	53.8	15.4	53.8	15.4
7 to 13 days	35	21	60.0	40.0	45.7	8.6
14 to 20 days	22	13	59.0	36.4	50.0	13.6
21 to 28 days	24	11	45.8	37.5	45.8	12.5
1 to 2 months	74	36	48.7	32.4	54.1	9.5
3 to 5 months	29	14	48.2	27.8	51.7	13.8
6 to 9 months	17	9	52.9	29.4	51.8	17.6
10 to 12 months	9	3	33.3	22.2	44.4	33.3
1 to 2 years	13	7	53.8	30.8	46.2	23.1
Over 2 years	7	1	14.3	14.3	57.1	0

* Visual improvement or visual decrease refers to a difference of at least two lines on the Snellen chart between preoperative and postoperative vision.

TABLE 12

INFLUENCE OF LOCATION AND SIZE OF DETACHMENT ON POSTOPERATIVE RESULTS

Location	Phakics		Aphakics	
	Number of Cases	Mechanically Successful (Percentage)	Number of Cases	Mechanically Successful (Percentage)
Upper quarter or half	48	56.2	19	31.5
Lower quarter or half	88	54.5	24	20.8
Temporal half	40	62.5	6	66.6
Nasal half	7	0	3	66.6
Total detachment	21	23.8	4	25.0
At Least 40° Field Cut				
1 quadrant	24	75.0	5	20.0
2 quadrants	108	51.0	26	42.3
3 quadrants	48	45.8	20	25.0

whether the detachment is in the upper or lower half, but all of the seven cases with a detachment nasally were unsuccessful. However, 23.8-percent operative success was obtained in total detachments, necessarily including the nasal half. In the nine aphakics here noted there was no difference in operative results between temporal and nasal detachments. According to normal anticipation, the proportion of success in phakic eyes drops steadily with greater area of detachment, as detected by cuts in the visual field.

TABLE 13

INFLUENCE OF RETINAL PERFORATIONS ON POSTOPERATIVE RESULTS

Type and Number of Retinal Perforations	Phakics		Aphakics	
	Number of Cases	Mechanically Successful (Percentage)	Number of Cases	Mechanically Successful (Percentage)
None	94	40.4	34	23.5
1 Perforation	101	59.3	17	47.1
2 Perforations	14	57.1	1	0
3 or more perforations	7	42.9		
Disinsertion, less than 1 quadrant	17	47.1	4	75.0
Location of Perforation				
Upper temporal	64	53.1	9	66.6
Lower temporal	46	58.7	7	57.1
Upper nasal	14	71.4	3	66.6
Lower nasal	11	54.5	2	50.0
Macular hole	2	100.0	1	100.0

TABLE 14

IMPORTANCE OF PREOPERATIVE TENSION ON POSTOPERATIVE RESULTS

Tension	Phakics		Aphakics	
	Number of Cases	Mechanically Successful (Percentage)	Number of Cases	Mechanically Successful (Percentage)
Under 8 mm. Hg	4	0	0	0
8 to 13 mm.	7	42.9	3	0
14 to 19 mm.	27	48.1	4	0
Low to fingers	32	40.6	3	66.6
20 to 28 mm.	18	61.1	0	0
Normal to fingers	156	53.2	42	35.7
29 mm. and over	20	50.0	0	0

8. Retinal Perforations. Operative results were significantly poorer when no retinal perforation was found (table 13). This might be explained by the fact that a hole was present but undetected preoperatively, and the subsequent generalized barrage did not properly seal off the hole. Those cases in which the retina was disinserted from its attachment to the ciliary body compared favorably with those having retinal perforations. The location of the perforation had no effect on the operative result. Weve[12] remarked that a typical disinsertion at the ora serrata heals well when operated, and in support of his statement reported total success—100 cures in 100 cases.

9. Preoperative Tension. Increased tension is considered by some to be an important factor against operative success in detachment. So strongly does it militate against cure, said Deutschman quoted by Schauren,[13] that he considered a tear in the retina as actually favorable for healing because it

reduces tension. This conclusion is not corroborated by our findings, there being a 50-percent operative success in patients in whom the preoperative tension was 29 mm. Hg (Schiøtz) or over (table 14).

10. Retinal Elevation at Time of Operation. Although statistical tabulation is lacking in the literature on this point, some authors have tacitly assumed that the greater the retinal elevation at the time of operation the less the chance of recovery. The findings in this series show no difference in this respect (table 15). It may be concluded that a wide gap between retina and choroid is no insuperable barrier to success. In this connection it may be interesting to recall a remarkable cure made by Weve in Utrecht, reported by Zorab,[14] of total detachment of such an extreme nature that most of the retina was actually folded over so that its posterior surface was facing anteriorly. Complete reattachment followed operation.

TABLE 15

EFFECT OF HEIGHT OF RETINAL ELEVATION IMMEDIATELY BEFORE OPERATION ON POSTOPERATIVE RESULTS

Retinal Elevation (Diopters)	Phakics		Aphakics	
	Number of Cases	Mechanically Successful (Percentage)	Number of Cases	Mechanically Successful (Percentage)
0	3	66.7	0	0
1 to 3	8	37.5	3	66.6
4 to 6	35	48.6	6	0
7 to 10	71	54.9	3	33.3
11 to 14	34	47.1	6	66.6
Over 14	37	37.8	8	12.5

Summary. From the above data which correlates preoperative clinical findings with successful reattachment of the retina after operation, it is possible to enumerate those factors which had the most effect on ultimate prognosis in this series in such a way that potentially unfavorable cases can be defined preoperatively as those which had the following characteristics: (a) Phakics—total detachment of the retina, positive aqueous ray, myopia over 10 diopters, and patients over 70 years of age. (b) Aphakics—over two months' duration of detachment before operation, and total detachment. Accordingly the cases have been classified as favorable and unfavorable in Table 16. Such a classification of cases makes an appreciable difference in the results to be expected from operation.

TABLE 16

RELATIVE RESULTS IN FAVORABLE AND UNFAVORABLE CASES

Type of Case	Number of Cases	Mechanically Successful Reattachments	
		Number	Percentage
Phakia—favorable	200	113	56.5
Phakia—unfavorable	46	11	24.0
Aphakia—favorable	45	18	40.0
Aphakia—unfavorable	13	2	15.4

COMPARISON AND EVALUATION OF THE RESULTS OF VARIOUS OPERATIVE TECHNIQUES

1. Year of Operation. Table 17 shows the steady and gratifying improvement made over the years in operation for retinal detachment. Also worthy of note is the contrast in number of cases operated; 31 in the first 7 years as against 215 for the last 11 years. Expansion of hospital facilities does not account for the increased number, and there is no reason to suppose that retinal detachment is any more prevalent now than it was 15 years ago. The answer is that

increasingly good results obtained have brought with them more hope of success, and as a result, many an operation is advised now that would not have been recommended in the not-so-distant past.

2. Type of Operation. Table 18 affords in itself a brief history of the results of various operative techniques for retinal detachment both in phakics and aphakics. In the early pioneer stage, Gonin's operation is the only one having any prospect of success. With the beginning of penetrating diathermy, success rises sharply for both phakics and aphakics. It will be noted that while unmodified Lacarrere diathermy punctures yielded poor results in 19 cases, a combination of Walker pins and Lacarrere diathermy punctures showed up well, particularly on aphakic eyes.

Five straight thermophore operations showed 60-percent success after first operation and one case was successful after second operation, raising the percentage of success to 80.0. Two cases of Lacarrere-Thermophore combined showed 50.0-percent successful reattachment. This number of cases affords too small a basis for reliable comment.

TABLE 17

COMPARISON OF RESULTS OBTAINED BY OPERATIONS FOR RETINAL DETACHMENT IN VARIOUS YEARS (PHAKICS ONLY)

Year of Treatment	Number of Cases	Successful Reattachment (Percentage)
1927–1929	6	16.7
1930–1933	25	36.0
1934–1936	42	50.0
1937–1944	173	53.8

3. Subretinal Fluid. The amount of subretinal fluid obtained at operation has little effect on the final reattachment (table 19).

4. Use of Perforating Diathermy Before or After Escape of Subretinal Fluid. When diathermy punctures were made both before and after escape of subretinal fluid, the effect was about the same as when the punctures were performed only before the escape (table 20).

5. Area Coagulated (table 21). In detachments of comparable size, equally successful results were obtained when extensive areas

TABLE 18

COMPARISONS OF RESULTS OBTAINED BY VARIOUS TECHNIQUES FOR RETINAL DETACHMENT

Technique	Phakics		Aphakics	
	Number of Cases	Successful Reattachment (Percentage)	Number of Cases	Successful Reattachment (Percentage)
Gonin	15	33.3	0	0
Gonin—Other	2	0	0	0
Various older procedures	8	0	2	0
Total of early procedures	25	20.0	2	0
Safar	17	54.0	3	0
Walker	124	51.6	39	35.8
Walker-Lacarrere	45	64.4	9	55.6
Lacarrere	19	27.8	3	0
Lacarrere—Other	10	50.0	0	0
Total of penetrating diathermy	215	52.2	54	35.0
Thermophore	5	80.0	0	0
Lacarrere—Thermophore*	2	50.0	1	0
Total Thermophore	7	71.4	1	0

* Also included above under Lacarrere—Other.

were coagulated and when coagulation was limited to the area around the hole or one quadrant. When three quadrants were detached the best mechanical results were obtained when the area of coagulation was relatively limited. Extensive barrage of all three quadrants was less successful in 13 cases.

6. Position of Retina at End of Operation. The position of the retina following evacuation of subretinal fluid was found to be of utmost importance in determining final reattachment (table 22). When the retina remained greatly elevated at the end of operation, the likelihood of successful reattachment was strikingly reduced. In 166 phakic cases in which the retina was found flat or only slightly elevated at the end of operation, in 60.8-percent successful reattachment occurred. However, in 72 cases where the retina remained greatly elevated at the end of operation, only 29.2 percent were eventually successful. In 37 cases of aphakia where the retina was flat or only slightly elevated at the end of operation, 43.2 percent were successful, whereas in 16 aphakics with greatly elevated retina at end of operation, there was only 6.3-percent success.

7. Intraocular Injections. During the past

TABLE 19

RELATION OF AMOUNT OF SUBRETINAL FLUID OBTAINED AT OPERATION TO FINAL REATTACHMENT

Amount of Subretinal Fluid Obtained	Phakics		Aphakics	
	Number of Cases	Successful Reattachment (Percentage)	Number of Cases	Successful Reattachment (Percentage)
None	5	40.0	0	0
Moderate	188	51.1	39	33.3
Large	53	49.1	18	43.7

TABLE 20

COMPARISON OF RESULTS WHEN PERFORATING DIATHERMY IS USED BEFORE OR AFTER ESCAPE OF SUBRETINAL FLUID

Time of Perforating Diathermy	Phakics		Aphakics	
	Number of Cases	Successful Reattachment (Percentage)	Number of Cases	Successful Reattachment (Percentage)
Only before escape of subretinal fluid	137	52.6	38	31.6
Before and after escape of subretinal fluid	102	51.0	19	42.1

TABLE 21

RELATION OF AREA OF COAGULATION AND SIZE OF DETACHMENT TO POSTOPERATIVE RESULTS

Area Coagulated	Size of Detachment							
	1 Quadrant		2 Quadrants		3 Quadrants		4 Quadrants	
	Number of Cases	Percent Reattached	Number of Cases	Percent Reattached	Number of Cases	Percent Reattached	Number of Cases	Percent Reattached
Only around hole	7	57.1	12	66.6	3	100.0	5	20.0
1 Quadrant	23	78.2	20	40.0	7	57.1	3	33.3
2 Quadrants			103	50.5	17	47.2	10	30.0
3 Quadrants					13	23.1	3	0

few years in those cases when at the end of the diathermy operation the retina was still elevated, attempts have been made to restore the retina to proper position at the close of operation by the intraocular injection of either air or saline. The importance of leaving the retina relatively flat at the end of operation has been emphasized above. In many of those cases in which ophthalmoscopic examination revealed marked elevation of the retina persisting after the evacuation of subretinal fluid, saline has been injected into the anterior chamber or vitreous of aphakic eyes. Intravitreous injections are ordinarily made by first incising the sclera with a Ziegler knife or preferably diathermy current to prevent intraocular hemorrhage and aid in sealing off the retinal hole made by the needle. A small gauge hypodermic needle on a 2-cc. syringe is then inserted into the vitreous under direct observation through a dilated pupil or with an ophthalmoscope. Sufficient saline is injected to make the globe firm or to restore the retina to its proper position. Anterior-chamber injections with a hypodermic needle are facilitated by first making a slanting Ziegler incision in the peripheral cornea.

The results of these intraocular injections are given in Table 23. Of 15 phakics in which the retina failed to fall back properly after the withdrawal of subretinal fluid, injection of saline through the attached portion resulted in seven successes (46.7 percent), an improvement but not significant difference from those cases in which the retina was allowed to remain elevated (table 22). Injection of saline through a quadrant in which the retina was detached gave poor results (only one cure in 11 attempts). The intraocular injection of saline by any route in aphakics resulted in significant improvement over those in which the retina remained greatly elevated at the close of operation (table 22). From this table it is evident that in phakic eyes, the injection of

TABLE 22

IMPORTANCE OF POSITION OF RETINA AT END OF OPERATION RELATIVE TO FINAL REATTACHMENT

Position of Retina at End of Operation	Phakics		Aphakics	
	Number of Cases	Successful Reattachment (Percentage)	Number of Cases	Successful Reattachment (Percentage)
Flat	85	65.9	21	42.9
Slightly elevated	81	55.6	16	43.8
Greatly elevated	72	29.2	16	6.3

TABLE 23

EFFECT OF INTRAOCULAR INJECTIONS IN OPERATION FOR RETINAL DETACHMENT

Injection	Phakics		Aphakics	
	Number of Cases	Successful Reattachment (Percentage)	Number of Cases	Successful Reattachment (Percentage)
None	218	52.8	25	44.0
Saline through detached retina	11	9.1	6	33.3
Saline through attached retina	15	46.7	3	33.3
Saline in anterior chamber	0	0	14	35.7
Total number saline injections	26	30.6	23	34.5
Air injections	0	0	9	11.1

TABLE 24

INCIDENCE OF SUCCESSFUL DETACHMENT OPERATIONS AFTER PREVIOUS FAILURES

Operation	Phakics		Aphakics	
	Number of Cases	Successful Reattachment (Percentage)	Number of Cases	Successful Reattachment (Percentage)
After first	246	40.6	58	25.9
After second	72	26.4	22	18.2
After third	18	33.3	15	0
After fourth	5	20.0	3	0
After fifth	1	100.0	0	0
Total cases, one or more operations	246	50.3	58	32.8

saline was apparently of no value, the incidence of mechanically successful reattachments following this procedure being 30.6 percent, against a 29.2-percent success in those cases when the retina was elevated at the end of operation, and no saline injection was made. In aphakic eyes, however, the procedure appeared of definite value, the incidence of mechanically successful reattachments following such injections being 34.5 percent, while in those aphakic eyes when the retina was still elevated at the end of operation, and no saline injections were made, the incidence of mechanically successful reattachments was only 6.3 percent (table 22).

Injection of air in aphakics proved unsatisfactory, only one success being obtained in nine cases.

No serious complications followed the intraocular injections; for example, infection, cataract, hemorrhage, or persistent vitreous opacities. However, attempts to introduce the needle through the detached portion of the retina tended to push off the retina further, and to produce a larger tear through which the saline could escape. Large tears would frequently permit the saline to escape without pushing back the retina.

8. Subsequent Operations. The literature is scanty on the subject of reattachment after two or more operations, and it is therefore of interest to analyze cases in this series to this end (table 24). The retinas of about 41 percent of phakic detachments were successfully reattached on the first attempt. Of the 145 cases which failed less than half had second operations, with 26.4-percent resulting success. Although the ratio is smaller than that achieved in the first attempt, it shows that one failure is by no means final, and offers strong incentive to reoperate. For phakics, the incentive exists for even as many as five operations. Reoperations have raised the final percentage of success to 50.3 percent, notably higher than the 40.6 percent at which it would have remained had not the undiscouraged surgeons, with

TABLE 25

FINAL VISUAL RESULTS IN MECHANICALLY SUCCESSFUL REATTACHMENTS

Final Corrected Vision	Phakic		Aphakic	
	Number	Percentage	Number	Percentage
20/20 and better	22	18.0	1	51.0
20/30 to 20/40	36	29.5	6	30.0
20/50 to 20/100	38	31.2	7	35.0
20/200 to 20/400	25	20.5	6	30.0
Less than 20/400	1		0	0
Unknown vision	2			

the permission of undiscouraged patients, "tried again." Of the 43 aphakics whose retinas failed to reattach on the first try, 22 resubmitted to operations and four were rewarded by recoveries on the second attempt. No successes were noted beyond the second operation in 18 third and fourth attempts. Only one operation after failure is therefore advised.

Final visual results

The final visual results in 122 phakic eyes and 20 aphakic eyes in which a mechanically successful reattachment of the retina was obtained are given in Table 25.

The causes for the poor visual results; that is, below 20/40, are shown in Table 26. The predominating causes were macular degeneration and vitreous opacities, conditions which are probably the concomitants of long standing detachments.

TABLE 26

Causes of poor final vision in mechanically successful reattachments

Cause	Phakic		Aphakic	
	Number	Percentage	Number	Percentage
Macular degeneration	28	43.8	5	41.7
Vitreous opacities	20	31.2	7	58.3
Secondary cataracts	5	7.8	0	0
Phthisis bulbi	0	0	0	0
None of the above causes	1	15.6	0	0
Total	64		12	

Summary

A survey of 246 cases of retinal detachment in phakic eyes and 58 cases of detachment in aphakic eyes reveals the following findings:

A. Etiologic factors

1. Forty percent of the detachments occurred in phakic eyes with myopia, but myopia was relatively uncommon in aphakia.

2. Evidence of vitreous disturbances was present in many of the cases in this series. Floating vitreous opacities were present in 46 percent of the phakic eyes and 10 percent of the aphakic eyes. In aphakia it has been shown elsewhere[7] that the loss of vitreous is associated with high incidence of later detachments of the retina. Such detachments occur relatively late after the cataract extraction, suggesting that degenerative changes in the vitreous have probably been taking place in the intervening period.

3. Myopic and cystic degeneration of the retina were found in 18 percent of the phakic eyes, a likely forerunner of retinal perforations. It is not clear whether 5 percent of the phakic and 10 percent of the aphakic eyes which had a positive aqueous ray at the time of operation represent a low-grade uveitis or possibly are secondary to degenerative changes.

B. Preoperative clinical findings determining favorable and unfavorable prognosis

1. Phakic eyes. The following clinical features if present indicate a poor prognosis: Total detachment of the retina; a positive aqueous ray: myopia over 10 diopters; and an age over 70 years. Less significant factors include the inability to find a hole in the retina, and an age level over 60 years.

2. Aphakic eyes. Those paitents in which the detachment had been present over two months obtained poor operative results, only one successful reattachment being obtained out of 11 cases. Other suggestive detrimental factors include the loss of vitreous at time of

cataract extraction, and the inability to detect a retinal tear.

C. Comparison and evaluation of the results of various operative techniques

1. A notable improvement in final results has followed the institution of various techniques using penetrating diathermy in spite of the fact that more unfavorable cases have been operated upon. Although the number of cases in each group is too small to permit any definite conclusions as to the best operative technique, the use of Walker pins often accompanied by multiple Lacarrere punctures appears to be the most successful.

2. The amount of subretinal fluid evacuated at operation and the escape of subretinal fluid before the diathermy have no appreciable influence on the operative prognosis.

3. For large detachments involving three quadrants, the best results were obtained when the area surrounding a demonstrated retinal perforation and not more than two quadrants were included in the coagulation.

4. The position at the end of operation is of great importance in the determination of final result. This is especially true in aphakic eyes. In aphakic eyes the injection of saline through the pupil into the vitreous chamber was of significant aid in restoring the retina to its proper position and increasing the incidence of mechanically successful reattachments.

5. In aphakic eyes in which the first operation was unsuccessful, a second operation succeeded in 18 percent of the cases. No successes were obtained after two operations in aphakic eyes, while in phakic eyes one success was obtained even after the fifth operation.

Johns Hopkins Hospital (5).

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THE VALUE OF INJECTING SALINE INTO THE VITREOUS AS AN ADJUNCT TO DIATHERMY OPERATIONS FOR RETINAL DETACHMENT*

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In the treatment of retinal detachments, injections into the vitreous cavity were tried long before Gonin pointed out the necessity of closing retinal holes to obtain reattachment. Thus Deutschmann[1] (1895) tried injecting rabbits' vitreous, Rohmer[2] (1912) injected air, and Wood[3] (1920) injected a mixture of saline and subretinal fluid. These early injections, given with the idea of forcing the retina back against the choroid, were usually doomed to failure because the retinal holes were not closed. As early as 1902 Galezowski[4] aspirated subretinal fluid and also cauterized the sclera over retinal tears, but his work unfortunately did not gain acceptance and was overlooked for many years.

In the modern surgical treatment of retinal detachments, it is well recognized that not only must an artificial choroiditis be created at such sites as to close the retinal holes, but that subretinal fluid must be drained through openings in the sclera if a high percentage of reattachments is to be attained. The openings through the sclera are most frequently made by means of diathermy puncture or trephine, and should remain patent a number of days. The physiologic formation of aqueous postoperatively is usually counted upon to fill the vitreous cavity, displacing the subretinal fluid and forcing the retina back in contact with the choroid. However, in eyes with very marked elevation of the retina and slow formation of aqueous, the scleral openings may close before this desired result is obtained or else the areas of artificial choroiditis are no longer active enough to close the retinal holes by the time the retina arrives in contact with the choroid. In such cases it is now common practice with many ocular surgeons either to remove subretinal fluid at the time of operation by means of suction applied through the scleral openings or to inject air into the vitreous cavity in order to force the retina back into place at the time of operation.

During the past seven years patients with retinal detachment operated on by members of the full-time staff or the house staff of the Wilmer Institute frequently had saline injected into the vitreous at the close of the diathermy operation in order to force subretinal fluid out of the eye and if possible reposit the retina against the choroid. These saline injections were usually performed only if the retina was still markedly elevated after diathermy application and the establishment of pathways through the sclera for drainage of subretinal fluid. Conversely, in most (but not all) instances where the retina remained elevated at that stage of operation, saline was injected. The present study represents an evaluation of the possible beneficial effects of these saline injections.

MATERIAL

During the period from February, 1939, through June, 1946, a total of 305 patients had diathermy operations for detached retina in the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital. An analysis of the case histories of these patients revealed that 155 cases of retinal detachment not secondary to uveitis or perforating injury had diathermy operations performed by members of the full-time staff or the house staff, and had final ophthalmoscopic descriptions recorded by a member of the full-time staff or by the resident ophthalmologist. In six of these cases, detachment operations

* From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University.

were performed on both eyes. The results of operations on these 161 eyes form the basis for this study.

Results

The criterion for successful reattachment of the retina was taken to be a completely flat retina at the time of the last recorded ophthalmoscopic examination. If there was any retinal separation, even apparently localized and nonprogressive, the operation was classified as a failure from the standpoint of reattachment.

In the cases of 159 eyes, the first operation for retinal detachment was performed in the Wilmer Institute. The results of the first detachment operation, classified as to whether the eye was phakic or aphakic and whether or not saline was injected into the vitreous, are shown in Table 1. The results of the second detachment operation, performed on eyes in which the first operation was a failure, are shown in Table 2.

A casual glance at the results pictured in Tables 1 and 2 shows that the percentages of reattachments were not significantly different in those eyes receiving saline injections and in those eyes not receiving saline injections. The natural conclusion to be drawn from a first glance at these statistics is that saline injection into the vitreous does not enhance the probability of reattachment of the retina. However, these figures can be quite misleading. If those eyes receiving saline injections were those with much the poorer prognosis for reattachment, the finding of equal percentages of reattachment in the groups with and without saline injections

TABLE 1

RESULTS OF FIRST DIATHERMY OPERATION FOR RETINAL DETACHMENT IN PHAKIC AND IN APHAKIC EYES WITH AND WITHOUT INJECTION OF SALINE INTO THE VITREOUS

		No. Cases	No. Reattachments	% Reattachments
Phakic eyes	No saline	93	53	57%
	Saline injected	30	17	57%
	Total	123	70	57%
Aphakic eyes	No saline	13	4	31%
	Saline injected	23	6	26%
	Total	36	10	27.8%
Total		159	80	50.3%

TABLE 2

RESULTS OF SECOND DIATHERMY OPERATION FOR RETINAL DETACHMENT IN PHAKIC AND IN APHAKIC EYES WITH AND WITHOUT INJECTION OF SALINE INTO THE VITREOUS

		No. Cases	No. Reattachments	% Reattachments
Phakic eyes	No saline	14	5	36%
	Saline injected	15	5	33%
	Total	29	10	34%
Aphakic eyes	No saline	4	0	0%
	Saline injected	7	3	43%
	Total	11	3	27%
Total		40	13	33%

would indicate that the injections were of real value. In general, saline injections into the vitreous were performed only in those eyes where the retina was still markedly elevated after diathermy had been applied and adequate openings made (either by diathermy puncture, trephine, or knife) between the subretinal space and the outside of the sclera.

It has long been our clinical impression that an eye in which the retina flattens out at the close of diathermy operation has an excellent chance for reattachment of the retina, and conversely that an eye in which the retina remains markedly elevated at the close of operation has a poor chance for reattachment of the retina, in spite of entirely adequate openings through the sclera for postoperative subretinal drainage. In an attempt to confirm or disprove this clinical impression, we selected for study all those case histories in which a definite statement was contained in the operative note as to whether ophthalmoscopic examination at the close of operation showed the retina to be essentially flat or still definitely elevated. In 49 instances the operative notes contained this information. The final results of these 49 operations, classified as to whether the retinas were flat or still elevated at the close of the operation, are shown in Table 3. The tremendous difference in these results (69-percent reattachments contrasted to 29-percent reattachments) amply confirms our impression that an essentially flat retina at the close of operation carries with it a good prognosis, and vice versa.

Inasmuch as saline injections into the vitreous were used as a means of flattening those retinas which did not largely flatten after establishment of subretinal drainage alone—that is, were used in those cases with the poorer prognosis for reattachment—we are justified in concluding that the saline injections were of value. The percentage of reattachments, in those cases where saline was injected, should have been much lower if saline had not been injected or unless the retina was flattened at the close of the operation by some other means such as injection of air into the vitreous or drainage of subretinal fluid by suction.

TABLE 3

RESULTS OF DIATHERMY OPERATIONS FOR RETINAL DETACHMENT CLASSIFIED ACCORDING TO POSITION OF RETINA AT CLOSE OF OPERATION

	No. Cases	% Reattachments
Retina flat at close of operation	26	69%
Retina still elevated at close of operation	23	26%

TECHNIQUE OF SALINE INJECTION

Injection of saline into an aphakic eye is performed by making a tiny slanting opening through the cornea at the limbus with a Ziegler knife, introducing a 27-gauge hypodermic needle with an attached syringe filled with normal saline through the tract made by the knife, and injecting saline into the anterior chamber. The saline goes back through the pupil into the vitreous cavity.

For injection into phakic eyes, a 27-gauge needle with attached syringe filled with saline is inserted through conjunctiva, sclera, and pars plana of the ciliary body in whichever quadrant the retina is least elevated. As the needle is inserted, diathermy current is passed through it. The needle is inserted in such a direction that the point slants backward from the lens, thus avoiding the danger of injuring the lens. Saline is then injected directly into the vitreous cavity.

In either phakic or aphakic eyes the injection is performed only if the retina remains appreciably elevated after the diathermy operation, including establishment of adequate scleral openings for subretinal drainage, is completed. The saline is injected before the conjunctiva is closed. It is injected slowly, forcing subretinal fluid out of the scleral punctures and forcing the retina back into

contact with the choroid. A sufficient amount is injected to flatten the retina as completely as possible. If there is not too large a retinal tear, the retina can usually be flattened completely or almost so; the globe will become quite firm when all the subretinal fluid has been displaced, and the reposition of the retina and the firmness of the globe will persist after the needle is withdrawn. However, if there is an extremely large tear or disinsertion, the saline will often pass through the tear and out the scleral punctures without flattening the retina. If such is the case, the globe will not become firm and any amount of saline (10 cc. or more) can be injected without producing the desired flattening of the retina.

In three phakic eyes an attempt was made to introduce saline into the vitreous by way of the anterior chamber, as is done in aphakic eyes. In one case the saline did pass between the iris and lens and filled the vitreous chamber but in the other two the lens-iris diaphragm was merely displaced backward.

Comment

Saline injected into the vitreous does not produce any inflammation. Injection of anything directly into the vitreous cavity will cause some disruption of the vitreous with minor vitreous opacities if the vitreous is "formed." However, all eyes with marked separation of the retina already have considerable disorganization of the vitreous, and inasmuch as saline injections are reserved for such eyes, the injection is in itself a benign procedure. The use of "vitreous" from another eye for such injections must rest on a misconception of the structure of the vitreous. Once vitreous passes through a needle its structure collapses, so that it becomes merely slightly viscous aqueous containing strands of protein molecules which can only serve as vitreous opacities.[5] Actually, saline is not only as good but is better than "vitreous" for injection into the vitreous cavity, because the injection of saline will not introduce undesirable opacities.

We have preferred injecting saline into the vitreous rather than air because saline does not hinder ophthalmoscopic examination. It is theoretically possible that air would flatten a retina which saline would not, since saline may pass through a retinal tear more easily than air. However, in three cases in this series in which injection of saline failed to flatten the retina, injection of air also failed to flatten the retina. These three cases represent the only instances in which air was tried after saline failed. Also, it is possible for air to enter the subretinal space and increase the detachment. It seems probable that if saline injection does not flatten the retina, it is better to try evacuating the subretinal fluid by suction.

Summary

Reattachment of the retina was obtained in 69 percent of eyes in which the retina looked flat at the close of operation. In contrast, reattachment was obtained in only 26 percent of eyes in which the retina was very appreciably elevated at the close of operation.

Injection of saline into the vitreous at the close of a retinal detachment operation will very often flatten the retina in those cases where the retinal elevation does not largely disappear after merely establishing adequate drainage of the subretinal fluid. In a series of diathermy operations for retinal detachment, including 159 first operations and 40 second operations, saline was injected into the vitreous in most instances where the retina remained quite elevated at the conclusion of diathermy application and scleral punctures. The percentage of reattachment in these eyes was as high as the percentage of reattachment in those eyes where saline injections were not necessary to cause flattening of the retina. We believe saline (or air) should be injected unless the retina flattens almost completely without the necessity of such a procedure.

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INTEGRATED IMPLANTS AND ARTIFICIAL EYES FOR USE AFTER ENUCLEATION AND EVISCERATION*

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Seven years ago necrosis of the cornea occurred in a case of gold-sphere implantation into the sclera by the method of Burch at the time of an evisceration, leaving an eye with what appeared to be a gold cornea.† The motility of the implant was perfect, exactly like the other eye, since the muscle acted normally on the intact sclera. This case stimulated the thought that, if an artificial eye could be attached to the implant by some means, it would improve the eye since there would be little or no lost motion between the stump and the artificial eye as is present in the conventional artificial eye.

In this case, the gold ball was removed six weeks later because it was felt that, if an ordinary artificial eye were fitted, it would come directly in contact with the gold sphere and that scratches on the eye and implant would result in tissue irritation. The probability of an ascending infection was borne in mind.

Ruedemann's[1] epoch-making work, demonstrating that an eye can be sewed in place and that sufficient sealing off will take place around the implanted eye to prevent an ascending infection, stimulated more intensive development of permanently retained, partially exposed implants and integrated detachable artificial eyes which could be replaced or adjusted for position when desired. This paper is a preliminary report of the results to date.

SEARCH FOR MATERIALS

Search for a proper substance from which to make the implants was begun. The most likely materials seemed to be the various plastics, tantalum, gold, and Vitallium.

Plastics were rejected because it was felt that (1) the design contemplated for the implant would not be sufficiently strong if made in one piece; (2) there might be some wear and scratching over a period of time; (3) occasional allergy to plastics might cause tissue reaction in some cases; (4) aging of the plastics might cause cracks to develop; (5) if metal parts were combined with plastic, there would be cracks and crevices for stagnant secretions to collect and infections would be difficult to eliminate.

Gold was rejected because of its prohibitive price. The cost of the raw metal that would be needed to make only one enucleation implant would be about $65.

Tantalum was rejected because of the re-

* Read at the meeting of the Section of Ophthalmology, New York Academy of Medicine, April 21, 1947.

† Movies were taken of this operation and the case was reported at a meeting of the New York Ophthalmological Society in 1941.

action it produces in tissues adjacent to the metal. While this might be desirable in certain locations such as in skull plates, it could lead to limitation of motility if the delicate fascias and muscles controlling movement of the implants were involved. Tantalum is also difficult to fabricate.

Vitallium* was finally selected because of its moderate cost, its strength, its adaptability to casting in any shape, and its prolonged use in orthopedic surgery and dentistry with minimal tissue reaction.[2] This material, an alloy composed of molybdenum, cobalt, and chromium, has practically no electric potential and, therefore, very little tissue reaction in the body.[2] It has been used for buried eye implants,[3] dental plates, colostomy plugs, bile-duct repairs, bone screws and plates, and replacement of portions of bones, such as the jaw, femur, skull, and so forth.

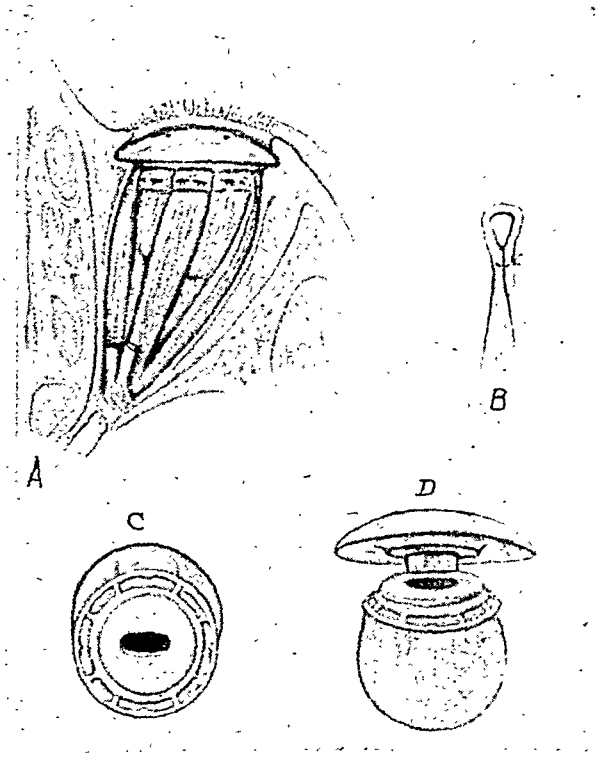


Fig. 1 (Hughes). Original model Vitallium enucleation implant. (A) Method of suturing muscles and fascia to the attachment bar of the enucleation implant. (B) Method of suturing tendon strip around the bar. (C) Front view. (D) Surgical form with peg fitting into depression on front of implant.

Description of implants

Preliminary models for the implants were made up in brass and discarded until the present designs were decided upon. Two types were made first—one for enucleation (fig. 1) and one for evisceration (fig. 2). Each type had the same standard anterior surface with an oval depression for the reception of a peg on the back of an artificial eye to integrate the movement of the eye with the implant and to help support the eye.

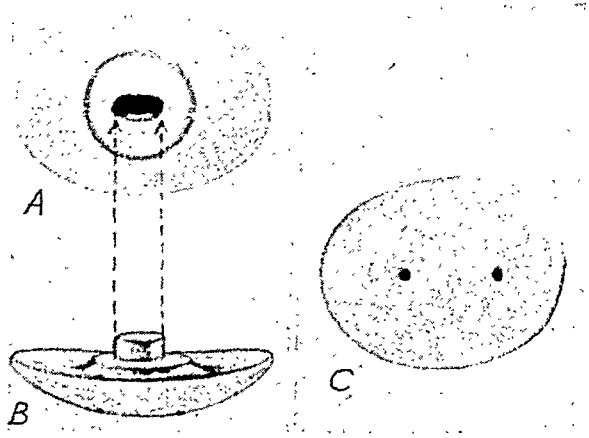


Fig. 2 (Hughes). Original model Vitallium evisceration implant. (A) Front view. (B) Surgical form. (C) Surgical form, front view.

The third type is now ready for use in replacing certain buried implants after enucleation and evisceration.

Enucleation implants

An integrated enucleation implant for immediate use at the time of enucleation is illustrated in Figure 1C. The posterior three fifths of the implant is spherical, approximately 18 mm. in diameter with a highly polished, smooth surface. The anterior portion of the body of the implant is extended to form approximately a truncated cone ending in a flat face, 10 mm. in diameter. On the anterior surface of this flattened portion is a roughly rectangular depression, with all its

* Made by Austenal Laboratories, 224 East 39th Street, New York, New York.

angles and corners rounded extending backward. Its sides slope very slightly for the reception of a slightly tapered peg with similarly rounded corners extending from the rear surface of the artificial eye.

Surrounding this neck is a ring attached to it by eight small attachment bars providing spaces for the ocular muscle tendons in the horizontal and vertical locations and for the reception of the fascia bulbi (Tenon's capsule) in the four diagonal positions. There is sufficient clearance between the bar and the implant to allow for the passage of the tendons of the muscles and the fascia bulbi.

Operative technique. Enucleation. The conjunctiva is ballooned up slightly over the sclera. It is incised around the cornea and dissected back beyond the recti muscle insertions. Parallel incisions are made 4 to 5 mm. apart through the outer two thirds of the sclera toward the limbus parallel to the margins of the tendons for a distance of 3 to 4 mm. in front of the muscle insertions. These strips of sclera in front of the insertion of each rectus tendon are shaved off to the depth of two thirds of its thickness and remain attached to the tendons. These are for the purpose of extending the length of the tendons so that they will be sufficiently long to pass around the attachment bar without tension. One end of a double-armed, 4-0 white-silk (cotton or linen seems to do equally well) suture is passed through one side of each scleral strip and laid aside; 3-0 plain gut sutures may be used equally well.

The enucleation then proceeds in the usual manner. The oblique muscle insertions and posterior small nerves, arteries, and optic nerve are severed. After the oblique muscle tendons are severed, a tonsil snare can be passed over the eye and the structures, posteriorly, including the optic nerve and ophthalmic artery and vein, can be severed. There is less bleeding by this method but it is difficult to get a long section of the nerve if desired. If an intraocular tumor is suspected, the enucleation scissors are used to section the nerve farther back.

When the enucleation is completed, the implant is placed into Tenon's capsule with the long axis of the depression on its front surface placed horizontally. The double-armed white sutures, previously placed in the tendon strips, are threaded through the four horizontal and vertical spaces provided. The muscle tendons with the scleral strips attached are pulled forward and under the bar and sewed back to the muscle itself, forming a complete loop around the bar. An additional suture is placed on the other side of the tendon to spread out its attachment as much as possible (fig. 5). Two sutures are used to attach each of the four strips of fascia bulbi between the muscles (Tenon's capsule) around the bar in a manner similar to the muscle attachments. The fascia is pulled forward between the ring and the body of the implant and is sewed back to itself with two sutures spreading it out as widely as possible. In all, 16 sutures are used, two for each muscle and two for each fascial strip. The conjunctiva is then sewed down around the flat anterior face, anchoring it to the tissues passing over the ring, to assure its healing in the proper position, leaving the face exposed but covering all underlying tissues. A form (fig. 1D) is then placed in the conjunctival sac to retain the fornices, and a moderate pressure dressing is applied. The dressing is changed in 5 to 7 days and, thereafter, every 3 to 5 days for a period of three weeks. For the first two weeks a peep hole of not more than 1.5 cm. is used over the good eye. Hot compresses and mild cleansing drops and ointment are used after the dressing is removed in three weeks.

Integrated implant for replacing buried implants

In cases in which an implant has been buried previously at the time of an enucleation, the implant can be removed and a somewhat similar type with a smaller body (12

mm. diameter) can be implanted in its place. This is feasible if there is good motility of the buried implant and if there is sufficient tissue to form connective-tissue strips attached to the recti. The original implant should also be in approximately normal location and the fornices of normal depth.

Operative technique proposed. The operation of replacing the buried type of implant with the integrated implant can be done either under local or general anesthetic. The conjunctiva is ballooned up so that the fascia in front of the old implant can be separated and dissected into strips, 3-mm. wide, attached to each of the tendons of the recti muscles. These strips are then passed around the attachment bar of the implant and sewed back to themselves in a manner similar to that described in the enucleation implant operation. In the diagonal positions, a sheet of fascia bulbi is dissected and passed forward around the bar in its diagonal positions in a like manner. The conjunctiva is also closed in a similar manner.

In some cases, sufficient tissue may be present on the anterior surface of a large buried implant to permit the use of the larger regular enucleation implant. The strips that pass around the ring to retain the implant should do so without tension. If the larger implant fits easily, it should be used. Procedures for the completion of the operation are similar to those previously described.

Integrated implant for use in evisceration

The original design for this implant was irregularly oval, extending anteriorly to a flat face with an oval indentation similar to the two implants already described. Of the four of these implants used, one was extruded at the end of six months. Two bars were then added,* one above and one below, through which a tongue of sclera could be passed in order to anchor the implant from behind.

Operative technique. The eye is held down by a retention suture at the upper limbus. A transverse conjunctival incision is made over the superior rectus insertion. A suture (double-armed, 3-0 plain catgut) is tied into the muscle tendon which is then detached. An arcuate scleral incision is made. This is a concave posteriorly or V-shaped incision with its apex forward directly behind the insertion of the lateral rectus, and with its use there should be less likelihood of neurotrophic atrophy of the sclera anterior to the incision because there is less severing of blood vessels and nerves than with the straight horizontal incision.

The evisceration is done through the scleral incision, using an iris repositor to detach the root of the iris from the scleral spur and the retina and choroid around the optic nerve. With a large mastoid curette the contents of the eye can usually be removed en masse and, very frequently, the normal anatomic relationships of the iris, lens, ciliary body, choroid, and much of the vitreous body can be preserved for specimen examination, if desired. The interior of the sclera is inspected to see that the scleral cavity is clean. The implant is then placed into the scleral cavity through the upper incision and the cornea is then removed at the limbus. The implant is adjusted to proper position so that the flat surface protrudes through the corneal opening with the long axis of the depression horizontal. The upper scleral incision is sewed up, the scleral edges overlapping, and the superior rectus is replaced. The conjunctiva is sewed up with a continuous mattress suture of 5-0 catgut.

Final step in each of the above procedures. A transparent, concave-convex form is placed over the implant and into the conjunctival fornices to retain them in proper position. In an emergency, if the regular

* One more was extruded after 4½ months necessitating a change in design.

transparent ones are not available, a form can be fashioned for this purpose out of dental wax. A fine dusting of sulfadiazine or tantalum oxide and a moderate pressure dressing are applied. The dressing is changed at intervals of 4 or 5 days for a period of 2½ to 3 weeks. After this, hot applications and mild cleansing drops with some sulfathiazole ointment are used three times daily.

The evisceration cases are usually ready for artificial-eye fittings at the end of 4 weeks, and the enucleation cases at the end of 4 to 6 weeks. As soon as the reaction has subsided, a fitting form is inserted for the purpose of locating the pupillary position so it will match the other eye. The color of the iris is matched in daylight with the iris of the normal eye, the average size of the

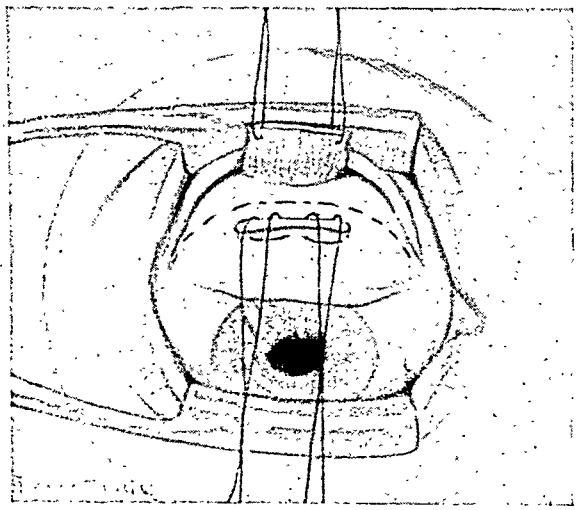


Fig. 3 (Hughes). Evisceration implant operation. Superior rectus detached and incision in sclera planned.

pupil is noted, any enophthalmos or exophthalmos is measured, and the data are sent to the artificial eye maker.* The finished eye is then returned with the iris properly located so it will match the other eye. Any final shaping of the margins can easily be done by a technician skilled in artificial-eye making.

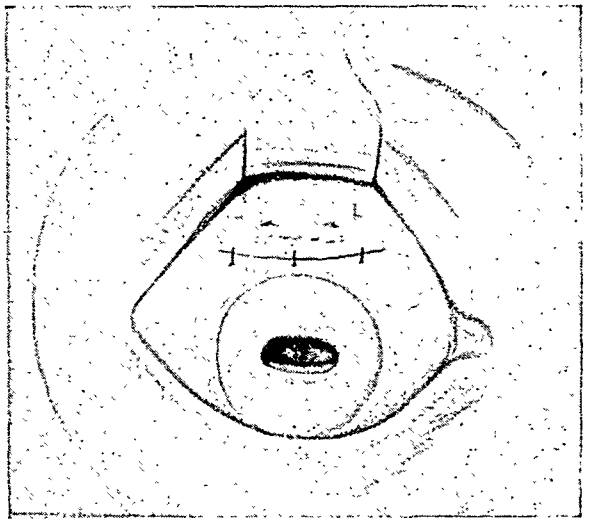


Fig. 4 (Hughes). Implant in place in sclera and incision closed. Superior rectus reattached over the scleral wound.

Case reports

Three cases of evisceration and five of enucleation were the first to be done according to the previously described methods.

Evisceration

Case 1. Mr. W. H., aged 28 years, sustained an injury from an intraocular foreign body which resulted in a chronically irritated eye with phthisis bulbi. An evisceration was decided upon and carried out in the above manner on October 23, 1946. Healing was uneventful. Photographs (fig. 5) show the motility and condition of the lids. The motility was measured on a perimeter and found to be temporally 30 degrees; nasally, 20 degrees; up, 25 degrees; and down, 30 degrees. Although this case had excellent appearance and motility, the implant was extruded after six months.

Case 2. Mrs. C., aged 70 years, had absolute glaucoma with uncontrollable pain. An evisceration was done, as herein described, and the final result is excellent motility and position.

Case 3. Mr. A. E. W., aged 56 years, suf-

*The Monoplex Eye Division of the American Optical Company, Southbridge, Massachusetts, is coöperating in the making of this type of eye.

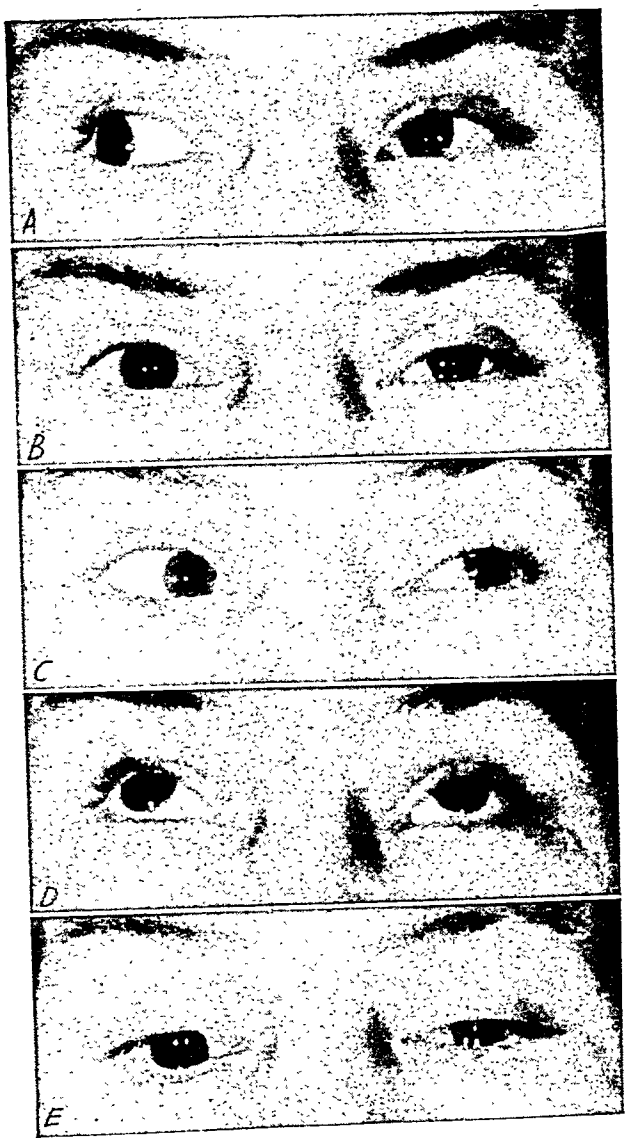


Fig. 5 (Hughes). A study of Case 1, evisceration with integrated prosthesis. (A) Eyes right; (B) eyes straight; (C) eyes left; (D) eyes up; (E) eyes down.

fered a perforating injury of the right eye in December, 1946. He was admitted to the ward service at the New York Eye and Ear Infirmary, and a conjunctival flap was drawn over the corneal laceration. Severe reaction with intraocular hemorrhage necessitated evisceration three weeks later. The afore-described technique was used. There was considerable edema and encroachment of the conjunctiva of the flap over the flat surface of the implant corresponding to the area of the cornea previously covered. This finally subsided but the upper nasal fornix, where the flap had been previously dissected up, was short. This man was reoperated recently and has been fitted with an artificial eye with excellent movement.

Enucleation

*Case 4.** Mr. A. B. had absolute glaucoma with much irritation and pain of the right



Fig. 6 (Hughes). A study of Case 4, enucleation implant with integrated eye. (A) Eyes straight; (B) eyes right; (C) eyes left; (D) eyes up; (E) eyes down.

* Implant was extruded after 4½ months and was replaced with the more recent replacement type of implant.

eye. Enucleation was done by the technique already described. There was moderate conjunctival edema particularly in the lower fornix for about five weeks after the operation. It was two months before an artificial eye was finally obtained for this patient. A plastic eye with a peg on the back was fitted and the motility (fig. 6) was: nasally, 30 degrees; temporally, 35 degrees; upward rotation, 30 degrees; downward rotation, 30 degrees. The fold in the upper lid and its motility provided an excellent match for the other upper lid (fig. 6).

Case 5. Mrs. O'L. had absolute glaucoma, with tearing and chronic irritation of the right eye. Enucleation was performed, and a vitallium enucleation implant of the above type was inserted. Considerable edema of the conjunctiva, particularly in the lower fornix, persisted for about 7 to 8 weeks. This reaction was attributed, at least partially, to the chronic inflammatory reaction in the eye before enucleation. An artificial eye now gives good movement and holds the upper lid in good position with a normal fold and motility.

Case 6. Mrs. M., a colored woman, aged 56 years, had chronic glaucoma in the right eye and absolute glaucoma in the left eye. An enucleation was done by one of the residents and an integrated vitallium enucleation implant was inserted. There was about 20 degrees of divergence with 15 degrees of hypertropia of the face of the implant. A similar eye was finally fitted six weeks after enucleation with good motility of the prosthesis and normal condition of the upper lid.

Case 7. Mr. A. E.* suffered a laceration of the eye by a piece of wire which was followed by long-continued irritation and edema of the conjunctiva. The surgeon who attended the patient at the time of the original accident said that there was no injury to the ciliary body. There was some shrinking of the cornea and the globe. The regular sized implant was placed in the sclera after evisceration through a >-shaped incision under the lateral rectus, and only after the removal of the corneal portion was it possible to close the scleral incision under considerable tension. Fascia bulbi was drawn over the scleral wound and the lateral rectus reattached. The conjunctiva was closed. Because of difficult closure of the scleral wound, it was felt that the implant would probably be extruded, which event took place 10 days later. The sclera healed into a ball, and motility of the stump was quite good. It is planned to put in the replacement type of implant at a later date.

Case 8. Mrs. B had a melanoma of the ciliary body which was first noticed in the anterior-chamber angle four months after a successful anterior sclerectomy with iris inclusion for congestive glaucoma. The tension had remained normal and the inside of the wound area could be well visualized by gonioscopy. An enucleation implant was inserted, using very short scleral lips at the end of the recti tendons. Five weeks later an integrated eye was fitted. The motility was excellent.

Discussion

This is a preliminary report of the progress in the work on this type of implant to date. The final word will not be written for several years.

Advantages

There are some obvious advantages to this type of implant over the buried type of implant.

1. The motility of the implant is transmitted to the artificial eye because of the integration of the eye with the implant. The slippage between the buried type of implant and the eye is eliminated.

2. The position of the eye may be changed by altering the position of the peg on the back of the eye.

* Case operated on by Dr. Kronenberg.

3. A stock plastic eye can frequently be used by placing a peg on the posterior surface to integrate it with the implant.

4. The motility is excellent in all directions as noted by measurements in several of the cases reported. Convergence was noted on many of the cases.

5. The normal fold of the upper lid is retained and the sinking, so common with ordinary artificial eyes with buried implants, is eliminated. This is due to the eye being supported by the implant through the medium of the peg on the back of the eye integrating it with the implant. The eye is held backward so that the peg is held into the depression on the front of the implant by the normal tonicity and muscles of the lids. The lower lid no longer needs to support the entire weight of the eye plus the pressure exerted by the upper lid.

6. The one-piece metallic, hollow construction of metal, 0.002 inch in thickness, is an advantage over any combination of two substances; for example, the combination of plastic and metal.

Disadvantages

The disadvantages of this type of implant at present apparent are:

1. The mere fact that this is a new procedure and a new type of implant renders the final results uncertain.

2. In order to make this artificial eye the technician needs some special training.

3. The cost of the implant and eye is considerably more than that of the spherical implant and ordinary plastic or glass eye.

4. There is more discharge present with the integrated eye than with the ordinary artificial eye with buried implant. This shows a decrease in the more recent cases and new techniques.

Conclusions

Some progress is being made in the matter of a better type of enucleation and prosthesis than has been thought possible in the past. What the final method of choice will be only further experience with various types of implants and eyes can determine.

131 Fulton Avenue.

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OXYCEPHALY WITH OPTIC ATROPHY*

Report on results of the King operation

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Oxycephaly is a congenital abnormality of the bones of the skull in which there is premature synostosis of the cranial sutures. This disorder is followed by extremely serious sequelae and complications, notably marked deformity of the face and head, increase of intracranial pressure, and loss of vision from optic atrophy.

Classification

Faber classifies the common and most important cranial synostosis as falling into three groups.[1] The cases in the first and most common group are due to closure of the sagittal suture with failure of transverse growth of the skull; there is compensatory lengthening of the skull in the anteroposterior dimension, particularly in the occiput, and often elevation of the frontal region (scaphocephaly).

The second group is composed of those cases in which the coronal sutures are involved; here the normal growth in the anteroposterior dimension is inhibited; growth can now occur transversely, producing a short, broad skull often high in the parietal region (brachycephaly).

Comprising the third group are those cases in which the coronal as well as the sagittal sutures are involved; growth is now inhibited in both the anteroposterior and transverse directions and can expand only vertically. With the suture lines closed tightly, only the anterior fontanelle remains open, as the last part of the suture line to close. The brain continues to exert intracranial pressure in all directions. The point of least resistance at the anterior fontanelle slowly gives way; the bony margins are slowly pushed upward until complete ossification occurs. This results in a distorted skull with the bulging portion at the site of the fontanelle. The deformity of the skull, then, is a resultant of two factors: (1) Limitation of expansion in directions perpendicular to the lines of sutural closure, and (2) overgrowth of those areas where suture lines are still open due to growth pressure of the brain.

Signs and Symptoms

The brain itself is not pathologically small, as in microcephaly, and mental retardation is not as prominent a feature. The development of the brain, however, is restrained because of the small intracranial space. The signs and symptoms are those due to chronic increased intracranial pressure; namely, headaches, vomiting, convulsive seizures, and some mental retardation. The intracranial pressure may rise to levels as high as 500 mm. of water. The inner table of the skull becomes thinned and the convolutional atrophy, as seen by Xray, is extreme. The orbital plates are depressed. Friedenwald[2] found that the vertical diameter of the orbit may be decreased by as much as 10 mm. The great wing of the sphenoid may form the posterior instead of the lateral wall of the orbit, which is shortened, deformed, and its axis changed. These factors contribute to the small volume of the orbits in some of these cases, with resultant exophthalmos and possible lagophthalmos and corneal ulceration. Exotropia is frequently seen and probably is related to a distorted orbital axis.

Vision

Fletcher[3] has reviewed the subject carefully and says of the vision in oxycephaly: "This occasionally is unimpaired, but in the majority of cases sight is very defective." Al-

*Presented before the New York Society for Clinical Ophthalmology, February 3, 1947. From the neurologic service of Dr. Nathan Savitsky, Morrisania City Hospital, New York.

gyogyi[4] estimates the incidence of impaired vision at almost one-half the cases of oxycephaly. Of Mehner's 21 cases, 15, or 71 percent, showed it.[5] Loss of vision occurs early. The choice of operative procedure for prevention or palliation depends upon the underlying pathologic conditions.

Unfortunately, confusion has arisen from a long-standing difference of opinion as to whether the optic atrophy is a result of the increased intracranial pressure or of a narrowed optic foramen. The appearance of choked disc has been observed in many cases. Transition from papilledema to secondary optic atrophy has also been seen. Sometimes, one dise is papilledematous and the other atrophic. Although most reviews of the subject speak of secondary optic atrophy, case reports in the same papers describe the typical appearance of primary atrophy. In 91 percent of Gunther's[11] cases, optic atrophy developed.

It is always a great temptation to diagnose secondary atrophy when the intracranial pressure is known to be very high. This was true in the report by Levine[6] of the case operated by Cushing in 1916; secondary optic atrophy was reported many times until 21 years later when examination revealed typical medullated nerve fibers.

In some cases, it may be that deformities of the body or wings of the sphenoid lead to narrowing of the optic foramen. The hypoplasia of the bones at the base of the skull may result in stenosis of the various foramina-transmitting blood vessels and nerves; venous return may be interfered with, and the optic nerves may be dragged down and injured by being forced against the sharp edges of the sulcus chiasmatis; or they may undergo compression because of an abnormality of the internal carotid artery (Behr).

Faber[7] has studied the case reports that form the basis for the contention that a small optic foramen is the cause of optic atrophy; on critical analysis he finds no basis for this theory. Wilson[8] reports that the foramen opticum itself does not appear to be narrowed as some have maintained. Autopsy reports reveal the optic nerves to be stretched and thinned due to great distortion of the normal anatomical arrangements.

Differential diagnosis

The syndrome of oxycephaly develops during the first five years of life, affecting males more frequently than females, and rarely has a hereditary or familial incidence. The cranial deformity is recognizable at or shortly after birth; the syndrome may develop very slowly; characteristic examples are not likely to be confused with other anomalies of development. Resemblance to craniofacial dysostosis is sometimes rather intimate. Differentiation depends on the local character of the deformity in the dysostosis and the diffuse nature in oxycephaly. The hereditary transmission of craniofacial dysostosis is not seen in oxycephaly. The low sella turcica of oxycephaly is not seen in craniofacial dysostosis.

Differentiation from hypertelorism is made by the presence of marked mental and physical retardation, the great breadth between the eyes and the presence of open suture lines.

Report of a case

I. C., a nine-year-old Negro schoolboy, was first observed on the neurologic service of the Morrisania City Hospital on May 9, 1941. The patient himself had no complaints, but the guardian had noticed abnormal posturing of his head on reading; for the preceding year he had developed the habit of turning his head to the right to allow reading matter to be visualized by the left eye. There was an occasional frontal headache. Adequate familial history, as well as details of his birth and postpartum development, were not obtainable. His mother had died five years previously, cause unknown, and he was under the care of a guardian. Two siblings were living and well. Apparently, his development had been normal. School was begun at the age of seven years and there had been adequate progress. There were no per-

sonality difficulties and no history of craniocerebral trauma or convulsions.

PHYSICAL EXAMINATION

Examination revealed a well-developed, adequately nourished, nine-year-old Negro boy with a peculiarly shaped head (figs. 1 and 2). Measurements revealed the cranium to be smaller than normal with elongation in the anteroposterior and narrowing in the transverse diameters. The boy was alert and coöperative, bright and of average intelligence. There were no focal neurologic signs. General physical examination failed to reveal any abnormalities. Blood, urine, and serologic studies were negative.

OCULAR EXAMINATION

There was no exophthalmos. The motility was not impaired and no strabismus was evident. There was moderate insufficiency of convergence.

Right eye. Vision was light perception with poor projection. The pupil was larger than its fellow and reacted sluggishly to light through a small arc. It responded well consensually. Optic atrophy of the primary type was present. A visual field could not be obtained.



Fig. 1. (Lisman). Lateral view of head taken when the patient was nine years of age. The skull is small in the anteroposterior diameter but does not rise to a point at the site of the fontanelle.



Fig. 2 (Lisman). Frontal view of the head at the age of nine years. The narrowing in the transverse diameter is evident.

Left eye. Vision was 20/20. The pupillary responses were physiologic; the consensual reaction was poor. The nerve head was suspiciously pale in the temporal half only. The visual field was normal in its extent, without contractions or scotomas; the blind spot could not be mapped out.

LABORATORY STUDIES

X-ray studies of the skull (figs. 3 and 4) showed an increase in height of the cranium together with a narrowing in its transverse diameter. There was marked convolutional atrophy of the inner table. The sella turcica was normal in position and configuration. The lambdoidal and coronal sutures were

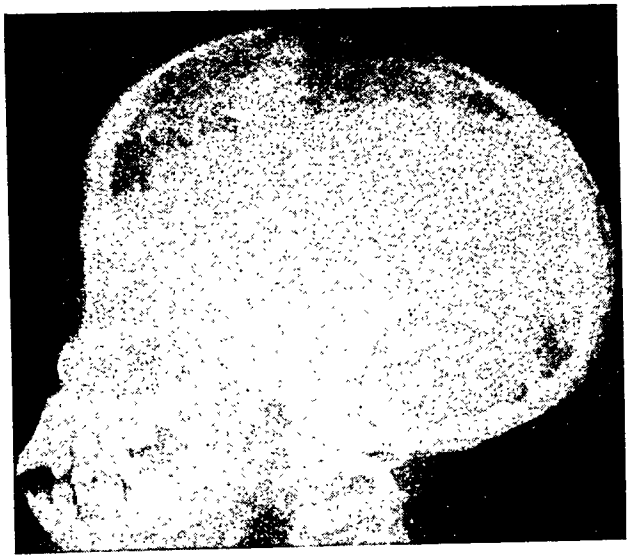


Fig. 3 (Lisman). Lateral X-ray study of the skull showing the convolutional atrophy of the inner table.

open; the optic foramina were of normal size. The sagittal suture was not well visualized.

Spinal tap. Initial pressure was 260 mm. of water. The Ayala index was 4.5. There was no response on pressure over the left jugular but adequate response on the right.

The spinal fluid analysis showed sugar present and no increase in protein or cells.

Diagnosis. A diagnosis of synostosis craniae with optic atrophy was made.

Operation

A King morcellation operation was performed on May 24, 1941, by Dr. Sidney Gross. After reflection of the scalp and periosteum, multiple perforator openings were made on each side of the midline through the bones of the vault down to the dura. These were joined by means of a Gigli saw, leaving only an intact ridge of bone over the longitudinal sinus. As the fragments of bone were cut loose, each became slightly elevated above the surface of the skull indicating high intracranial pressure. After careful attention to hemostasis, the scalp incision was closed (fig. 5).

Postoperative course

Postoperatively, the course was uneventful. The visual acuity improved to finger counting at 12 feet within two weeks.

On September 22, 1942, a tonsillectomy was performed under ether anesthesia without complications. The patient was readmitted to the hospital on November 5, 1944, following minor trauma to his head, sustained the preceding day. A few hours after striking a glancing blow to his head on a door knob, he complained of headache, vomited, and became semistuporus. Examination 24 hours later revealed a semistuporous boy with a stiff neck, a temperature of 101°F., and without any focal neurologic signs. A spinal tap revealed a clear, acellular spinal fluid under a pressure of 150 mm. of water; sugar was present, and there was no elevation of protein. The blood count was W.B.C. 23,440, 77-percent polymorphs, and 23-percent lymphocytes. Within 24 hours, the boy was alert and coöperative and fully re-

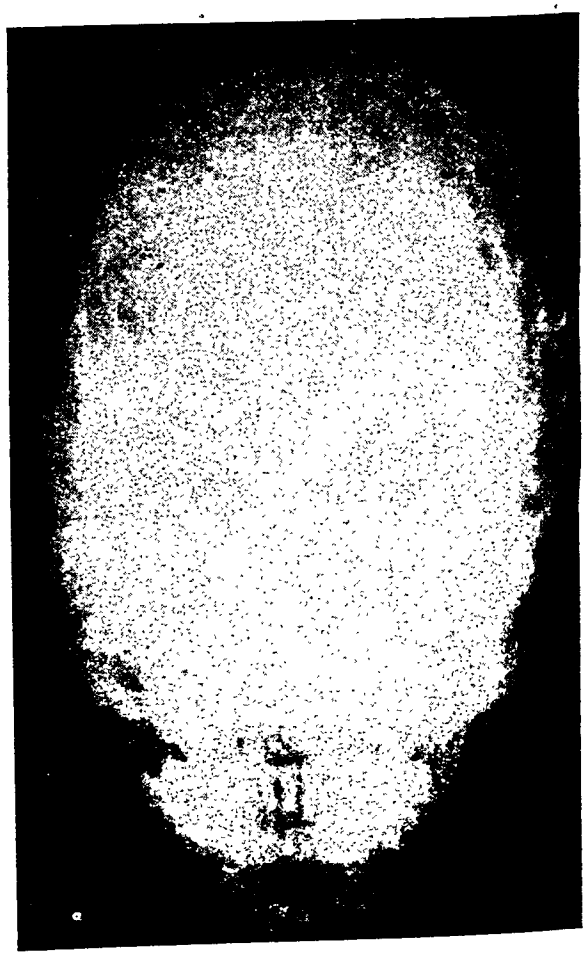


Fig. 4 (Lisman). An anteroposterior X-ray view of the skull showing the convolutional atrophy and the increase in height.

covered; there were no relapses. The etiology of this episode is obscure. Skull X-ray studies at that time revealed only a small part of the operative site that was not completely filled in with new bone.

Reëxamination after five years

A reëxamination on August 28, 1946, revealed an alert, coöperative boy, aged 14 years. The skull had increased in size and its contours were more rounded (figs. 6 and 7). His physical stature was smaller than average. Psychometric studies gave him a composite I.Q. rating of 76 on the Bellevue scale. The classification of "borderline intelligence" was given with the note that this boy was handicapped by having only one eye



Fig. 5 (Lisman). An X-ray picture of the skull taken two weeks postoperatively showing the surgically produced fracture lines of the King operation.

which undoubtedly penalized him in the tests that required perception.

A radiographic examination of the skull (fig. 8) on this date showed: "The skull vault is small and of peculiar form. The bitemporal diameter is narrow. There is an old, healed fracture in the right parietal region; probably the result of a surgical procedure. There is slight increase in the convolutional markings. In a subject of this age, this degree of increase is without clinical significance. No pathologic changes are ap-



Fig. 6 (Lisman). Frontal view of the head taken when the patient was 14 years of age. It shows the increase in transverse diameter.



Fig. 7 (Lisman). Lateral view of the head at the age of 14 years.



Fig. 8 (Lisman). An X-ray study of the skull taken in September, 1946, when the patient was aged 14 years. Most of the fracture lines have closed. The skull has increased in size.

parent in the base of the skull, including the sella turcica. The optic foramina are within normal limits of size and form."

Ocular examination. There was primary optic atrophy of the right eye, with no light perception. Vision in the left eye was 20/20. The fundus was normal, as was the field. There was no exophthalmos as measured on the Hertl exophthalmometer.

Spinal tap. The initial pressure was 190 mm. of water. The Ayala index was 5.

Comment

Optic atrophy in oxycephaly is a result of one or all three of these factors: (1) small optic foramina, (2) papilledema, (3) distortion of the optic nerves by traction.

Most frequently mentioned, and yet most infrequently seen, is optic atrophy due to compression by a small optic foramen. Papilledema, while discussed, is reported only infrequently in case reports. It appears that the traction and distortion of the optic nerves subsequent to the marked skull deformity is the most important factor producing optic atrophy in synostosis craniae.

As is the case with maldevelopments of any kind, it is never easy to specify at what point departure from the normal becomes anomalous. Surely many persons with oxycephaly of mild degree grow to be normal adults and require no operative correction. If severe, however, the condition should be recognized in infancy and preventive measures should be taken. Faber and Towne[12] make an impassioned plea for preventive operation before the age of six months.

The palliative operations that have been recommended are: (1) Subtemporal decompression that gives only temporary relief. (2) The operation of linear resection that does not permit satisfactory symmetrical enlargement of the skull. (3) Resection of the optic canals if stenosis has occurred (rare). (4) The preventive operation of "linear craniectomy" of Faber appears to be the most rational; in this operation, channels of bone are cut at the side of the sagittal suture and another paralleling the coronal suture.

The cure of exophthalmos in oxycephaly has never been satisfactorily explained. The exophthalmos recedes immediately after operation, even though the orbital volume has not been increased.[9, 10] Probably, most of the exophthalmos is due to an increase in orbital contents by edema. The hypoplasia of the bones at the base of the skull in craniostenosis results in distortion of veins and interferes with the venous return from the orbit. After any operation that increases cranial volume, the exophthalmos decreases; this is probably due to better venous drainage from the orbit.

Summary

1. A case of craniostenosis is presented.

2. The King morcellation operation was performed and the patient was observed after five years.

3. The temporary improvement in visual acuity in the eye with optic atrophy was not maintained. Vision remained normal in the unaffected eye.

4. The intracranial pressure was partially controlled.

5. The etiology of optic atrophy is discussed.

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SOME METHODS OF LID REPAIR AND RECONSTRUCTION*

V. Displacement of the canthi

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Cases of displacement of the canthi are not common and have been rarely reported. They are usually complicated cases because the trauma causing them must of necessity be extensive and severe. Thus, in the three cases listed below, not only were all the involved eyes lost but the first patient had an attendant cicatrical lagophthalmos and partial lid loss (fig. 1a) and the other two had a complicating cicatricial epicanthus (figs. 5 and 6).

Wheeler[1] has described a method of handling this type of traumatic deformity but his exposition of the technique is deceptively simple. It was undoubtedly a simple procedure in the hands of this master surgeon. However, as may be inferred from the reports below, the surgery required is usually extensive and occasionally formidable.

Report of cases

Case 1

History. R. J. S. was injured on January 28, 1945, in Germany by mortar-shell fragments. He sustained wounds of the left frontal area of the skull, left eye and face, and right knee. The next day the left frontal sinus was exenterated, the left frontal brain lobe debrided, and the left eye enucleated. After convalescence, he was returned to this country. The defect in the skull was repaired with a huge tantalum plate (fig. 1b). He was then referred for plastic repair of the lids.

Examination disclosed (fig. 1a) an empty left socket and a severe cicatricial lagophthalmos, with the external canthus drawn up to an angle of 45 degrees. The outer half of the left upper lid was absent The lid was bound down to the subjacent tissues by cicatrices and was immobile.

Technique of repair. Anesthesia was ob-

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tained by local infiltration with 1-percent novocaine with adrenalin. A Z-shaped incision was made as illustrated in figure 2a. All three arms of the incision were 3.5-cm. long. The upper two arms included the displaced external canthus between them. The lower

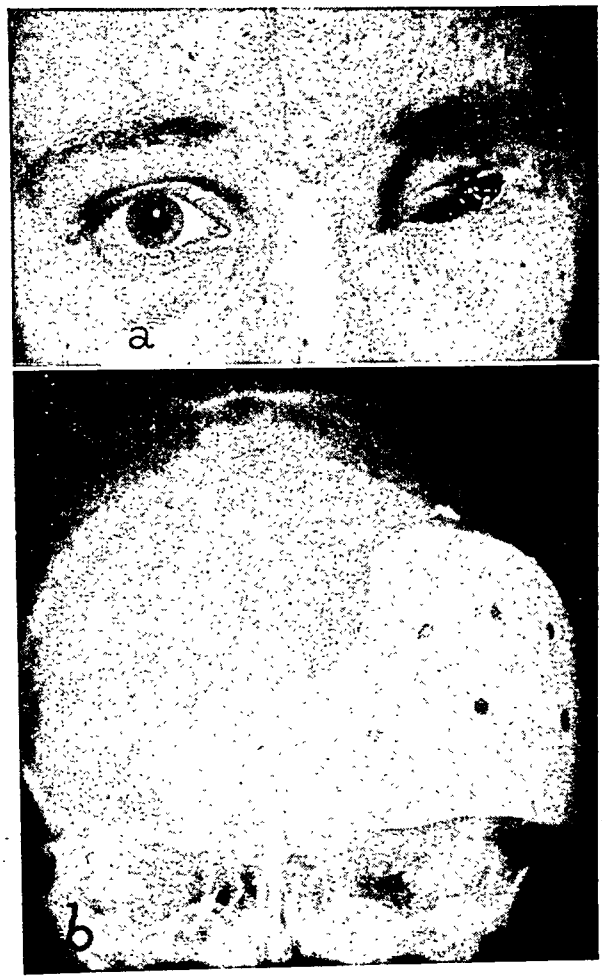


Fig. 1 (Fox). *Case 1.* (a) Left anophthalmos with dislocated outer canthus, cicatricial lagophthalmos, and loss of outer half of upper lid margin. (b) X-ray picture of skull showing extent of injury and tantalum plate.

two arms created a flap of skin from the lower lid. The incisions were carried down to the tarso-orbital fascia. Much scar tissue was encountered and resected. The external canthal ligament was difficult to identify but plenty of equivalent tough fibrous tissue was found to serve. In order to lower the external canthus and conjunctival sac to their normal positions the tarso-orbital fascia had to be incised to attain sufficient mobility (fig. 2b). The flaps were transposed and the ligament was sutured to the zygomatic bone behind the orbital rim at the same height as the external canthal ligament of the fellow eye with 3-0 chromic catgut sutures (fig. 2c). Subcuticular sutures were used to fasten the lower flap to the periosteum of the lower orbital margin and a double-armed stay suture of 3-0 black silk was passed through skin, external canthal ligament, and periosteum of the lower orbital rim, brought out through the skin of the cheek, and tied over oiled silk pegs (fig. 2d). The skin wound was closed with interrupted 4-0 black silk sutures. Figure 3a shows the repair six days

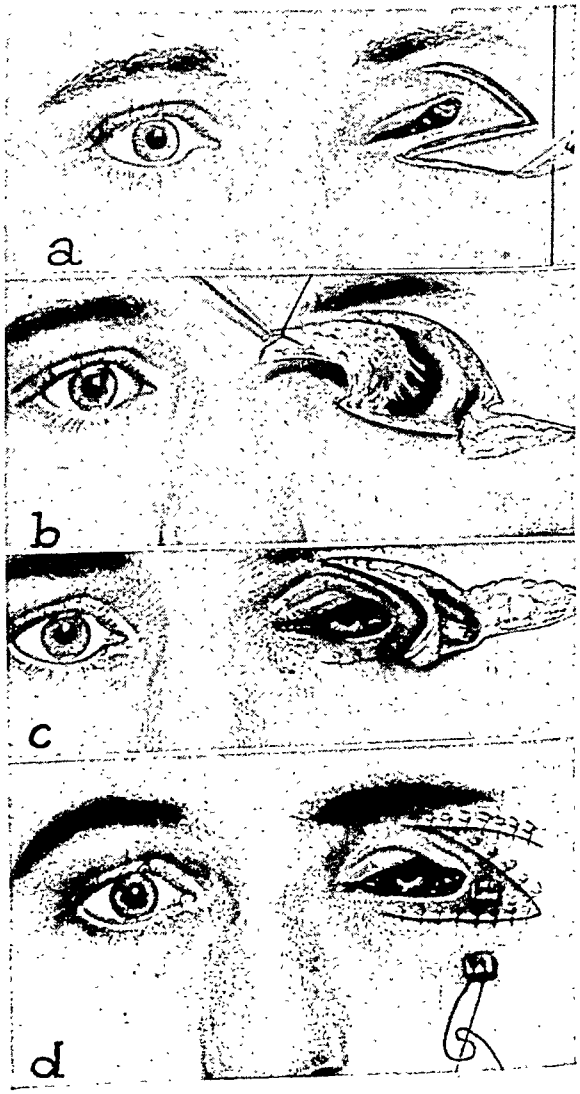


Fig. 2 (Fox). Technique used for repair of dislocated outer canthus in Case 1. For complete description, see text.

later before removal of the skin sutures. The canthal stay suture was removed on the 12th day.

Eight weeks later the outer half of the left upper lid was repaired and lashes grafted. Figure 3b shows the final result eight months after the first operation.

CASE 2

History. L. E. R. was injured by machine-gun fire in February, 1945. His left eye was destroyed, the left frontal, left ethmoid, and right frontal sinuses fractured, and the dura lacerated. The left eye was enucleated, the brain wound debrided, and the dura repaired by a graft of fascia lata. Convalescence was uneventful.

Examination. The patient was returned to this country where examination disclosed a vertical scar running across the forehead down through the medial end of the left brow and through the left inner canthus. The canaliculi were severed. There was a left cicatricial epicanthus with downward displacement of the inner canthus (fig. 5a).

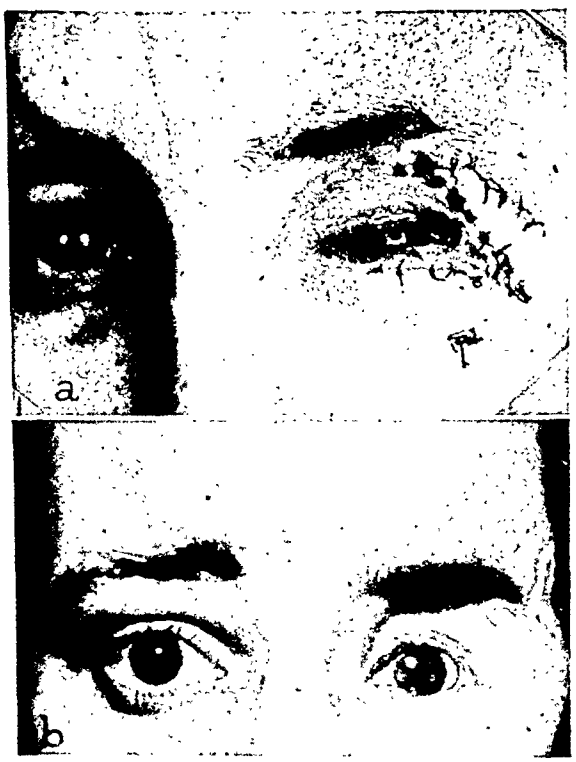


Fig. 3 (Fox). *Case 1.* (a) Appearance six days after repair and before removal of sutures. (b) Appearance after repair of upper lid margin with lash graft and prosthesis in place.

Technique of repair. At operation under local anesthesia a Z-shaped incision was made as shown in Figure 4a with the displaced canthus enclosed by the incision angle BCD. The incision was carried down to periosteum. The two flaps thus created were

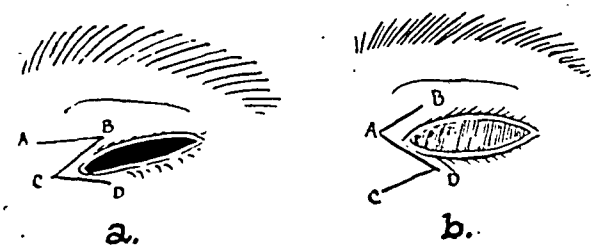


Fig. 4 (Fox). Incision and transposition of flaps used for repair of dislocated internal canthus in Cases 2 and 3. For complete description, see text.

mobilized by free incision of the tarso-orbital fascia and excision of fibrous tissue. The flaps were transposed so that flap ABC occupied position ADC and flap BCD was rotated up into position BAD (fig. 4b). The flap BCD (fig. 4a) included the internal canthal ligament and some surrounding scar tissue which was sutured to the periosteum of the anterior lacrimal crest with a double-armed 3-0 chromic catgut suture. Subcuticular sutures of the same material were used to suture the flaps to the periosteum of the upper nasal orbital rim. The skin incisions were closed with 4-0 black silk interrupted sutures.

Figure 5b shows the repair six days after operation before removal of the skin sutures. Figure 5c shows the patient eleven weeks after operation with a prosthesis in place.

CASE 3

History. E. F. R. was struck by an automobile in November, 1942. He sustained lacerations of the face, rupture of the left eye, and a fracture of the left maxilla. He was in a hospital until February, 1943, during which time his left eye was enucleated and his maxilla repaired by wiring.

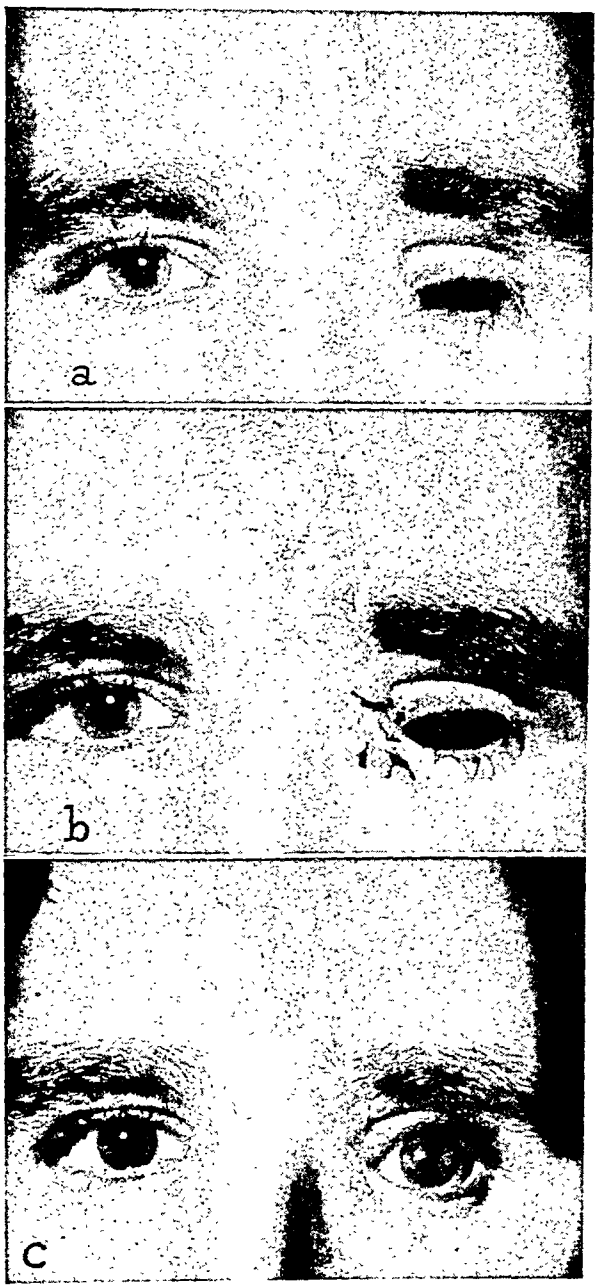


Fig. 5 (Fox). *Case 2.* (a) Left anophthalmos with cicatricial epicanthus and downward displacement of the internal canthus. (b) Six days after repair, with sutures in place. Operative site still shows some postoperative edema. (c) Final repair with prosthesis in place.

Examination. When seen in September, 1944, he had a wide linear scar running from his forehead down the left side of his nose, over the left ala to the vermilion border of the upper lip. The left socket was anophthalmic. There was a left cicatricial epicanthus with the superficial skin knobby and scarred and a large, irregular mass of subcutaneous fibrous tissue involving the caruncle and the internal canthus which was displaced downward about 8 mm. The canaliculi were severed. There was a congenital epicanthus on the right side (fig. 6a).

Technique of repair. A Z-shaped incision was made as described in Case 2 with the two lower arms of the "Z" enclosing the dropped canthal ligament (fig. 4a). The resultant skin flaps were undermined and a mass of subcutaneous fibrous tissue exposed and resected. The dislocated canthal ligament and adjacent fibrous tissue were identified

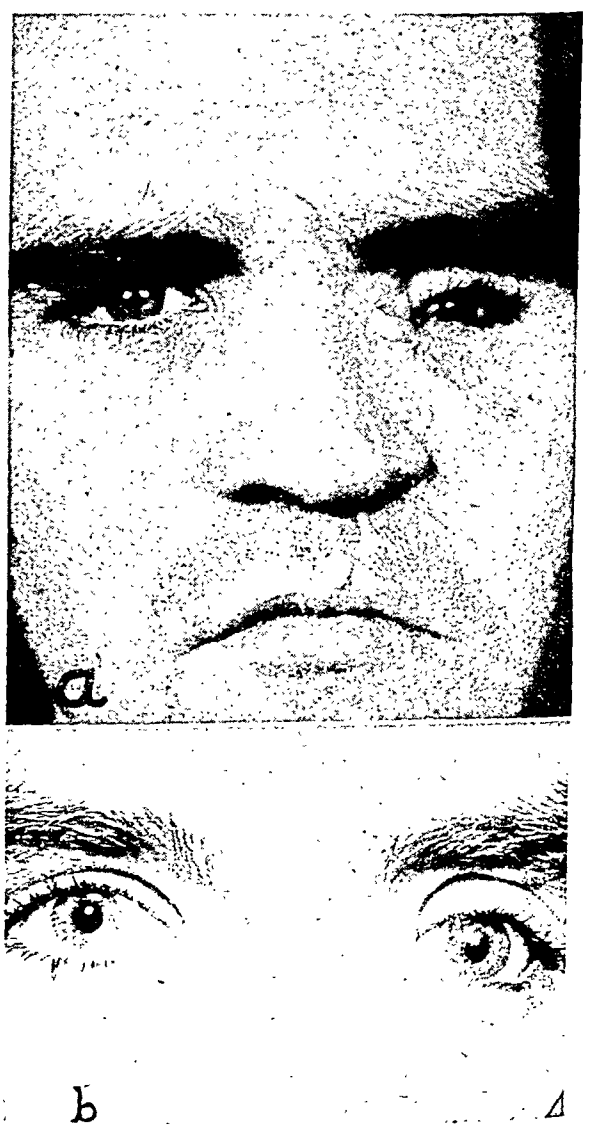


Fig. 6 (Fox). *Case 3.* (a) Left cicatricial epicanthus with downward displacement of the internal canthus. (b) Appearance after repair. Note absence of caruncle and bilateral epicanthus.

and freed. The external canthal ligament was cut, as recommended by Wheeler,[1] and the tarso-orbital fascia of the lower nasal orbital quadrant was incised to attain full mobility. The ligament was then rotated upward and sutured to the periosteum of the anterior lacrimal crest at the same height as the attachment in the right eye. Closure was made as described in Case 2. Recovery was uneventful. After healing it was seen that the canthus was back in normal position but the epicanthus persisted. A double-Z plasty was then performed after the method of Blair[2] to repair this. A secondary orbital implant and excision of the scar of the face were done subsequently to complete the repair.

The final result is shown in Figure 6b. Note that a trace of the epicanthus remains. This, however, just about matches the congenital epicanthus of the right eye and is not noticeable. What is obvious is the absence of the caruncle; this would have improved the result a great deal.

Discussion

One of the few cases in the literature describing this condition was reported by Roy[3] at the International Ophthalmologic Congress in 1922. This was a case of bilateral lagophthalmos with displacement of both external canthi upward. The repair here was also made by a relocation of the external canthal ligament although there was no preliminary "Z" incision. Apparently not so much scar tissue was encountered since this was not a traumatic case and hence less dissection was necessary to free the canthal ligaments. The result was excellent.

It must be emphasized that unless the ligaments or their equivalents are thoroughly mobilized the operation will be a failure. This requires sufficient incision of the tarso-orbital fascia so that the ligaments can be placed in proper position easily and without the slightest tension. When the internal canthal ligament is displaced, it is usually necessary to sever the attachment of the external canthal ligament to assure sufficient mobility.

It is also important to bear in mind the points of attachment of the two ligaments. The lateral palpebral ligament inserts into the orbital tubercle on the zygomatic bone which is behind the lateral palpebral raphe of the orbicularis. Thus it lies deeper than the medial palpebral ligament and does not form a prominence as does the latter. The medial palpebral ligament attaches to the frontal process of the superior maxilla *beyond* the anterior lacrimal crest and forms a prominence which is normally easily palpable. Despite this the attachment is deeper than one would suppose. This is important especially when the caruncle has been preserved. For unless the canthus is replaced back to its original position at the lacrimal crest the caruncle and semilunar folds are hidden and the optimum cosmetic result has not been obtained. This defect is especially noticeable in Case 3 where the caruncle has been lost, and illustrates this point nicely.

All fibrous tissue must be resected to reduce as much as possible the danger of displacement by scar-tissue pull during the healing process. Hence, also, the ligament must be firmly anchored in place.

There are two advantages in using the Z-incision technique in such cases. First, it tends to counteract the danger of healing scar-tissue pull, which may displace the canthus again, by using the skin flaps and skin sutures as well as subcutaneous sutures to counteract this tendency. Secondly, the transposition of skin flaps supplies skin tissue where most needed from adjacent sites; this is always a good rule in plastic surgery. In Case 1, it added tissue to a lagophthalmic lid which would have had to be obtained from somewhere else either by pedicle flap or free graft. The additional advantage here is that next to lid skin itself, skin from below the lower lid is nearest in appearance to actual upper-lid skin. Furthermore it has the advantage (in this case) of being somewhat heavier and less elastic and hence more like-

ly to counteract upward pull by healing scar tissue. In the last two cases this particular technique also happens to be an excellent method for the repair of epicanthus as well.

In general it is probably true that replacement of the external canthus is easier than the internal. This is due to the fact that the structures around the internal canthus are more important cosmetically and their destruction or improper repair will affect the final result much more adversely. Should the lacrimal passages be intact the problem then becomes much more delicate and difficult. Fortunately, or unfortunately, trauma in this area usually severs the continuity of the lacrimal passages and this problem is not often encountered.

Summary

Three cases of traumatic dislocation of the canthi with the methods of repair are reported.

The first was a case of upward displacement of the external canthus with cicatricial lagophthalmos.

The second and third cases showed downward displacement of the internal canthus with cicatricial epicanthus.

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EYE INJURIES FROM SO-CALLED NONCASUALTY WAR GASES

Report of cases

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The partial incidence[1] and eye lesions of the clinical[2–4, 9] and experimental[6–8] burns caused by some of the casualty war gases during World War II have been described. On the other hand, little clinical information regarding the so-called noncasualty war gases has been presented, mainly because these gases do not ordinarily cause serious eye damage.

Tear gases

The most important tear gases are chloroacetophenone, chloroacetophenone solutions, and bromobenzylcyanide.

A soldier, aged 20 years, was admitted to the hospital at Edgewood Arsenal, Maryland, for burns of both eyes from a chloroacetophenone solution. This solution was dispersed as a spray from an experimental 3-gallon decontaminating apparatus attached to a jeep. The epithelial surfaces of both corneas were hazy and stained a bright green with a 2-percent alkaline fluorescein solution (6× loupe). The epithelium recovered and/or regenerated within 24 hours after treatment with homatropine and 10-percent albucid (sodium sulamyd, sodium sulphacetamide, or sodium-amino-benzene-sulfonyl-acetylimide).

A droplet of liquid bromobenzylcyanide placed in the eye of a rabbit produces corneal edema and ulceration with fluorescein staining extending even to Descemet's membrane. Usually the eye recovers in about 72 hours. Particles of solid chloroacetophenone entering the eye result in effects similar to those from droplets of bromobenzylcyanide.

In September, 1943, while riding a bicycle across a firing range in the European Theater Operations, a man was struck in both eyes with bromobenzylcyanide dispersed as a spray from a diving plane 50 to 75 feet overhead. Although he saw the spray leave the plane, the attack was unexpected and he was unable to shield himself. He felt drops enter both eyes and had instant severe pain, blepharospasm, lacrimation, and photophobia—to such an extent that he fell off his bicycle. During the next 45 minutes the spasm of the eyelids was so severe that it was practically impossible to irrigate his eyes. Three hours later, however, his subjective symptomatology subsided so that he was able to carry on with his usual duties. His eyes were examined by slitlamp an hour after contamination and the following findings were observed: Swelling of the lids, moderate edema and injection of the conjunctivas, bedewing (edema) of the corneal epithelial cells with superficial punctate staining of the lower two thirds of the corneas (fig. 1).

It is interesting to note that many of the patients during World War I were hospitalized for as long as two weeks, and the soldiers complained of photophobia and lacrimation for three to four weeks. Unless there is secondary infection or reëxposure, facts now indicate that even patients with the severest burns need not be hospitalized longer than 3 or 4 days.

If infection is able to get a foothold, however, the prognosis may be poor. Schmelzer[5] reported the case of a young man whose left eye was injured by a shot from a tear-gas pistol. On the 14th day the cornea became cloudy, the anterior chamber filled with pus, and blindness resulted.

During a demonstration at Edgewood Arsenal a second lieutenant threw a hand grenade filled with chloroacetophenone. The

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grenade failed to detonate. After a few moments the officer picked up the grenade and the explosion occurred. Both corneas were damaged to such an extent that permanent blindness resulted. This case is interesting in view of the fact that the degree of damage attributable to the physical force of the



Fig. 1 (Uhde). Photograph taken one hour after contamination with bromobenzylcyanide from an airplane spray shows swelling of the lids and moderate edema and injection of the conjunctiva. Slitlamp examination showed bedewing of the corneal epithelium with superficial punctate staining of the lower two thirds of the cornea.

solution striking the corneas is an unknown quantity. In other words, if water, or any nonirritating solution, was placed in a grenade and exploded a few feet from the eyes, how much damage would there result to the corneas?

Rather severe allergic reaction may ensue from prolonged and/or repeated exposure to the tear gases. A white chemical engineer, aged 28 years, who was working on important tear-gas problems in the Technical Division, Edgwood Arsenal, developed a severe conjunctivitis, blepharitis, and contiguous dermatitis. These signs, and his symptoms, disappeared only after removal from the vicinity of the tear gases. Medicaments were useless. At the patient's request, since his work was important to the war effort, an attempt was made to keep him at his job. However, since the lesions always appeared after a reëxposure and became progressively worse after each succeeding exposure, the effort was finally given up three months after the appearance of the initial lesions.

Although irrigation was recommended in tear-gas splashed eyes, it appeared to have little value in the presence of the severe lid-spasm. The profuse tearing which results from the action of the gas per se is probably as adequate as any irrigation from a canteen. Soldiers should be warned not to rub their eyes because the corneal epithelium is damaged.

In the European Theater Operations, medical officers in forward echelons carried discs of flourescein, homatropine, and atropine for diagnostic and therapeutic care of corneal injuries. Discs were used because of their nonspillable (and perhaps less deterioration) advantage over solutions.

Choking gases

The common choking gases, or pulmonary irritants, are phosgene, chlorine, and chloropicrin.

On November 8, 1942, at Edgewood Arsenal, a Negress, aged about 19 years, was supposedly splashed in her left eye with phosgene, when a new employee became excited and dropped a tube of liquid phosgene on the table in front of the patient. Although the cornea did not stain with alkaline fluorescein (6× loupe), there was severe edema and hyperemia of the lids and conjunctiva with complaints of lacrimation, photophobia, and blepharospasm. The eye recovered in 72 hours without any specific treatment.

It is said that liquid chloropicrin when splashed upon the cornea will cause ulceration. In a lesser concentration chloropicrin is a strong lacrimator, although less effective

than the true lacrimators, and the flow of tears is the first symptom noted. It was a frequent and only symptom observed in these patients treated at Edgewood Arsenal.

Screening smokes

White phosphorus, sulfur trioxide-chlorsulfonic acid, and titanium tetrachloride are some of the screening smokes.

A case report,[1] illustrated by a photograph, of a severe white-phosphorus burn resulting in blindness has already been published. Phosphorus was used extensively during World War II, both as a casualty and noncasualty agent. The protection given by the ordinary eyeshields against white phosphorus varies considerably. When a 11-mg. piece of phosphorus, dried on blotting paper, was placed on an eyeshield and ignited with a hot wire, penetration occurred in 10 seconds. On the other hand, on another occasion under similiar conditions, a 12-mg. fragment penetrated an eyeshield in 3.2 seconds (fig. 2). Even though the penetration time is rapid in some instances (when the smoke is disseminated from shells or bombs, the dispersal force may tend to diminish the penetration time even further), the protection afforded probably suffices to permit the lid reflex adequate time to act and protect the eye against a destructive burn.

On November 19, 1942, a white man, aged about 37 years, was treated for sulfur-trioxide-chlorsulfonic-acid burns of his left eye, left side of his face and neck, and left forearm after a "burster-well" in a leaking shell exploded suddenly. He ran immediately under a shower and his left eye and skin were thoroughly washed. The eye burned and lacrimated but did not otherwise particularly disturb the patient until about 24 hours later at which time the lids were so swollen that he was unable to see. Other than this swelling of the lids and conjunctivas, the eye appeared normal. The swelling subsided in four days and the skin burns healed in seven days.

The following case history stresses two important facts: (1) that a so-called noncasualty war gas may at a point of dispersal cause considerable damage and, (2) that it is potentially dangerous to give an eye patient a local analgesic for self-medication, even though it contains an antiseptic. The pain may be relieved but the pathologic processes may progress.

In February, 1943, in a southern camp,

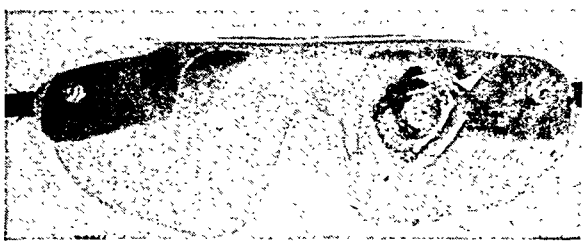


Fig. 2 (Uhde). Antigas eyeshield showing penetration made by a flaming 12-mg. fragment of white phosphorus in 3.2 seconds.

a master sergeant, aged 24 years, splashed titanium tetrachloride into his left eye while removing a cork from a bottle. The eye was irrigated immediately and for about five minutes with 2-percent sodium bicarbonate. A medical officer gave him an ointment of metaphen (1:3,000) with butyn (2 percent) with instructions to use it freely. Twenty-four hours later while en route to Edgewood Arsenal, the sergeant observed that his lids were severely swollen and that he had blurred vision with severe pain (relieved by the ointment), lacrimation, blepharospasm, and photophobia. Examination three days after the eye was contaminated showed severe inflammation of the lids and conjunctiva, numerous conjunctival and subconjunctival hemorrhages, central corneal ulceration, 4 mm. in diameter, which stained bright green with fluorescein and which extended into the stroma, haziness (infiltrates and edema) of most of the remaining corneal tissue, and reflex miosis. The aqueous was clear. The patient was placed in a dark room; the pupil was dilated with a mydriatic, and albucid (10 percent) was instilled every

four hours. The ulcer healed slowly, leaving a faint nebular scarring in the visual axis.

Incendiary agents

The incendiary agents produce a heat burn when brought in contact with the body. Some of the principal incendiary agents are thermite, white phosphorus, combustible oil, and combustible metal incendiaries.

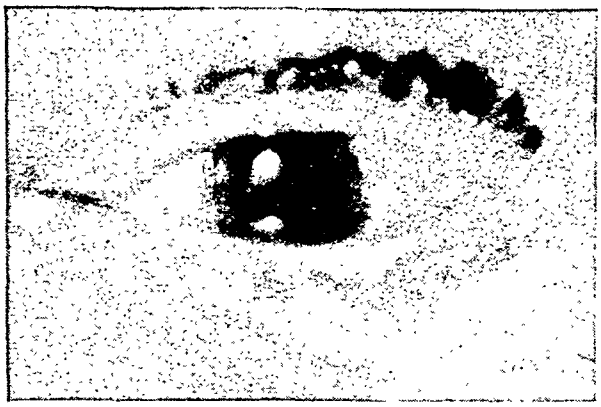


Fig. 3 (Uhde). Photograph of a human eye taken 24 hours after being burned with thermite. The patient was wearing spectacles which were covered with a thick layer of metallic-like matter after the accident. Photograph shows charred cilia and swelling of the lids and conjunctiva. There was bright-green fluorescein staining of the visual axis of the cornea with either a pale-green staining or haziness of the remaining corneal surface.

In February, 1943, a T/4, aged about 27 years, was treated for thermite burns of both eyes, neck, and both hands. He was drilling a hole into an experimental bomb which unexpectedly ignited. Fortunately he was wearing spectacles which were covered with a thick layer of metalliclike material after the accident. Examination showed burns of the face, neck, and hands, charred cilia (fig. 3), hyperemia, and chemosis of the lids and conjunctivas, bright-green fluorescein staining of the visual axis of the right cornea, with either a pale-green staining or haziness of the remaining corneal surface, and superficial punctate staining of the left cornea. After treatment with a mydriatic and sterile liquid petrolatum in a dark room for 24 hours, the corneal surface no longer stained and the epithelium appeared normal (6× loupe).

That the antigas eyeshields give considerable protection against the incendiaries was shown in the discussion on white-phosphorus burns and by the fact that an eyeshield resists the flame of a Bunsen burner for 3½ seconds (fig. 4).

The treatment and prognosis of an incendiary burn is that of any heat burn of the same degree and extent. The eye should be irrigated gently with normal saline, and a mild ointment or oil and a mydriatic should be instilled. The lids should be closed with a pad of dampened gauze immediately over them and then with a dry pad held with adhesive, since the best dressing for the cornea

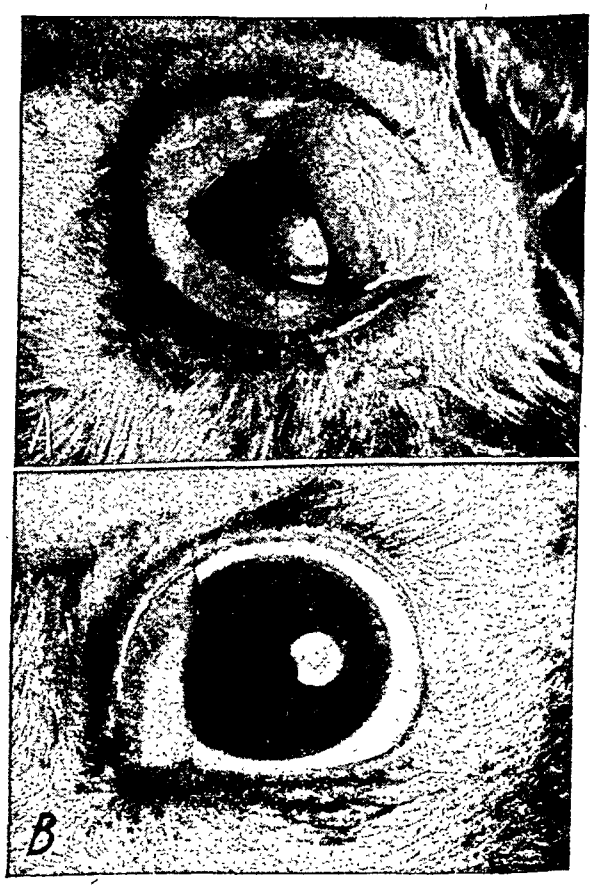


Fig. 4 (Uhde). (A) photograph of a rabbit's eye taken 24 hours after exposure to the flame of a Bunsen burner for 3½ seconds. (B) control eye showing protection given by an antigas eyeshield on exposure to the same flame for 3½ seconds.

is the lid. Cocaine or other local anesthetic should not be used, as anesthesia of the cornea might lead to damage.

Summary

Case reports of eye injuries due to splash burns from chloroacetaphenone, chloroacetophenone solution, bromobenzylcyanide, phosgene, white phosphorus, sulfur-trioxide chlorsulfonic acid, titanium tetrachloride, and thermite are presented. Treatment is discussed.

Nichols General Hospital (2).

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A PROCEDURE TO FACILITATE INTRACAPSULAR FORCEPS EXTRACTION OF INTUMESCENT CATARACTS*

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The procedure consists in puncturing the lens capsule with a fine needle near the equator at the 12-o'clock position. A small amount of pultaceous cortex is thus permitted to escape, after which the capsule, no longer tightly stretched, can be picked up with smooth capsule forceps. While this procedure is not original, it was stumbled on independently by us. It has received scant mention in the literature available to us, and there are no articles concerning it in the American literature. Although our experience with it is limited to seven cases, the uniform success following its use, its simplicity, and its apparent lack of recognition justify, we believe, this brief discussion.

We fell on the procedure by accidentally pricking the lens capsule with de Wecker iris scissors in performing a peripheral iridotomy. To our surprise the wound in the capsule remained localized throughout the extraction, the capsule became relatively flaccid and was picked up easily with Arruga capsule forceps, and the extraction was intracapsular. In our next case of intumescent cataract, a Graefe knife was intentionally used to puncture the capsule; however, the incision enlarged itself and the lens could not be extracted in the capsule. Since then we have used a fine needle to make the puncture, with resulting intracapsular extraction in all of the seven cases so far attempted. Three of these extractions were done through round pupils.

DISCUSSION IN LITERATURE

Lindner[2] was probably the first to use the procedure. In 1942, he recommended the use of a Graefe knife to prick the capsule when the latter is very tense, allowing some cortex to escape so that the capsule may be grasped more easily with the forceps. That this article was not abstracted in English until 1946 is undoubtedly due to the inaccessibility of German publications during the war. Traquair,[7] in 1944, in discussing a paper on cataracts, mentioned that intumescent cataracts can be extracted in the capsule, if the capsule is pricked with a needle before an attempt is made to grasp it. Sedan and Sedan-Bauby,[5] in 1946, reported its use in seven cases, all successful. They, too stumbled on the procedure by accident, in almost the same way as we did. In performing a peripheral iridectomy they accidentally tore the capsule with fine-toothed iris forceps, with the same surprising result. They use the puncture only after they have failed to deliver the lens by the Smith technique.

That intumescent cataract is particularly difficult to extract in the capsule is well known. Elschnig,[1] who was one of the earliest proponents of intracapsular extraction with capsule forceps, stated that the intracapsular extraction is not suitable in intumescent cataract, or is successful in but a small percentage of cases. He was of the opinion that this is the only stage of senile cataract in which the operation should be postponed for at least several weeks until the anterior chamber is almost normal, or at least has become deeper. In the beginning of intumescence the capsule cannot be grasped. When the lens becomes dehydrated in the transition to maturity, it is easily grasped. He also stated that if an iridectomy is performed, the lens may be delivered in the capsule in a small percentage of cases by the Smith or Smith-Pagenstecher technique. Meller[3] in one of the most recent textbooks on surgery is still of the opinion that intracapsular extraction is contraindicated in in-

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tumescent cataract. Our limited experience leads us to believe that this contraindication is not valid if the lens is punctured with a fine needle before being grasped with forceps. Moreover, the punctured lens may be delivered through a round pupil smaller than is otherwise required, by using combined traction and pressure.

The erisophake is considered suitable for intracapsular extraction of intumescent lenses. In this regard Ribeiro,[4] in an exhaustive article on suction extraction of cataracts, points out that for intumescent cataracts one should use a large suction cup and a low degree of suction. A small suction cup applied to a small area requires a greater amount of suction which will undoubtedly break the capsule. He also points out that the larger the suction cup, the more difficult it is to manipulate because it can easily include the edge of the iris and produce an iridodialysis. Spaeth[6] is of the opinion that regardless of the operator who is using the erisophake, there is a greater incidence of vitreous loss with this procedure, than with extraction using forceps. The puncture offers an alternative to the use of erisophake and permits extraction of intumescent lenses with forceps.

Operative technique

The technique is simple. No additional paraphernalia other than a sharp, fine-gauge (No. 25 or No. 26) needle is needed. The puncture is made just before the lens is to be grasped with forceps. The site of puncture is in the anterior capsule near the upper edge. It is made through a peripheral iridotomy, peripheral iridectomy, or through a total iridectomy. Some resistance is offered to the point of the needle by the lens capsule, and the lens is felt to move backward a little just before the needle penetrates the capsule. Once the capsule is punctured, the needle is at once withdrawn, and is followed by a small amount of milky-white fluid. The relaxed capsule is now easily grasped in its lower or upper third and the extraction completed by using traction combined with pressure. No attempt is made to seal off the hole in the capsule by grasping its edges with the lens forceps.

Sedan[5] states that Charles Thomas of Nancy told him in a personal communication that he had used this type of puncture, but had made it with a cystitome in the lower third of the anterior capsule and had then attempted to close off the wound by grasping its edges with the lens forceps. He succeeded in 8 of 12 cases.

We feel that the small wound in the capsule may act as a safety valve during the extraction particularly when it is being done through an intact sphincter with a not well-dilated pupil. In one case of ours this was strikingly illustrated. The capsule was punctured as described above, after an attempt to grasp it with forceps had been unsuccessful. As always, a milky-white fluid escaped from the wound in the capsule. The pupil in this case was round and narrow. Some resistance was felt in loosening the lens from the zonule and in pulling it into the rather small pupil, when suddenly all resistance was felt to disappear. It was thought at this point that the capsule had torn. The capsule was then drawn through the pupil and out of the eye by putting one forceps after another upon it in a hand over hand fashion as described by Verhoeff, and to our surprise, it emerged intact almost empty except for a thin yellow nucleus. This seems to indicate that the capsule and the solid portion of the lens which it surrounds may be extracted through a pupil of a diameter slightly greater than that of the solid portion of the lens, although considerable pultaceous cortex may be lost in the process.

The puncture is not indicated, of course, in lenses with senile sclerotic changes. In one case, we experimentally inserted a needle into a completely sclerosed lens. It felt like hard clay. Upon withdrawl of the needle nothing issued from the wound in the capsule. The capsule was easily grasped with forceps and the extraction was intracapsular. While the procedure has no advantage in a

sclerosed lens, in this particular case it did no harm. A large series of cases may demonstrate that the puncture does not prejudice the successful intracapsular extraction of any lens upon which it is performed.

We have had no complications following this procedure. The small amount of pultaceous cortex which ordinarily escapes from the wound in the capsule is probably pushed out of the eye ahead of the lens. We have not practiced routine irrigation of the anterior chamber after this kind of extraction and have had no iritis or other complications in the seven cases in which we have used it.

Summary and Conclusions

1. Puncture of the capsule of the intumescent lens near the equator at the 12-o'clock position facilitates intracapsular extraction with forceps.

2. No complications result from the use of this procedure.

3. Intracapsular extraction of intumescent cataract through a round pupil is made possible by this procedure.

1117 Medical Arts Building (2).

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NOTES, CASES, INSTRUMENTS

FIBRINOUS EXUDATIVE CYSTS OF THE IRIS

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Dramatic recoveries of iridocyclitis after the administration of penicillin have recently been reported, such as the case by Weizenblatt.[1] Other types of therapy having been simultaneously used, the effectiveness of the penicillin is not easy to evaluate. In the instance to be reported, arsenicals and bismuth used for syphilis had apparently produced an acute hepatitis, although causing both the blood and spinal serologic tests to be negative. The cysts, which subsequently appeared when the constitutional reactions of an acute hepatitis were in a process of subsiding, were inflammatory in character and responded to penicillin therapy.

It was suggested that the cysts arose from the anterior iris crypts at the site of the posterior synechias. Duke-Elder[2] described similar spontaneous cysts of exudative nature which may arise from clefts in the iris.

REPORT OF A CASE

A 24-year-old white man entered the hospital on September 14, 1946, complaining of general malaise, increased fatigability, and discoloration of the skin and sclera, which began four weeks before admission. Later, on October 17, 1946, he developed an iridocyclitis, complicated by the formation of fibrinous exudative cysts of the iris..

History. The previous history was unimportant except for the fact that, four months prior to entrance, in April, 1946, he had a penile chancre followed by a positive serologic test. He received injections of bismuth and an arsenic preparation, each once a week, up to the week before admission to the hospital; this included three weeks after the appearance of a generalized jaundice.

Family history. The family history was irrelevant except that the mother had died from an embolus from varicose veins of the legs. Past history was otherwise irrelevant.

Physical examination. A young white man, deeply jaundiced and not acutely ill, with no temperature, presented himself.

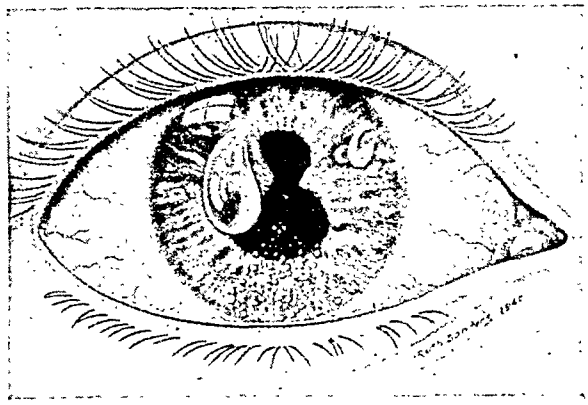


Fig. 1 (Thomas and Burnside). Fibrinous exudative cysts on the iris.

Conjunctiva and sclera are yellow, pupils equal, dilate and react to light and accommodation. Eyegrounds are normal in appearance. All systems were negative except for slight bilateral cervical and inguinal adenopathy. The abdomen was described as soft, no rigidity, but with slight tenderness in the right upper quadrant. The liver was palpated some two to three finger's breadth below the costal margin, although the edge was not distinctly felt. No other organs were palpable.

Treatment. Because it was assumed that the patient had an acute drug hepatitis from arsenic, he was given treatment including methionine, choline, high-carbohydrate, high-protein, and low-fat diet, brewer's yeast, liver extract, and bed rest.

Eye symptoms. Recovery proceeded uneventfully until October 16, 1946, when the patient complained of slight pain and diminution of vision in his right eye. No manifest refractive error was present and the

visual acuity was: O.D., 20/60; O.S., 20/20. Tension to finger palpation was normal.

On October 17, 1946, gross examination revealed a slight edema of the lids with purplish discoloration. The conjunctiva was edematous with the presence of moderate ciliary injection. The cornea was slightly cloudy. The pupil was irregular and fixed, about 3 mm. in diameter. A clear grayish-yellow, tear-drop appearing structure hung from the anterior surface of the iris at the 10-o'clock position over a definite nodule. At the 2-o'clock position, a nodule supporting a very small similar type of cystlike structure was present. After dilation of the pupil, two posterior synechias were noted at the 10- and 2-o'clock positions. Ophthalmoscopic study of the right eye was unsatisfactory due to the cloudy cornea and presence of inflammatory products in the anterior segment.

Biomicroscopic study revealed the cornea to be edematous throughout, with many irregular folds in Descemet's membrane. Numerous keratic precipitates of a dark-brown color covered the lower fourth of the endothelium of the cornea. The aqueous was filled with many cells and clumps of cells seemed to be moving freely. A moderate engorgement of the entire iris gave it a muddy appearance. At the sites of the synechias, the iris vessels were strutted over an iris segment which was definitely elevated.

Two pedunculated cysts appeared to rise from a small anterior iris nodule at the 10-o'clock position. A common stalk was the origin of both. The larger cyst had a thin, transparent, veil like, outer wall and was of grayish color with particles of uveal pigment and inflammatory cells adherent to it. This larger cyst was approximately 4.5-mm. long, 2.5-mm. wide, and its depth allowed its surface to be almost in contact with the cornea. A similar miniature cyst arose from the same nodule and over the larger cyst. Both hung across the base of the firmly fixed posterior synechias. At the 2-o'clock position and medial to the adjacent synechias was a small reddish nodule 1 by 1.5 mm., and overlying this was a small, half-moon shaped, transparent cyst with a wall similar to those previously described.

Therapy. Instillations of atropine and 10-percent neosynephrin failed to release the synechias or to dilate the pupil satisfactorily. This treatment was followed the next day by a subconjunctival injection, but the synechias held firm. Penicillin was started with 5,000 u. every three hours, and this was increased daily until 100,000 u. were given at each intramuscular injection. In 48 hours the cysts were reduced to half the original size. By October 24, 1946, eight days later, they had disappeared along with the synechias, following a repetition of a subconjunctival injection of atropine and adrenalin. Only a small indistinct nodule remained at the sites originally described. By November 1, 1946, no evidence of active pathologic processes of the iris was seen except a slight iris atrophy. A few keratic precipitates remained, but no free cells were noted in the aqueous.

Laboratory findings. Blood Wassermann and precipitation tests were negative. Spinal serology was negative and a colloidal gold test was 0000000000. Cell count showed three polymorphs per cm. First urine specimen: dark brown color; turbid; reaction acid; specific gravity, 1.011; albumin trace; sugar negative. W.B.C., rare; R.B.C., 2-3 (high-powered field), many granular casts, bile strongly positive, urobilinogen positive.

Feces: bile acids were negative. On September 28, 1946, cephalin cholesterol showed a flocculation of two plus. The icterus index fell from 135.6 on admission to 13.7 when dismissed on November 6, 1946. X-ray studies of the abdomen and chest were negative.

Comment

An unusual inflammatory cyst of the anterior chamber, associated with an iridocyclitis and causing little pain, was suspected of being luetic in origin because of the dramatic response to penicillin given systemically.

It was believed that the jaundiced state of the patient was due to liver damage produced by the administration of arsenicals, since cessation of the hepatitis began with the stopping of the arsenic therapy. Therefore, the iridocyclitis was probably due to a luetic infection, although the serologic tests on admission were negative. The large doses of penicillin supplied sufficient concentration to the site of the inflammation of the anterior chamber; and, even though large amounts of inflammatory exudate were present, an unusually rapid response occurred. This also suggests that, when anterior-segment inflammatory processes are sensitive to penicillin therapy, they have an excellent prognosis when the drug is given parenterally.

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CLINIC FOR BINOCULAR PROBLEMS*

THREE EMMETROPIC PATIENTS TREATED WITH ANISEIKONIC GLASSES OVER 8- TO 10-YEAR PERIODS

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Aniseikonia usually arises when anisometropia or unequal astigmatism is corrected with ophthalmic lenses. The fact that it is measured occasionally in emmetropic patients with ocular symptoms which are otherwise inexplicable is of great theoretical interest. As suggested by Hughes,[1] the seat of the anomaly in these patients may be in the comparative density of retinal sensory elements in the two eyes, or in the neurologic processes in the ocular cortex. The following cases are cited as examples.

CASE REPORTS

CASE 1

S. B. W., a white woman, was first seen at the age of 15 years, on August 31, 1938. Her complaint was fatigue of the eyes after reading, movies, or riding in a car. After an hour's study, there was headache in the frontal region which could be relieved by resting her eyes one-half hour. The onset of this complaint was in 1935 following treatment for sinusitis. She had worn these glasses for 18 months without relief: R.E., −0.12D. cyl. ax. 180°, 20/15; L.E., −0.25D. cyl. ax. 5°, 20/15.

External examination and ophthalmoscopy were found to be normal. The subjective noncycloplegic refraction was: R.E., −0.25D. cyl. ax. 150°; L.E., −0.25D. cyl. ax. 40°. Diplopia tests for phoria were negative both distant and near.

Fusional amplitudes were: Distant: Divergence, 9/7$^{\Delta}$ (break and recover). Convergence, 10/8$^{\Delta}$. Vertical, ±2/1$^{\Delta}$ (+ is B.D. right). Near: Divergence, 21/16$^{\Delta}$. Convergence, 40/18$^{\Delta}$. Vertical, ±3/2$^{\Delta}$.

Tests for aniseikonia on the ophthalmoëikonometer without the refractive correction showed the need for magnifying the image of the right eye by 1.0% overall.

After wearing the prescription: R.E., 0.00D. sph. with 1.0% overall; L.E., 0.00D. sph., for seven weeks, she reported relief of her fatigue and headache.

In October, 1941, she returned stating that the glasses had done very well for two years, but since she had entered a secretarial school, she had begun to get headaches over the right eye after reading or when watching a movie.

Second examination. External and ophthalmoscopic examinations were normal. Visual acuity without glasses was 20/15 O.U. Keratometer readings showed: R.E.,

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* From the Dartmouth Eye Institute, Hanover, New Hampshire.

42.37/10, 42.62/100, with a −0.25D. cyl. ax. 10°; L.E., 42.62/35, 43.37/135, with a −0.75D. cyl. ax. 35°. Subjective noncycloplegic refraction was: R.E., −0.25D. cyl. ax. 90°; L.E., −0.25D. sph. ⌒ 0.25D. cyl. ax. 35°.

Diplopia tests showed orthophoria for both distant and near vision. The fusional amplitudes had increased in three years to: Distant: Divergence, 12/10Δ. Convergence, 16/12Δ. Vertical, ±4/3Δ. Near. Divergence, 18/16Δ. Convergence, 24/20Δ. Vertical, ± 6/4Δ.

Tests for aniseikonia on the ophthalmo-eikonometer without refractive lenses showed: 0.25% overall combined with 0.25% ax. 90°. Tests on the space eikonometer[2] showed: ax. 90°: R.E., 1.0% ax. 180°: L.E., 0.75%; delta: −0.3° (which measurements correspond to an aniseikonic correction of R.E., 1.75% meridional, ax. 130°).[3] The patient was given the prescription: R.E., 0.00D. sph. with 1.5% ax. 135°; L.E., 0.00D. sph. which she reported in a letter of June 14, 1943, again relieved her complaints. On November 20, 1943, she returned to the clinic at the insistence of her father who thought she had been using her eyes too much. Her refractive and aniseikonic conditions were found to remain the same.

CASE 2

L. M. S., a white man, aged 33 years, was a gymnasium instructor. He was first seen in December, 1936. His chief complaint was headache in the frontal and occipital region of 12 years' duration. The headaches were almost continuous, although he had a few days relief at intervals. The headache had no apparent relation to physical fatigue or any activity. There was no train or car sickness. He would sometimes wake up with the headache, feeling physically exhausted. The headaches often interfered with rest at night. He did much reading in spite of his headache. He had tried wearing glasses (presumably plus for near) and also tinted lenses without relief. After one-half hour's reading, his eyes would tire and pull. Objects stared at seemed to fade in and out. There was photophobia, burning and lacrimation, blinking and blepharospasm when he tried to concentrate on a moving object.

History. Since the age of 11 years, he had had "sick headaches" with nausea and partial temporary field changes. These came once or twice a year, but had not occurred for the past three years. In 1930, the patient was treated for acute conjunctivitis with "the wrong prescription." He stated that due to this treatment, he had to keep the eyes bandaged for two weeks, and wear dark glasses for several weeks following.

The family history was negative except that his mother had had "sick headaches" all her life.

Examination. External and ophthalmoscopic examinations were normal. Keratometer readings were: R.E., −0.37D. cyl. ax. 160°; L.E., −0.12D. cyl. ax. 180°. Subjective noncycloplegic refraction showed: R.E., +0.25D. cyl. ax. 60°, 20/15; L.E., +0.25D. cyl. ax. 175°, 20/15. By the diplopia test, there was 1Δ esophoria for distant vision, and 5Δ exophoria for near. He was given a prescription for +0.75D. sph., O.U., which he wore for a week. He reported no relief whatever.

When tested on the ophthalmo-eikonometer, he was found to have slight left meridional aniseikonia:

R.E., +0.50D. sph., L.E., +0.50D. sph., with 1.0% magnification axis 180°. After wearing this prescription for a month, he reported that the eyes were more relaxed, and there was less blinking and smarting of the eyes.

Second examination. On reëxamination on April 27, 1937, he was found to be emmetropic, and tests on the ophthalmo-eikonometer without refractive lenses showed: R.E., 0.75% ax. 90°; L.E., 1.0% ax. 180°. He was given this prescription in fitover lenses over planos. These proved to be superior to his previous glasses, so he was given the prescription in permanent form.

On December 6, 1937, he appeared at a clinic seminar conducted by the late Dr. Bielschowsky. The patient reported that he was no longer aware of headaches at all. He had often checked himself to be sure the headaches were real, by temporarily removing the glasses. He had occasionally tried to read a few minutes without the glasses, but invariably suffered a headache. He was no longer annoyed by photophobia, burning of the eyes, or strain on watching moving objects. The reading required in his work no longer gave him such discomfort.

In commenting on the case, Dr. Bielschowsky said, "It is hard to understand how an anomaly can cause trouble some times, and can then disappear, and come back." (He meant prior to wearing the glasses.) "I think one has to assume that where nothing can be found but aniseikonia, one has to wonder if other factors have to be considered, such as physical fatigue, excitement, or worry, because if the aniseikonia would be the only anomaly we would not understand how there could be any free intervals at all."

Third examination. On February 1, 1946, the patient was again examined. He had been wearing the plano-aniseikonic glasses for nine years. His vision had remained good, but he was complaining of difficulty with reading. (Aged 42 years, this visit.) He complained that his migrainelike headaches had returned. There were premonitory flashing lights. In eight days, he had had five severe headaches. He was working long hours in spite of frequent colds and fatigue.

External and ophthalmoscopic examinations were normal. The keratometer reading was: R.E., 44.75, 45.50, with a −0.75D. cyl. ax. 180°. L.E., 44.75, 45.25, with a −0.50D. cyl. ax. 180°. The subjective refraction was: R.E., −0.50D. sph., 20/20+; L.E., −0.25D. sph., 20/20+. The dynamic crossed-cylinder test indicated that an add for near was required: +1.00D. sph., O.U. at 16 inches.

Diplopia tests showed orthophoria for distant vision, and 5$^{\Delta}$ exophoria for near. The ophthalmo-eikonometer with the above refractive prescription measured: R.E., 1.5% ax. 90°.

He was given a pair of glasses: R.E., −0.50D. sph. with 1.25% ax. 90° (in fitovers); L.E., −0.25D. sph., and an additional pair of fitovers for reading, consisting of +1.00D. sph., O.U.

On June 13, 1946, he reported that the glasses were quite satisfactory. There had been a few headaches since he received them, but they were not severe. Therefore, the above prescription was made up in permanent bifocal form.

CASE 3

G. K., a white man, was first seen at the age of 16 years, in December, 1936. His chief complaint was slow reading. He admitted some fatigue after prolonged reading, but seldom had headache or eye strain. He had been examined by an ophthalmologist three years previously, and had been given convergence exercises.

History. His past history was normal. He had a sister with squint, and a brother with myopia and color blindness. A complete physical examination of the patient was found negative. External and ophthalmoscopic examinations of the eyes were normal.

Keratometer readings were: R.E., 42.00, 42.25, with a −0.25D. cyl. ax. 180°; L.E., 42.12, 42.37, with a −0.25D. cyl. ax. 180°. The subjective noncycloplegic refraction was: R.E., +0.50D. sph. ⊂ +0.25D. cyl. ax. 180°, 20/15; L.E., +0.50D. sph. ⊂ +0.25D. cyl. ax. 180°, 20/15.

There was esophoria of 2$^{\Delta}$ for distant vision, and an exophoria of 2$^{\Delta}$ for near. Dominance was left eye, right hand. Tests on the ophthalmo-eikonometer without refractive correction showed: R.E., 1.75% ax. 90°; L.E., 0.75% ax. 180°. Next day the test was repeated and R.E., 1.75% ax. 90° was found, so he was given this prescription in a fitover over plano lenses.

After a month, he reported improvement in his reading, and less fatigue. He was

tested five times on the ophthalmograph, which is an instrument that photographs eye movements while reading unfamiliar material. This test is considered unreliable when used in this way, but it did seem to indicate improved reading while wearing the aniseikonic glasses.

Second examination. He was reëxamined in December, 1937. On tests with the ophthalmo-eikonometer identical readings were found. He stated that his glasses had helped him in his school work. His school registrar reported February 24, 1937: "G. K. is doing a good job. He tells me that he feels that his glasses are helping him appreciably. You will be interested to know that he says his reading speed has increased about 50 percent already. Although he is undemonstrative and rarely shows enthusiasm, he is greatly encouraged by this development."

On September 15, 1943, a letter was received from G. K. from an Army camp. He requested another pair of his plano-aniseikonic glasses. In January, 1946, he again wrote, stating that his glasses had worn out, and that he wished to get another pair of the same prescription.

SUMMARY

Three cases of aniseikonia in emmetropia are reported, showing relief of symptoms from 8 to 10 years each. Of these cases, one was studied by the late Dr. A. Bielschowsky.

640 South Kingshighway (10).

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USE OF THE GONIOLENS FOR DIAGNOSIS OF RETAINED FOREIGN BODY IN THE ANTERIOR CHAMBER

MERRILL J. REEH, M.D.
Portland, Oregon

It has been said that a great number of errors encountered in the practice of medicine are the result of omission rather than commission on the part of the physician. Frequently, because of shortage of time or mental inertia, one fails to use all of the facilities readily available in an effort to learn more about an eye. The following case is not in itself unusual and has undoubtedly been encountered by numerous ophthalmologists before, yet it serves admirably to emphasize the need for more frequent use of gonioscopy.

CASE REPORT

Mr. X., a young man, came to my attention on July 28, 1947, because of a red, moderately painful, irritable right eye. He stated that a foreign body had entered the eye about 14 years before while he was working on a farm repairing machinery. At that time he struck the wheel of a tractor with a dirty hammer and at the same moment felt something strike his right eye. Several days later an X-ray film was taken and revealed a foreign body in the globe. A cataract had also developed in the interim. An unsuccessful attempt was made to remove the foreign body with a magnet. The patient was told that the foreign body was nonmagnetic and was located behind the opaque lens in the vitreous chamber. The eye became quiet in due time. On a subsequent occasion, X-ray films of his eye

were taken in another city and he was again told that there was a foreign body in the globe. Gonioscopy was not employed at any time.

Examination now revealed a normal left eye with 20/15 vision. The right eye showed a 10-degree divergence. It was moderately injected, principally in the pericorneal region, more pronounced in the lower half of the globe. The pupil was about 3 mm. in diameter and reacted sluggishly to light. The lens was cataractous and about half absorbed. The slitlamp revealed epithelial edema (bedewing) in the lower third of the cornea. A small corneal scar was also visible. There was a slight flare with a few cells but no keratic precipitates. The tension was: R.E., 6 mm. Hg (Schiøtz); L.E., 17 mm. An X-ray film demonstrated a faint opacity in the region occupied by the anterior segment. With a large-size Troncoso goniolens* in position, the angle was studied by means of a loupe and a small flashlight. A small, black, oblong foreign body was found lying in the angle at the 6-o'clock position in such a manner that the opaque sclera prevented its direct visualization.

After the acute inflammation was brought under control, the foreign body and the remainder of the opaque lens were removed. A subsequent X-ray study showed that the faint opacity previously noted in the anterior-segment area had disappeared. The foreign body was found to be a small piece of organic material, either wood or weed stem. The eye healed uneventfully and the inflammation promptly subsided. Eight weeks after the removal of the foreign body the vision was correctible to 20/25.

Discussion

This foreign body, which was entirely invisible, was easily and accurately located with the aid of gonioscopy. If it had been permitted to remain, the eye might ultimately have been lost. Sympathetic ophthalmitis, while extremely rare, was always a threat as long as the eye remained irritable because of a retained foreign body.

4212 N.E. Broadway (13).

* Troncoso, M. U.: A new model of contact glass for gonioscopy (goniolens). Am. J. Ophth., 28:1360 (Dec.) 1945.

CONGENITAL RETINAL FOLD WITH VITREOUS DISORGANIZATION*

A case report

I. J. Eisenberg,† M.D.
Philadelphia, Pennsylvania

In 1928, the first case of congenital retinal fold was reported by Ida Mann in the *Transactions of the Ophthalmological Society of the United Kingdom.* In 1936, six more cases were reported by her. In the same year, Weve reported eight cases of the same condition, which he called "Ablatio Falciformis Congenitalis." Other cases were reported by Ancona (1935), Kiewe (1936), Tillema (1937), Theodore and Ziporkes (1940), Van Manen (1941), and Gartner (1941).

This congenital defect is characterized by the presence of folds involving the inner layers of the optic cup (the retina without the pigment epithelium) which projects into the vitreous. From the cases reported, the general opththalmoscopic picture can be summarized by (1) the solid appearance of the fold, (2) branches of the retinal artery on the fold, (3) septumlike connections with the retina, (4) attachment anteriorly to the ora serrata, (5) strands passing to the lens near the equator, (6) clear vitreous and lens.

Case report

The case presented is that of a young girl, T. M., aged eight years, with a history of poor vision in the left eye discovered during a routine examination five months before be-

* Read at the meeting of the Eye Section, Philadelphia County Medical Society, April 2, 1947.

† Clinical Assistant, Wills Hospital, Clinic of Dr. Louis Lehrfeld.

ing seen by us in the clinic. Close questioning of a rather intelligent mother did not reveal any history of injury or inflammation involving her daughter's eyes.

History. The family medical history showed that the father had had a detached retina (spontaneous) with secondary glaucoma about 10 years ago, resulting in enucleation. Three other children in the family were all apparently normal. The child's past medical history told that she had had whooping cough at the age of three years, measles at four.

Examination. The adnexa were normal. E.O.M. appear to be normal. There was no evidence of nystagmus nor strabismus. The pupils were equal and reacted to light and accommodation. Vision was: O.D., 20/20; O.S., light perception (questionable).

The fundus examination showed the media of the right eye to be clear; the disc well defined and normal in color; the vessels normal. The lens of the left eye appeared to be clear; the vitreous was hazy with many fine dustlike opacities; the retina could not be visualized at this time. With a +12 lens, a large white area was seen between the 7- and 9-o'clock positions. At this time the large gray-white mass appeared to be extending anteriorly to the posterior part of the lens and near the ora serrata and posteriorly into the vitreous.

Under slitlamp examination, the cornea appeared to be normal; the anterior chamber was normal; X-ray studies of the orbit appeared normal, except for a small opacity near the posterior cortex at the center. The anterior vitreous showed fine opacities made up in the form of a reticulum. Strands were present which appeared to run from the mass horizontally and temporally near the posterior surface of the lens.

The mass transilluminated poorly; tension was normal; X-ray studies of the orbit showed no evidence of calcification.

Laboratory studies. The blood count was in normal range; Wassermann test was negative.

Course. Although no medication was prescribed, the patient was observed at frequent intervals. Within a period of about two months, although opacities were still present, the vitreous appeared to clear sufficiently so that a view of the retina was possible. An examination of the fundus with a +12 lens showed a large gray-white area between the 7- and 9-o'clock positions. The mass appeared to extend into the vitreous from the disc area and, anteriorly, to the posterior part of the lens and ora serrata. The area tapered off and appeared to fold into the retina. The temporal side of this mass presented a sharply demarcated surface seeming to fold under itself. Small minute blood vessels appear on its surface. Just posterior to the lens, strands could also be seen running horizontally from this mass, temporally. Inferiorly, when the eye was well dilated, a small grayish white mass could be seen near the ora serrata, which had, apparently, no connections with the larger mass.

Diagnosis. The differential diagnoses considered in this case were: A. Inflammatory causes—(1) cyclitic membrane, (2) retinitis proliferans, and (3) detached retina. B. Neoplastic causes—(1) retinoblastomata and (2) melanoma of the choroid. C. Congenital defects—(1) persistent tunica vasculosa lentis, (2) fibroblastic remains with Cloquet's canal, and (3) retinal fold.

The history, the ophthalmoscopic appearance, the clinical course, and the associated findings ruled out all the above etiologic factors except retinal fold.

Thus the solid appearance of the mass with the underfolding of the temporal surface, the extension from the disc to the ora serrata, strands passing near the lens, the exclusion of the other etiologic factors, and the lack of any specific history indicated that this was a congenital retinal fold. The partial disorganization of the vitreous may either be secondary or it may be entirely unrelated to this defect.

1713 Pine Street (3).

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

March 3, 1947

DR. BENJAMIN FRIEDMAN, *president*

OFFICE PROCEDURES IN BACTERIOLOGY

DR. FREDERICK H. THEODORE spoke on this subject during the instruction period.

BETA IRRADIATION IN OPHTHALMOLOGY

DR. CHARLES E. ILIFF spoke of the various uses of beta irradiation in ophthalmology and illustrated his talk with slides and motion pictures. He said that beta rays possess the same qualities as other rays in the power of selective tissue destruction, but in contrast to gamma rays their penetration is shallow. In no single case has any damage to the lens been observed either clinically or experimentally.

Dr. Iliff said that excellent results have been obtained in the treatment of vernal conjunctivitis. Recurrences are less frequent, and when these do occur, are less severe. In anterior ocular tuberculosis, beta therapy seems to shorten the course and decrease the severity of the symptoms with less residual scarring of the cornea. Irradiation, though, did not prevent future tuberculous recurrences. Dr. Iliff said that small benign tumors of the lid and anterior segment can be easily and safely removed with excellent cosmetic results. In corneal scars, where vascularization is a prominent feature and where there is still activity, irradiation appears beneficial. In old calcified and dense scars, treatment is not successful. Superficial vascularization after keratectomies and keratoplasties can be controlled with beta therapy. Encouraging results were also obtained in the treatment of acne rosacea keratitis. Dystrophies, sarcoid, lupus erythematosus, pemphigus, punctate keratitis, and corneal ulcers due to pyogenic infections, are not improved by beta rays, and may be made worse by their use.

UVEITIS WITH HYPOPYON AND RECURRENT GENITO-ORAL OPHTHOSIS (BEHCET'S SYNDROME)

DR. HELEN O. CURTH presented the case of a 27-year-old man, with left postoperative anophthalmos and almost complete loss of vision of the right eye. These findings are the end results of recurrent attacks of uveitis. Two years after the onset of the disease, the patient showed hypopyon. The patient also suffered from recurrent genital ulcerations and recurrent oral aphthae. This syndrome has been described by Behcet. Various kinds of local and systemic treatment proved futile. Dr. Curth said that patients with only two manifestations of the triad are considered abortive cases of the disease. A girl with recurrent genital and oral aphthae was also shown. These two patients did not show erythema nodosum, which is frequently seen in patients with Behcet's syndrome.

Dr. Curth, in discussing the differential diagnosis, mentioned other systemic diseases with manifestations in the eyes and on the skin and mucous membranes, such as Reiter's and Stevens-Johnson disease. Dr. Curth concluded that close collaboration of ophthalmologists and dermatologists may prove of great value in the investigation of these diseases.

Discussion. Dr. Charles A. Perera, described the left eye of the first patient. An iridectomy was performed in July, a cyclodiathermy in September, and enucleation in October. Microscopic studies of the globe showed a surgical coloboma of the iris

superiorly and necrosis of the inferior ciliary body resulting from the cyclodiathermy. The underlying pathologic processes included polymorphonuclear exudate in the lower anterior chamber, plasma-cell and lymphocytic foci in the iris and remaining uveal tract, posterior synechia, complicated cataract, complete detachment of the retina following contracture, subretinal hemorrhage, perivascular infiltration of the optic nerve, and phagocytic cells containing blood pigment on the inner surface of the retina and in the optic-nerve head. This eyeball, then, was the seat of a chronic recurrent uveitis and intraocular hemorrhages, followed by the development of a cataract and secondary glaucoma. Dr. Perera said that there was no clue to the etiology, which is believed to be a virus infection by some authors and an allergic reaction by others.

Sarcoid simulating Mikulicz's disease and Parinaud's syndrome

Dr. Isadore Givner presented two cases of sarcoid, one simulating Mikulicz's syndrome and the other simulating Parinaud's oculoglandular syndrome. The first case was that of a colored woman, aged 35 years, with generalized skin nodules a diffuse swelling of the parotid glands, and an enlargement of both lacrimal glands. Tuberculin tests up to 1:100 mg. O.T. were negative. Typical findings of sarcoid appeared in the lung and phalanges. Biopsy of a nodule showed masses of epithelioid and giant cells. No caseation and very little round-cell infiltration were present.

The second case was that of a 15-year-old white boy, who presented a round granulomatous growth on the under surface of the left upper lid of a week's duration. The left preauricular gland was enlarged. Mantoux test, 1:100,000, was positive. Biopsy of the granulation tissue disclosed naked tubercules, typical of sarcoid.

Dr. Givner emphasized the importance of biopsy in suspected cases. He felt that the findings of a positive tuberculin test are in keeping with the trend of considering sarcoid a special type of tuberculosis.

Discussion. Dr. Raymond E. Meek said that anyone who makes a diagnosis of Boeck's sarcoid is to be congratulated. It means keeping in mind this condition and also means careful observation and investigation to establish the diagnosis. Dr. Meek said that Dr. Givner deserves much credit for discovering these two cases and presenting them.

Recognition of sarcoid has a practical aspect in the treatment of uveitis. Many ophthalmologists feel that remote foci of infection are the most important causes of endogenous uveitis, while syphilis, tuberculosis, and other systemic diseases are recognized as causes, but are less important. The usual recognized causes of granulomatous uveitis are syphilis, tuberculosis, brucellosis, sarcoid, lymphogranuloma venereum, and certain fungus infections, according to Alan C. Woods, in his lecture on "The Influence of Hypersensitivity on Endogenous Uveal Disease." (Am. J. Ophth., 30:257-274 (Mar.) 1947.)

Dr. Meek said that he felt that the problem of sarcoid may be of great importance in the treatment of uveitis. Once the problem of the etiology of sarcoid is solved, a new clue may be found for the prevention and treatment of this obstinate affection of the eyes. Woods said, "Nothing can be said of sarcoid, for the specific agent, whatever it may be, has never been isolated and the etiology of the disease is a complete mystery." Dr. Meek concluded by saying that we must continue our efforts in finding the cause of this disease.

Silent dacryocystitis

Dr. Frederick H. Theodore said that routine irrigation of the lacrimal passages in such a manner as to be able to examine the washings will frequently reveal the presence of an otherwise "silent" dacryo-

cystitis. This occurs in some cases with patent lacrimal passages and the complaint of persistent unilateral conjunctivitis. The examination of the washings is accomplished by having the patient sit with his head forward, so that the irrigating fluid comes out through the nose and is caught in the receptacle. The following observations are made: (1) the degree of patency, and (2) the character of the washings—whether shreds, pus, or mucus are present. Cultures and smears may be taken of this washing.

Dr. Theodore mentioned a number of cases of severe unilateral conjunctivitis which had persisted for months. The tear sac in each case had been declared normal because the irrigation had been done with the patient's head backward. By this method, the character of the washings cannot be observed. Treatment by frequent irrigation of the sac was followed by cure. Cultures of both the conjunctivitis and the mucus, revealed the same toxic organisms.

Dr. Theodore concluded that these observations suggest the existence of a subclinical, beginning mucous dacryocystitis, which may go on to frank dacryocystitis if untreated; therefore, the early diagnosis of this condition is of great value.

Bernard Kronenberg,
Secretary.

COLORADO OPHTHALMOLOGICAL SOCIETY

March 15, 1947

Dr. George Stine, *presiding*

Central choroiditis

Dr. Fritz Nelson presented a 26-year-old woman who suddenly, a few weeks previously, noticed a spot before her right eye after some domestic excitement. Central vision was measured at 5/100, and refraction revealed a −1.00D. of myopia. Funduscopy presented an area of edema around the macula extending to the disc. There was a crescentric, bright area above the fovea which might have represented either a folding of the retina or a subretinal hemorrhage. Under routine symptomatic treatment, vision improved to 5/15, although the fundus appearance remained the same. A Kahn test was normal, as were the blood count and a complete physical examination. No satisfactory diagnosis had been made.

Discussion. Dr. James Strong said that, although the history was of such short duration, it is most likely that the condition had existed a much longer time and had merely been brought to attention by the excitement. Dr. Leonard Swigert said he had noticed what he felt was pigment formation in the area, so that he deemed it to be a central choroiditis of not too recent origin. Dr. Nelson, in closing, said that the fact that the patient had suddenly noticed a scotoma seemed to indicate the condition to be acute since she would have noticed this before had it been present.

Microphthalmos

Dr. John C. Long presented a 2½-year-old girl with congenital, bilateral microphthalmos. Her prenatal, postnatal, and general history were entirely normal. No other member of the family had ever presented any ocular disease. Examination revealed severe microphthalmos with almost total opacification of both corneas. Vision consisted of light perception in the right eye only. The corneas measured 4.5 mm. in the right eye, and 3.5 mm. in the left. Ocular movement seemed normal and the child seemed physically and mentally normal in all other respects. The mother was of the opinion that both eyes had become larger during the past year.

Plastic and reconstructive surgery of the eyelids

Dr. George A. Filmer presented a com-

prehensive paper on this subject generously illustrated with kodachrome slides of patients in the Eye Department of the U. S. Army Beaumont General Hospital which served as a reconstructive eye center. The most frequent repair job called for was the repair of skin cicatrices. These could often be done by the simple "Z" plasty along the line of the scar. When this failed, a full-thickness skin graft was employed. These grafts were taken from the other eyelid, the retroauricular fold (which source proved exceedingly satisfactory) or the supraclavicular region. A proper pressure dressing must always be applied to these.

In revision of the lower lid at the inner canthus, a pedicle of "Z" flap around the canthus was most used. This often extended from the side of the nose well down over the upper portion of the cheek. If this failed or was not feasible, a skin graft was employed. At the outer canthus, the "Z" flap was also employed whenever possible. An external canthal tarsorrhaphy or the Kuhnt-Szymanowsky repair techniques were used. If too much damage had been done, a fascialata transplant was used as a sling around the whole lower lid.

Revisions of upper lids were accomplished by the routine methods of notch repair, by "Z" flaps, or by skin grafts. Eyebrow grafts were taken from the temple or the retroauricular fold. Eyelash grafts were best taken by vertical sections through the eyebrow. For controlling the slant and appearance of these lashes, the ordinary cosmetic eyelash curlers were recommended. For reconstruction of either lid, the regular Hughes reconstruction technique was employed. If this failed, then sliding flaps, pedicle flaps, and whole-thickness skin grafts were used.

Morris Kaplan,
Secretary.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

March 19, 1947

DR. HOWARD F. HILL, *presiding*

OCULAR PROPTOSIS

This subject was discussed by DR. DERRICK VAIL of Chicago in the paper of the evening. The classification of the types of proptosis, correlated with the etiology, signs, and symptoms, and the profuse number of illustrative slides made a very instructive and interesting paper.

Dr. Vail classified ocular proptosis into two main subdivisions: (1) apparent proptosis, and (2) true proptosis. In apparent proptosis, the protrusion of the lids without edema may be a result of fat, familial feature, or asymmetry of face; while protrusion of the lids with edema may be due to ocular causes such as iritis and glaucoma, or due to an inflamed lid caused by chalazion, hordeolum, abscess, lacrimal abscess, frontal sinusitis, periadenitis, trauma, insect stings, trichinosis, and so forth.

In true proptosis, the protrusion may be rapid with edema of the lids, as seen in glaucoma, iridocyclitis, panophthalmitis, cellulitis of the orbit, serous or purulent tenonitis, caverous sinus thrombosis, hemorrhages due to trauma or spontaneous hemorrhage associated with scurvy, anemia, rickets, hemophilia, and so forth. Gradual proptosis without edema may be congenital due to malformation of orbit, an encephalocele, and so forth; it may be due to ocular enlargements as seen in high myopia, buphthalmos, melanoma of choroid perforating posteriorly; or it may be associated with third-nerve paralysis with loss of muscle tone, or after a tenotomy. Unilateral proptosis with lateral displacement may be due to a mucocele or neoplasm from the sinus, exostosis of the orbit wall, meningioma, periostitis of orbital wall, complication of nasal surgery, em-

physema of the orbit, and so forth. Unilateral proptosis with central displacement may be observed in Graves's disease, in paradoxial exophthalmos, in vascular conditions such as arteriovenous aneurysm, varicose orbital veins, cirsoid aneurysm of orbit, or nevi, in association with tumors of the optic nerve. Unilateral proptosis with central displacement is also due to cysts of the orbit, either congenital such as encephalocele, congenital coloboma of choroid and dermoid, or acquired cysts such as the exudative type, traumatic epithelial inclusion, or parasitic. It is observed also with neoplasms either of benign type, such as plexiform neuroma, or of malignant type, primary or secondary.

Binocular exophthalmos may be due to familial congenital malformation, tower skull, Graves's disease, paradoxial or ophthalmoplegic exophthalmos, sarcoma of ethmoid, bilateral sinusitis, neurofibromas, myasthenia gravis, cavernous sinus thrombosis, Mikulicz disease, cranio-orbitofacial malformations such as hereditary craniofacial dysostosis (Crouzon's disease), multiple xanthomatosis (Schuller-Christian disease), and so forth.

Discussion. In the discussion that followed, Dr. Frederick Verhoeff spoke of the difficulties in making a diagnosis in cases of proptosis. He described a case of meningioma in a girl, aged five years, which went around the optic nerve but did not invade the papilla. He said that at the time there was considerable discussion as to whether the lesion was primary in the orbit or not. He felt that if it does occur, it must be very uncommon and that it was wise, in individual cases, to believe that it was not primary. He also mentioned that he has noted errors in making a diagnosis of neurofibroma of the optic nerve when glioma is present and has heard of some cases of glioma associated with neurofibromatosis elsewhere.

Dr. Edwin B. Dunphy added another type of proptosis to those mentioned by Dr. Vail, namely intermittent exophthalmos, usually occurring in an adult when he holds his breath, bends over, or during some athletic event. One eye will come forward as much as 5 to 8 mm. and then recede into the orbit. He had seen several cases, one supposedly due to varices in the orbit which filled up. He tried injecting urethane solution without success in this case.

Dr. H. Frederick Stephens asked about the effect of the meningiomas on the optic foramen and their surgical approach.

Dr. Vail (in closing) said that diagnosis will tax one's ingenuity to the utmost, requiring a most careful history, X-ray examination, including the optic foramina and sinuses as well as the orbit, and examination of the appearance of the orbit, including listening with the stethoscope. He agreed with Dr. Verhoeff that probably gliomas of the optic nerve have been mistakenly called neurofibromas. He mentioned a case of a 10-year-old child who had right ocular proptosis with slight limitation of movement with the characteristic pigment changes of neurofibromatosis in the skin. The child's grandmother had the same skin changes plus typical neurofibromatosis nodules on the entire body. He also has seen the intermittent exophthalmos described by Dr. Dunphy, and said that he believed most hemangiomas of the orbit also show the same type of exophthalmos eventually. He described a case with this type of hemangioma in which the exophthalmos with recurrent subconjunctival and subcutaneous hemorrhages disappeared entirely after insertion of radon into the orbit. In regard to the effect of a meningioma on the optic foramen, he said that he believed that study of the literature, as well as experience, would bear out the impression that one does not get an enlarged optic foramen in the presence of proptosis suggestive of an intraorbital tumor without having intracranial involvement. Therefore he agreed with Dr. Dandy that the real approach is always through the intracranial route and never through the orbital route. Serious

complications may occur using the orbital route, and the frontal approach is hazardous for some time after the orbital approach has been used unsuccessfully.

Mahlon T. Easton,
Reporter.

SOCIEDAD OFTALMOLOGICA DE MADRID

March 21, 1947

The Millard-Gubler syndrome

Dr. Casero presented this subject with reference to a patient who showed the syndrome in an anomalous manner.

Discussion. Dr. Marin Amat said that the symptoms presented in Dr. Casero's case—right hemiplegia, with paralysis of the left external rectus muscle and paresis of the right inferior facial—do not fall within the classical mold of the Millard-Gubler syndrome (alternate inferior paralysis) in that the hemiplegia is on one side and the paralysis of the external rectus (sixth cranial) and of the facial (seventh cranial) on the opposite side, with a lesion in the protuberance of the pyramidal tract before decussation (central neurone) and of the roots of the sixth and seventh cranial nerves beyond their origin in their respective nuclei (peripheral neurones).

In his opinion, this clinical incongruity might be explained by a poor interpretation of the neurologic examination and failure to differentiate between the deviation of the mouth to the right and a right facial paresis (antagonistic symptoms), or perhaps, failure to locate a lesion in the cerebral peduncle and in the protuberance.

The most acceptable explanation is that this is a case of one of those rare crossed (alternate) paralyses limited to the sphere of innervation of the cranial nerves.

Dr. Carreras said that it is evident that the case presented by Dr. Casero is one of a protuberance syndrome, but that it is not a pure example of the syndrome of Millard-Gubler. The lesion is, naturally, in part in the inferior protuberance, since only this localization can explain the simultaneous involvement of the fibers of the pyramidal fasciculus and the root fibers of the sixth pair of the same side. However, in order to explain the syndrome shown by the patient one must surmise that the same lesion extends sufficiently upward to involve the aberrant fibers of the pyramidal bundle which go to the facial nucleus of the opposite side. Thus can be explained the fact that the facial paresis is contralateral instead of ipsolateral, as in the typical Millard-Gubler syndrome. It is also necessary to assume that the lesion extends only to a slight depth in the body of the pons; otherwise, it would involve nerve structures which would greatly increase the symptomatology of the case.

Let us hope that the operation which the patient is soon to undergo will clear up the doubts which we still have with reference to the nature of the lesion. I believe it is a tumor, perhaps a glioma. The papillary edema, which was not present at first, supports the belief in a tumor.

Retinal detachment with cystic formation

Dr. Casero presented the case of a 16-year-old boy, emmetropic, who showed cystic formation in the retinas of both eyes with bilateral detachment. There was a history that two months before the detachment the patient was hit on the forehead. For this reason the author described the lesion as traumatic, since it was possible that the blow was a contributing factor in loosening the retina and causing a detachment. But undoubtedly there had been previously a degenerative cystic process in both retinas.

Joseph I. Pascal,
Translator.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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FUNDAMENTAL RESEARCH IN OPHTHALMOLOGY

In an article in the April 11, 1947, issue of *Science,* entitled "Fundamental Research in the Clinical Specialties," V. Everett Kinsey, biochemist at the Howe Laboratory of Ophthalmology of Harvard University, analyzes with exceptional acumen the problems connected with basic research in ophthalmology. A discussion of this aspect of ophthalmology seems particularly timely in view of the recent establishment of two new foundations for basic research in ophthalmology on the Pacific Coast.

Kinsey made a survey of the status of fundamental research in the clinical specialties at some of the larger universities and found the situation to be in general unsatisfactory. Research programs were found to be handicapped by inadequate funds and by the fact that neither the well-qualified department heads nor the unpaid clinical staff members were in a position to devote sufficient time to them. The current practice of assigning faculty members from basic-science departments to clinical departments,

and vice versa, with salaries and duties divided, was found to be more often unsatisfactory than satisfactory. Kinsey calls attention to the fact that the number of investigators working in any given field is frequently pitifully small. Glaucoma, for example, is one of the principal causes of blindness in individuals past middle age and yet in the United States at the present time not more than three investigators are devoting half or more of their time to it. He concludes that as a result of these half-way measures the amount of fundamental research in the clinical fields is extremely small and that even if sufficient funds were to be made immediately available few departments would have either the personnel or the programs ready to take advantage of them.

Kinsey then considers the various possibilities for expanding research in the clinical fields. He discusses the advantages and disadvantages of special laboratories for the study of specific diseases, and of special research institutes in which researches relating to a number of specialties could be performed. He concludes, however, that the soundest plan is to establish laboratories in connection with specific clinical departments in the medical school and to staff them with well-trained full-time workers. The principal function of each of these laboratories should be to develop the fundamental aspects of the clinical specialty concerned and to make them available to the postgraduate student. Kinsey states that the experience of the Howe Laboratory indicates that this type of research unit is effective. He feels that although fundamental discoveries have in the past been made by isolated workers devoting their leisure time to research, there is every reason to believe that the coöperative effort of individuals with different backgrounds and training inevitably yields the best results. He believes that research of this kind is essentially a full-time job if facilities and personnel are to be utilized efficiently and if the quality of the work is to compare favorably with that in other branches of science.

In Kinsey's opinion the first step in establishing a research laboratory is to obtain the services of an able director. He believes that in general the head of the clinical department should not also be the director of the laboratory since he hasn't the time for what should be a full-time job in itself. The clinical department head, moreover, is likely to be interested preëminently in the practice of medicine and to lack the scientific background which would qualify him to direct research. He concludes that both positions are of such importance that a parallel administrative organization such as obtains at the Howe Laboratory is to be preferred to a vertical administrative organization.

An important secondary function of the research laboratory should be the postgraduate teaching of the basic sciences as applied to the medical specialty concerned. Kinsey believes, however, that in no case should this teaching function be allowed to occupy over a quarter of the staff's time. He discusses in detail the question of the academic standing, remuneration, and tenure of the laboratory staff and expresses the opinion that the system of rank should be comparable to that of career men in other academic fields rather than to that of the clinical department. In the latter, outstanding physicians, devoting only a small fraction of their time to the medical school, may hold relatively low rank. In order to avoid the appearance of discrimination, the titles of the laboratory staff should be different from those of the clinical staff, for example, "professor of ophthalmological research" rather than "professor of ophthalmology." If capable men are to be obtained and retained, salaries must compare favorably with those in basic-science departments and industrial-research laboratories and reasonable tenure must be assured.

The objection may be made that if the basic scientist devotes the time and effort necessary to familiarize himself with both the medical and laboratory aspects of a

specialty, he may not be able to maintain the same proficiency in his basic field as the more specialized worker. Kinsey refers to the saying that such a man may be neither fish nor fowl but answers the objection by pointing to the example of the biochemist who is both biologist and chemist. He believes that this "hybrid" has contributed more to the knowledge of biochemistry than either the biologist or the chemist and suggests that in the future the great contributions to the advancement of knowledge in scientific medicine may well come from another hybrid who might be called the "medical scientist."

This article of Kinsey's comes at a time when the importance of the basic sciences in relation to ophthalmology is becoming more and more widely recognized. In this connection the role of the American Board of Ophthalmology in stimulating basic-science teaching and, indirectly, basic research should not be overlooked. Nevertheless, the position of the full-time investigator in ophthalmology is frequently not an entirely happy one. Workers devoting virtually their entire time to ophthalmologic problems have complained of relative isolation and of the fact that their specialization has precluded, or at least handicapped, the possibility of their returning to the basic-science departments. They have found, moreover, that their chances of advancement are poorer than they would be in comparable positions in the basic-science departments; in the latter there is of course always the possibility of becoming a department head.

As ophthalmologic research laboratories increase in number the factor of isolation will be reduced and it is to be hoped that the new laboratories will be organized in such a way as to provide adequate rank and remuneration. Kinsey's suggestion that the research laboratory be separated administratively from the clinical department has much in its favor, and the Howe Laboratory testifies to the effectiveness of this method. On the other hand there are several institutions, notably the University of Pennsylvania and Johns Hopkins University, in which the vertical type of administration has functioned exceedingly well. This is clearly due to the fact that the department heads in these institutions have been outstanding basic investigators as well as clinicians. Unfortunately this happy combination must be considered most unusual. Whatever the administrative set-up, however, there is no doubt but that in the future our specialty will be advanced in direct proportion to the output of the "medical scientist," working either alone or in coöperation with the clinical ophthalmologist.

Phillips Thygeson.

CRITICISM OF THE AMERICAN BOARD OF OPHTHALMOLOGY

Some workers in the field of education for the practice of ophthalmology may have felt concern as to certain parts of the address delivered by President Alan C. Woods at the annual meeting of the American Academy of Ophthalmology and Otolaryngology in October, 1947. Yet frank and understanding criticism in any field of human activity is desirable, and often serves the very admirable purpose of leading to improvement in method. On the other hand it is always proper to inquire whether the criticism is well founded; in other words one function of the critical faculty is to criticize the critic.

The American Board of Ophthalmology, founded 30 years or so ago, represented the carefully studied conclusions of as fine a group of stalwarts as the field of medical education has ever known. It would have been strangely superhuman if that group's judgments and procedures had been entirely free from error or doubt or beyond improvement. It must also be recognized that no large and greatly varied mass of conditions is ever uniformly well met by any set of regulations. But the quality that perplexes us in President Woods's address is that it seems at times to present criticisms which,

if taken too seriously, might endanger the whole fabric of the Board's endeavors.

What have been the main purposes of the American Board of Ophthalmology?

It has been repeatedly emphasized that no such Board could demand or achieve uniform perfection in the would-be specialist's scientific knowledge of his subject; but that the Board's desire should be to determine whether the specialist possessed such proficiency as to render him a safe practitioner of ocular diagnosis, therapeutics, and surgery. It is obvious that in the minds of different examiners there may exist appreciable variation as to what constitutes such proficiency, and it cannot be doubted that such variation has worked at times to the advantage or prejudice of individual candidates. But in a general way such broad conception of the Board's requirements has fitted the needs of the public as to the practice of ophthalmology.

The Board had to realize the existence not only of varying intelligence and training among its candidates, but the basic fact that teaching institutions throughout the country were not of uniform efficiency, but emphasized in unequal degree the significance of different phases of the subject of ophthalmology, now this, now that, according to the strength or weakness of individuals or teachers or equipment. Certain outstanding educational groups have shown a tendency to prepare students to assume the capacity of teachers rather than of private practitioners, and have therefore required exceptionally lengthy periods of internship or residency. But to make this system widespread might have a dangerous tendency to defeat the general educational purpose, by encouraging the existence of great numbers of uncertified, and therefore of poorly rather than well-trained specialists.

Woods objects, as others have objected, to the Board's requirement of a minimum of one year of internship in a general hospital. This problem has given rise to much debate. But, taking into account the still inevitable inequalities of method and efficiency in general and technical education, and the variations in human personality, the rule is probably much more frequently wise than foolish. Woods objects that the system wastes precious time. What system of training in a clinical institution does not waste precious time? How large a proportion of the activities of a student nurse is free from this accusation? How much of the time of an intern or resident in the great institution over which Woods presides at Baltimore is completely exempt from such a criticism? The important question with regard to the preliminary or general hospital internship is whether it makes the practitioner of ophthalmology better able to understand the relation of ophthalmology to general medicine, and not only the technical but the human problems of the patients' lives; and again it must be remembered that the American Board exists primarily not to create research and laboratory workers but to satisfy the clinical needs of the general community.

The presidential address further takes exception to the tendency to make the certificate of the examining board a condition for appointment or promotion in general or hospital staffs. This condemnation is even extended to include the action of the United States Veterans' Administration in requiring that persons appointed to its attending or consulting staffs be diplomates of the Boards representing their specialties, and also in granting a 25-percent increase in salary to members of its full-time staff who obtain certification.

But we cannot escape the truth that human nature very generally needs incentives for the performance of desirable acts. At the inception of the American Board for Ophthalmic Examinations (the original name of the present Board of Ophthalmology) this fact was recognized through adoption by the American Ophthalmological Society of the rule that future candidates for its membership must have received the Board's certificate; and by the American Academy of

Ophthalmology and Otolaryngology of the rule that candidates for membership must possess the certificate either of the Ophthalmologic or the Otolaryngologic Board. It is also true that these requirements have been a great stimulus to the success of the activities of those Boards. Are we now to dispense with this kind of incentive?

It is curious that, in considering weaknesses associated with the working of the examining boards, the Woods presidential address does not call even passing attention to the fact that the certificate of membership in the American Academy of Ophthalmology and Otolaryngology fails to indicate upon which Board certificate the approval for membership in the Academy is based. Yet the certificate of membership in the Academy is displayed in thousands of offices all over the country as one of the criteria of efficient training, and the certificate of the Board of Otolaryngology, usually rated as rather easier of attainment, will undoubtedly be sought by many Army and Navy veterans in preference to the certificate of the Board of Ophthalmology, whose greater emphasis upon basic and theoretic knowledge has aroused more fear and trembling among candidates.

There is at least the merit of frankness in the reminder that some 12 years ago the Medical Board of the Johns Hopkins Hospital adopted a resolution to the effect that the Board was opposed "to the principle that certification by any of the specialty boards should be a condition of appointment or promotion to any position on the staff of the Johns Hopkins Hospital"; and that the secretary of that Board was requested to notify such other hospitals as he deemed proper of the action of the Board in this instance. This was a rather unpleasant slap at standardization! As regards the principle involved, we are assured (in the presidential address) that the American Board of Ophthalmology does not appear to have recanted in any way, and the writer says: "To this activity of the specialty boards Dr. Chesney has applied the adjective 'pernicious.' In this I fully agree with him."

Yet surely in this country, with its peculiar balance between Federal and State constitutional rights, some such measures aimed at professional standardization are not only permissible but desirable; and the principle of advantage pertaining to the certificates of the specialty boards is a valuable step in the direction of such standardization. Is it not possible to retain the advantages of this principle and practice, without serious disadvantages? Would the writer favor some elaborate system of control through the Federal Government, under a general scheme of socialization?

Woods's fear that research institutions may suffer from the application of any such general principle or rule is surely exaggerated, because the good sense of the examining boards is bound sooner or later to recognize any such special exemptions as may prove necessary in the case of research workers. Equally exaggerated, it may well be argued, is the further pronouncement that the present policies of the national societies lie "squarely across" the pathway along which ophthalmology must henceforth develop. And surely it can be said that, subject to recognized standards of excellence, "the national societies" already comply with Woods's desideratum that they "open their ranks, without distinction or the creation of different classes, to all medical men or scientists whose primary interest lies in the field of ophthalmology." But it is hardly to be denied that a scientist cannot be regarded as an ophthalmologist unless he has a basic and adequate understanding of the clinical problems of ophthalmology, such as is demanded by the American Board.

W. H. Crisp.

OBITUARY

DR. LOUIS STORROW GREENE (1872-1947)

On November 12, 1947, during his sleep, Dr. Louis Storrow Greene was called to his reward which he richly deserved. He had been at work most of the day in his office and after dinner had conducted a meeting of the vestry of his church until after midnight.



LOUIS STORROW GREENE

He had a heart block, and was completely unconscious of the approach of the end of his life when he retired.

Dr. Greene, while of Virginia ancestry, was born in Columbus, Georgia, November 19, 1872. He was the youngest son of Anne Appleton Storrow and William Spencer Greene. His father, at that time, was a construction engineer of railroads: hence his early education was in the deep south, Alabama, and later in Virginia. His premedical work was at the University of Virginia from which he was graduated in medicine in 1895. He spent the next two years in New York doing postgraduate work at Charity Hospital and the New York Eye and Ear Infirmary.

In 1897, he came to Washington and associated himself with Dr. William H. Wilmer with whom he remained in the practice of ophthalmology until 1915. During these years, he taught diseases of the eye at Georgetown University Medical School. He served as ophthalmologist to the National Medical Advisory Draft Board during World War I; and was ophthalmologist to the Episcopal Hospital Aviation Unit.

He was associated in various capacities on the staff of the Episcopal Eye and Ear Hospital, being the last of the staff that began service in the present hospital. He was a senior surgeon at the time of his death.

Dr. Greene was a member of the American Medical Association, District Medical Society, Washington Ophthalmological Society, French Society of Ophthalmology, and of the American Ophthalmological Society, of which he was president in 1936.

Dr. Greene was a sound ophthalmologist, well rounded in the practice of his art. He was a very skillful surgeon and a keen diagnostician. His advice was often sought by younger colleagues as a consultant. His great joy was in selecting younger men and helping them start their medical careers: many of them owe their more rapid advance in their practice to his support and encouragement.

He was a loyal friend and a delightful companion. His vacations were often spent in hunting and fishing trips, on many of which I accompanied him. He had a keen sense of humor, was adept in the verbal passage of arms, in which he usually bested his adversary although he never left a sting behind.

His religious life was full, for he was a strong lay worker in his chosen church, the

Protestant Episcopal. He was senior warden at the time of his death.

He was married in 1903 to Miss Louise Packwood Burke who survives him together with two children, a son and a daughter. John W. Burke.

CORRESPONDENCE

An ocular test for penicillin susceptibility (dermatitis venenata)

Editor,
American Journal of Ophthalmology:

It has been my observation that, as the years roll by, people in the United States are getting more and more allergic. In this short report I do not wish to discuss allergy and its many vague and not yet understood ramifications, but briefly to call attention to one of our most modern drugs and to suggest an ocular test which may be of benefit.

I wish also to warn against the promiscuous use of this relatively new drug which is a most valuable adjunct to our pharmacopeia and which, as we all know, has proved its worth when used with reason and some caution.

When any new drug is discovered and is found worthy in certain pathologic conditions, we are sometimes fooled into the belief that we have a panacea for all the ills to which the flesh is heir. The medicine I wish to discuss briefly is penicillin. From the literature I am receiving, I find that penicillin is being used for almost every known ailment from treatment of the vagina with vaginal suppositories to treatment of the eyes with ophthalmic ointment.

In my own practice I have known and seen three cases whose reactions were far from those desired. Two cases for which the drug was given were of indefinite corneal infiltrations whose etiology could not be positively established, and one was a case of lid infiltration which later developed a Vincent's angina. The patients were all given "big shots" of penicillin. Two of the patients developed urticarial and vesicular eruptions while the other acquired a general diffuse desquamation which took some time to cure. One of the patients died.

I know that some cases are emergency ones and, when it is a matter of life or death, minutes count. There is no time to test the patient's reactions. But in those cases where time is not so valuable, and the intradermal or small dose injections have been tried, I wish to offer the following simple ocular test as an added precautionary measure and a safe way to determine the susceptibility of the patient to the drug.

The test is as follows. One eye is selected; the other used as a control. Penicillin ophthalmic ointment (calcium) is instilled in the lower cul-de-sac of the eye three times a day; the excess of the ointment is wiped off with sterile cleansing tissues. The eye should not be washed either before or at any time after the instillation of the penicillin. A positive reaction is manifested on the 4th or 5th day by a thickening of the lids, with a brawny desquamation and intense itching. If the finger is gently passed over the skin of the lids there is a sensation as if the finger were passed over very fine sandpaper. The upper lid is usually more intensely affected than the lower lid. Strangely enough the conjunctiva and cornea are unaffected, the reaction being confined exclusively to the skin of the lids.

This test, I believe, will assist materially in diagnosing the susceptibility of individuals to penicillin. Since sensitivity to penicillin is usually manifested by skin lesions, it is my opinion that this test would be a very good indication of general sensitivity. In those cases which showed skin-lid reactions, the conjunctiva and cornea were positively *not* affected.

(Signed) William Brown Doherty,
New York, New York.

BOOK REVIEWS

THE OCULOROTARY MUSCLES. By Richard Gordon Scobee, M.D. St. Louis, C. V. Mosby Co., 1947. 359 pages, clothbound, illustrated. Price, $8.00.

This is the first textbook on the extraocular muscles in the past 11 years and one of the most effective that has been written on the subject. A difficult and controversial division of ophthalmology is logically and clearly handled and, perhaps equally important, the book is interesting and readable. The underlying philosophy owes much to the work of the late F. Bernard Chavasse, a writer on the subject who has not received the attention that he has deserved.

Scobee's monograph begins with anatomic and physiologic studies. Photographs of an ophthalmotrope are utilized to indicate the attachments and functions of the oculorotary muscles. Diagrams aid materially in the interpretation. The concepts of muscle action are so well given as to relieve the obscurity engendered by the tables of straight and tilted blocks depicted in most texts. The 2nd to the 6th chapters deal with additional fundamentals of ocular deviations, such as the underlying neuromuscular mechanisms and elementary laws governing the action of the oculorotary muscles. Section II covers the latent deviations, the etiology, as well as prescriptions, and is separate from the rest of the book. Section III contains a discussion of the manifest deviations, and Sections IV and V deal with the diagnosis and treatment of the deviation. One of the best chapters is that on the "Analysis of the Case" wherein is described the routine employed by the writer.

Almost every ophthalmologist is interested in the surgical treatment of squint because, in many cases, surgery is necessary for a cure whether or not orthoptics or spectacles, or both, have been employed, and furthermore most ophthalmologists are interested in surgery. The chapter on the surgical principles indicates that the author believes in the theory followed in orthopedic practice of weakening the antagonistic muscles in cases of underactivity of a muscle rather than direct attack on the affected muscles. He does not advocate any specific surgical technique, being satisfied with the enunciation of the general principles of corrective surgery. He points out convincingly the importance of proper handling of the check ligaments after having previously clarified their anatomy. A careful study of the book is the best argument for a complete analysis of each muscle case including the findings on the operating table when surgery is indicated. From a perusal of the earlier chapter one can analyze the muscle or muscles at fault in a given case and treat the patient intelligently and individualistically. The findings under anesthesia must be used as the final criterion as to the surgery to be undertaken.

This splendid monograph will help ophthalmologists to an understanding of the modern concepts about the extraocular muscles and may lead them to abandon the indiscriminate recess-resect operations which have tended to be the only procedures employed by many ophthalmic surgeons.

The book is compact and well printed on good paper, with many excellent cuts and photographs that illustrate the text effectively and aid in the interpretation of otherwise difficult ideas. This is an outstanding contribution to ophthalmic literature.

Lawrence T. Post.

HEADACHE. By Louis G. Moench, M.D. Chicago, The Year Book Publishers, 1947. 207 pages, 55 illustrations. Price $3.50.

The author divides the subject into chapters dealing with pathologic anatomy and physiology of headache; headaches from intracranial pathology, spinal puncture and ventriculography; cranial nerve neuralgias; headache of ocular origin; headache of nasal origin; headache from pathology in the neck; headache from systemic disorders;

histamine headaches; migraine and headaches of emotional origin.

The first chapter opens with the statement that "no understanding of headache is possible without a comprehension of the pain-sensitive structures of the head and the disturbances which bring about their stimulation." Illustrated by excellent line drawings the various sensitive structures are discussed and the regions to which the pain is referred outlined. Of particular interest to the ophthalmologist is the frequency with which pain from stretching or irritating arteries is referred to, or behind, the eye. For example, the intracranial segment of the internal carotid artery, when stimulated, refers pain behind the eye and low in the temporal region. The middle cerebral artery and the sensitive proximal portion of the anterior cerebral artery refer the pain in and behind the eyes.

The chapter on ocular headaches consists of 11 pages in which the various ocular headaches are discussed briefly. For the small space devoted to this subject it would seem that too much emphasis has been placed on aniseikonia.

The book presents an excellent exposition on the underlying mechanism of headache together with a discussion of the areas to which the pain is referred.

The makeup of the book, the paper and the binding are all good.

Frederick C. Cordes.

CENTRAL AND INDIRECT VISION OF THE LIGHT-ADAPTED EYE. By Viggo Clemmesen. Acta Physiologica Scandinavica, 9:1-206 (Supplement 27), 1947.

This monograph with an extensive bibliography is written in English and has a summary in Danish. It is a report of the author's extremely thorough and capable investigation of indirect vision which he carried out because knowledge of the subject seemed rather deficient.

The first chapter is devoted to an analysis of the visual sense on the basis of the literature and for this purpose the subject is divided into light sense and physiologic resolving power. The first factor is measured by the discrimination factor and the second is not dealt with, in order to keep the investigation within manageable bounds. Under the heading, physiologic resolving power, an account is given of the possibilities of exact localization of image point in the monocular field, as well as the importance of optical factors, especially the resolving power of the optical system of the eye and the anatomic structure of the fovea. A functional unit is defined as the number of cones which are connected to the same optic ganglion cell through a conducting neurone. At the fovea the functional unit must consist of at least one cone. In the second chapter indirect vision is considered under the same headings.

In the second part the author describes his own investigations which consist of comparative sense-physiologic experiments on central and indirect vision. Experiments on the following functions are recorded: the minimum separable, perception of movement, form sense, aligning power, and discrimination of thickness of line.

The discrimination of thickness of line must be interpreted as a function of the intensity discrimination (light sense) when the object exceeds a certain minimum size. The minimum separable for objects illuminated from before may also serve as a measure of light sense.

Physiologic resolving power is measured by the minimum separable for luminous squares of threshold brightness on an unilluminated ground, or by the minimum separable for an unilluminated square on a luminous ground of threshold brightness. Perception of movement of a luminous point on an unilluminated ground can be used as a measure of physiologic resolving power and so can the form sense under certain conditions and with certain reservations.

The aligning power is of a complex nature. It is a function of physiologic resolving power and of the intensity of discrimination.

The physiologic resolving power yields information on the retinal structure and is, therefore, of the greatest interest for comparisons of central and indirect vision. Indirect vision begins to act at a distance of 2.7 inches from the center of the visual field; even at this small eccentricity the minimum separable is larger than at the center. The physiologic resolving power decreases rapidly with eccentricity irrespective of the structural limits in the retina (rod-free area). The size of the functional unit increases with eccentricity up to three degrees in the horizontal meridian and two in the vertical. Outside these eccentricities the units are no longer functionally separated, and it must be assumed that the nerve impulse spreads through horizontal neural connections. The variation in size of the functional unit within the fovea is caused by variations in the diameter of the cones and outside this area not only by the variations of the distances between the cones but also by the number of cones connected with each nerve fiber.

This necessarily brief glance into this very interesting monograph cannot hope to do more than suggest the pleasure that any reader who is interested in physiologic optics will derive from studying the original.

F. H. Haessler.

HANDBOOK OF OPHTHALMOLOGY. By Ignacy Abramovicz. Warsaw, Poland, Scientific Publications of the Medical Institute, 1947. 580 pages. Price, not listed.

Abramovicz, formerly professor of ophthalmology at the Medical School of Vilno, is at present director of the ophthalmological department of the Medical Academy at Danzig. This handbook evinces a mastery in condensing the entire domain of ophthalmology into a brief survey for the medical student and in selecting for more significant description those areas of ophthalmology, orientation in which is of greatest value to the general practitioner.

It is essentially a practical treatise, compiling massive data based on factual foundations and making no pretense to include the newer data or even to point out the directions of research. The chapters on trachoma, and ocular injuries are quite comprehensive. For the rest, the book follows the traditional pattern of devoting the first chapters to the anatomy, physiology, and embryology of the eye, with a special chapter on this domain in the newborn and infants. Refraction and motor anomalies are covered in some detail, and ocular surgery is completely left out.

The chapters devoted to ocular diseases present accurate, balanced, dependable descriptions, made more persuasive by profuse and excellent illustrations. The book contains 256 illustrations, some of which are reproductions from the literature, and 14 plates of fundus photographs in color; the illustrations are particularly numerous in the chapters on diseases of the orbit, lids, lacrimal apparatus, and the cornea. The printing is unusually good for publications received from this part of Europe. It was done in Sweden, as a contribution of the Swedish government to the cultural progress of Poland. While there is nothing new in this handbook, it undoubtedly represents a significant contribution to the ophthalmologic needs of Poland, for to our knowledge there was no handbook of a similar nature in the Polish language.

Ray K. Daily and Sylvan Brandon.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjuctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Gát L. **Topographic study of the insertions of the rectus muscles.** Ophthalmologica 114:43-51, July, 1947.

Post mortem measurements of the width in equatorial direction and the distance from the corneal margin of the insertions of the rectus muscles revealed very considerable individual variations. The results are presented statistically.

Peter C. Kronfeld.

Nordmann J., and Stoll R. **The pigment cells of the choroid of the chick embryo.** Ophthalmologica 114:99-102, Aug. 1947.

In the chick embryo the chromatophores of the choroid make their first appearance on the tenth day after fertilization. The development of the chromatophores appears to be related to that of the ciliary nerves and independent of the pigment epithelium of the retina.

Peter C. Kronfeld.

Sudakevitch, T. **The variations in the system of the trunks of the posterior ciliary arteries.** Brit. J. Ophth. 31:738-760, Dec., 1947.

The variation in the anastomoses of the ophthalmic artery and its importance has not been emphasized in the literature. The ophthalmic artery may start as one or two trunks. Should the ophthalmic artery start from only the external carotid then anastomoses are essential and important for the functions of the eye. The role of the ophthalmic artery is not chiefly concerned with the central retinal artery, but mainly with the ciliary arteries. A definite order of branching of the long posterior ciliary arteries for sustaining a favorable correlation in the system of the ophthalmic artery from the hemodynamic point of view is very important. Most frequently, the first branch is the medial one of the long posterior ciliary arteries, with a common trunk with the central retinal artery.

In cases showing embryonic interruption in the trunk of the ophthalmic artery a variation was seen in the usual order of branching. Here, the medial branch of the long posterior ciliary artery was found in the second part, after the lacrimal artery. When this occurred na-

ture provided anastomoses and accessory branches. In some cases the posterior ciliary arteries may take part in the anastomoses themselves, making junction with the first and second parts and forming a new collateral way toward the posterior ciliary and neighboring arteries.

Intracranial interruptions of the ophthalmic arteries are of embryonic origin. The definite osseovascular correlation which develops in the narrow intracranial space in front of the optic canal is of extreme importance for normal eye function. (28 figures.) O. H. Ellis.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Missiroli, Giuseppe. **Allergometric investigations on patients suffering from probable tuberculous ocular disease.** Boll. d'ocul. 26:171-178, March, 1947.

Continuing former investigations concerning the degree of cutaneous reaction to a tuberculin brand called "M.D.C. Terr." (Boll. d'ocul., Jan. 1947), the author compared the cutaneous reactions to this tuberculin in 17 patients affected by recurrent vitreous hemorrhages and in 11 patients with sympathetic ophthalmia. While in the latter group, most patients did not react to the 1 to 50,000 dilution—only one patient did—the patients with recurrent vitreous hemorrhages had positive cutaneous reactions even to dilutions of 1 to 100 million; 14 of these 17 patients reacted to dilutions of 1 to 100,000 and less. This seems to confirm the opinion of Stock and Axenfeld who, in 1909, postulated the tuberculous etiology of the recurrent vitreous hemorrhages. (1 table, 36 references.) K. W. Ascher.

Panzardi, Domenico. **Penicillin in the prophylaxis of postoperative infections of the eyeball.** Boll. d'ocul. 25:501-519, Oct.-Dec., 1946. (See Section 5.)

Reiser, K. A. **The problems of intraocular tuberculosis.** Klin. Monatsbl. f. Augenh. 112:1-12, May, 1947.

Intraocular tuberculosis has been a controversial subject because of the lack of sure diagnostic findings in the diseased eye. Many different diseases of the bulbus show similar clinical characteristics. Pathologic findings from the acute stage of the inflammatory process are scarce because the eyes are enucleated after, and not during, that stage, because of complications like secondary glaucoma. Therefore, the pathologist finds only the end result of the inflammatory process. Tubercle bacilli are only rarely found in these enucleated eyes and the histologically evident granulation tissue is not as pathognomonic as it once was thought to be. The clinical proof of the presence of a primary tuberculous focus is very difficult and frequently impossible, the Mantoux skin test is unreliable, a focal eye reaction after injections of greater doses of tuberculin is dangerous and, likewise, not foolproof and X-ray findings in the chest of persons with and without tuberculous eye disease are often identical. Serum reaction of the blood for tuberculosis as well as the isolation of tubercle bacilli from the blood are equally problematic. In spite of these uncertainties the author has no doubt of the existence of a true metastatic tuberculosis of the eye. He discusses four stages of investigation to make the diagnosis with certainty. The first stage embraces the general physical and laboratory examinations of the usual kind. A definite diagnosis is only rarely achieved and this stage usually ends with the diagnosis "uveitis of unknown etiology." During the second stage the findings are reviewed after removal of all possible foci of infection and after evaluation of the further course of the disease including resistance or response to treatment. At this point a diagnosis can often be made with probability. The third step embodies observa-

tion of long duration, sometimes after treatment in a sanatorium. Occasional hints of small, old tuberculous flare-ups in other parts of the body, recurrent attacks of the eye disease, changes in location of the ocular inflammatory process within the same eye and, again, evaluation of the therapeutic result are the considerations which make a diagnosis of clinically certain ocular tuberculosis possible. The fourth diagnostic stage is the positive proof of an active tuberculous lung process. The latter is found through repeated X-ray observation of seemingly inactive scars and glands over a long period of time. One then finds minute changes which correspond to caseous processes. The positive finding of bacilli in an enucleated eye belongs also to this last diagnostic part. The author states that, contrary to the old theories, lung tuberculosis and eye tuberculosis are actively co-existent in the same individual and that the disease in the two organs is only quantitatively, but not qualitatively, different. Max Hirschfelder.

Scholz, R. O., Cowie, D. B., and Wilde, W. S. **Studies on the physiology of the eye using tracer substances. Parts I and II.** Am. J. Ophth. 30:1513-1526, Dec., 1947. (3 tables, 3 figures, 9 references, discussion.)

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Bonhomme, C., and Ferrié J. **Changes in the lacrimal gland of the rabbit after the injection of pilocarpine.** Ophthalmologica 113:316-318, May, 1947.

Under the designation of apical ergastoplasm the authors describe and depict certain transient histological changes that occur in the cytoplasm of the secretory cells of the lacrimal gland under the influence of pilocarpine.

Peter C. Kronfeld.

Davson, Hugh, and Quilliam, J. P. **The effects of nitrogen mustard on the permeability of the blood-aqueous humour barrier to Evans blue. An instance of the influence of a lesion in one eye on the susceptibility of the other.** Brit. J. Ophth. 31:717-721, Dec., 1947.

The authors found that Evans blue injected intravenously does not appear in the aqueous of normal rabbits. After a solution of nitrogen mustard was instilled into the conjunctival sac of one eye the permeability of the blood-aqueous barrier was increased. Evans blue appeared in the anterior chamber of that eye and a ciliary injection appeared in the untreated eye. Solutions of different toxicity were used and the results showed that instillation of a high concentration of nitrogen mustard in one eye potentiates the action of a mild solution in the other eye by the reflex dilatation of the iris vessels.

O. H. Ellis.

Fischer, F. P. **Lens metabolism and cataract.** Ophthalmologica 114:1-9, July, 1947.

Fischer reviews and tries to integrate some of the more recent work concerning the metabolism of the normal and cataractous lens. The two principal views concerning the pathogenesis of cataracts are: lens opacities result from disturbances of either the carbohydrate and mineral metabolism or from the internal respiration of the lens. Fischer shows that these two views are not irreconcilable. The various phases of the carbohydrate metabolism are represented in a rather complex diagram. "The cataractous lens is an asphyxiated lens." Peter C. Kronfeld.

Leopold, I. H., and Adler, F. H. **Specific treatment of ocular burns due to Lewisite (Beta-Chlorovinyldichloroarsine).** Arch. Ophth. 38:174-181, Aug., 1947.

An effective antiarsenical agent, BAL

(2.3-dimercaptopropanol), was discovered and developed during the war years. It has been shown not only to be an effective therapeutic agent against arsenical war agents but also to be of value in the treatment of the various types of arsenical poisonings encountered in civilian practice.

The drug is irritating and produces ocular damage if used in concentrations greater than five percent or if repeatedly applied. It is recommended that it be applied once after the initial application. BAL is very effective in preventing severe ocular damage from Lewisite when applied promptly. It also has a specific effect on ocular lesions due to methyldichloroarsine, ethyldichloroarsine and phenyldichloroarsine and it has slight beneficial effect on lesions due to mustard gas (diethyl sulfide). The solvent and method of application is discussed in some detail. Apparently the use of 5-percent BAL in a special ointment base is most practical for military use.

John C. Long.

MacDonald, A. D. **Mydriatics: some developments.** Practitioner 158:413-417, May, 1947.

All mydriatics of the belladonna group —atropine, homatropine, euphthalmine, and hyoscine—have the common feature that paralysis of accommodation is of shorter duration than the accompanying mydriasis. The mydriasis is not maximal and can be increased by the use of sympathomimetic drugs. Eumydrine, also a member of this family, differs in that the effect on accommodation is more prolonged. The sympathomimetic mydriatics, including adrenaline and ephedrine produce no cycloplegia and do not increase the ocular tension. Cocaine, a local anesthetic, has a definite mydriatic effect and enhances the mydriatic effect produced by atropine.

The antispasmotic drugs such as papaverine, syntropan and benadryl, have little mydriatic effect. There is a short discussion of the methods of investigation of drugs for the mydriatic effect, and of the history of attempts to synthesize mydriatic drugs. In these investigations it has been found that certain choline esters are powerful mydriatics, of shorter duration than atropine. One choline ester, used increasingly at present, is dibutolin. Thus far these choline esters have been used infrequently, usually as substitutes for atropine. Benjamin Milder.

Olcott, C. T. **Experimental argyrosis. III. Pigmentation of the eyes of rats following ingestion of silver during long periods of time.** Am. J. Path. 23:783-792, Sept., 1947.

Ocular pigmentation due to the deposition of silver can be recognized during life and at autopsy in rats after ingestion of silver salts for long periods. The amount of pigmentation is directly related to the duration and intensity of the treatment. The zone of greatest pigmentation in the eye is the homogeneous layer of Bruch's membrane of the choroid and its continuation as the basal membrane of the epithelium of the ciliary body. Theodore M. Shapira.

Rosso, S. **The effect of acetylcholine shock on ocular tension and the retinal arterial pressure.** Rassegna ital. d'ottal. 16:357-369, Sept.-Oct., 1947.

After reviewing the effects of convulsive treatment in schizophrenia by various other means, Rosso reports his observations after the injection of acetylcholine. In a group of 35 patients, aged 20 to 35 years, he studied particularly the variations of the general arterial pressure in relation to the behavior of the retinal vessels. In the second group of 16 patients he reports the relation of the general arterial pressure to that of the retinal arteries and to ocular tonus. Shock was

induced by the intravenous injection of 0.50 gm. of acetylcholine bromide, dissolved in distilled water. The average results were as follows: a fall of general systolic pressure of 20 mm. of Hg and a 10 mm. fall in the diastolic pressure; the retinal arterial pressure fell about 10 percent and showed rather marked oscillations, but returned to normal more rapidly than the general arterial pressure; there was a contraction of the central retinal artery of brief duration; the average fall of intraocular pressure was 5 mm. Eugene M. Blake.

Stutterheim, N. A. **Peripheral and central disturbances of the visual fields. An aspect of di-ophthalmology.** Brit. J. Ophth. 31:721-730, Dec., 1947.

The author discribes in detail his observations on three patients in whom functional contraction of the visual fields of both eyes was present with diminished central vision, combined with various other symptoms of severe eyestrain. The condition is called astheno-vergence. Treatments using the kinetic principle rapidly cleared the condition.

O. H. Ellis.

Valerio, Mario. **Wetting agents in ophthalmology, with particular regard to their uses in ocular sulfamidotherapy.** Ann. di ottal. e clin. ocul. 72:428-436, July, 1946.

By experiments made on rabbits, Valerio found that therapeutic concentrations of sulfonamides can be obtained in both the vitreous and the aqueous if a wetting agent is used, whether the sulfonamides are administered by iontophoresis or in an ointment.

Since the anesthetic percaine (nupercaine) is a very efficacious wetting agent he recommends its use in ½-percent solution with 2-percent epinephrine for maximal mydriasis in examination of the fundus. Harry K. Messenger.

Van Dyke, H. B. **Autonomic nervous system and action of drugs important in ophthalmology.** Arch. Ophth. 38:145-153, Aug., 1947.

This is a general review of the pharmacology of the autonomic nervous system with special reference to the eye. For the purposes of the discussion, the older view that transmission of impulses depends on humoral agents, such as acetylcholine and substances closely related to epinephrine, has been adopted. The summary includes a very valuable outline of the action of the various ophthalmic drugs used for their action on the autonomic nervous system. John C. Long.

Vidal, F., Malbrán, J. L., and García Badaracco, J. **Neurocapillary test in experimental aniridia.** Arch. de oftal. de Buenos Aires 21:105, April-June, 1946.

The authors studied the action of carbaminoylcholine chloride in experimental aniridia and partial iridectomy in the cat. The drug produces a rapid fall in the intraocular pressure in both eyes which later increases gradually and is lower in the operated eyes. These lower values are believed to be due to the reduction of the dialyzing vascular area. (Bibliography.)

Plinio Montalván.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Angius, T. **Research on accommodation.** Rassegna ital. d'ottal. 16:370-376, Sept.-Oct., 1947.

The author devised and describes apparatus for measuring the near point of accommodation of each eye separately. With it he measured the power of accommodation of 1160 healthy young adults from 19 to 26 years of age and with normal vision. The normal power of accommodation for ages 19 to 20 is 11 D, and from 21 to 26 is 10 D. These values are

higher than those of Donders and close to those of Duane. (1 Figure.)

Eugene M. Blake.

Bucalossi, Antonio. **A subjective method for the study of the refracted light-bundle of the eye and the determination of the refraction.** Ann. di ottal. e clin. ocul. 72:385-407, July, 1946.

The refraction of the eye can be determined by viewing a white object on a black background through a filter, half of which is of red glass and the other half of green, so placed in front of the eye that the line of separation between the two colored fields passes through the center of the pupil. An object thus viewed generally appears to be of the color resulting from the fusion of the two colors of the filter and to be surrounded by colored zones or bands which vary according to the refraction and aberration of the eye. Six diagrams for interpreting the numerous variations are given.

Harry K. Messenger.

Cotlier, I. **Subjective astigmatoscopy in the determination of astigmatism.** An. argent. de oftal. 7:119-124, Oct.-Nov.-Dec., 1946.

Subjective astigmatoscopy is based on the examination of a point of white light which is seen as a diffusion line by an astigmatic eye. To perform the test the author utilizes a subjective kinescope in which a line of light is employed to determine the principal meridian of astigmia, by an apparent subjective lengthening or shortening of the constant source of linear light. Additional blue or red filters may be used for further refinement, especially in cases with hypermetropia. Lenses are then placed before the eye until the dispersion and lengthening effects due to the astigmia are made to disappear. (2 figures, bibliography).

Edward Saskin.

Cross, A. G. **Contact lenses.** Practitioner 158:406-412, May, 1947.

This survey of the present status of contact lenses includes a brief description of their history from the original blown glass lenses to the present plastic contact lenses. The author discusses the advantages, cosmetic and industrial, of contact lenses. Indications for use include asymmetric ametropia, keratoconus, corneal irregularities due to scarring, and monocular aphakia. In addition, therapeutic indications include lagophthalmos and neuroparalytic keratitis. Eyes with recurrent erosions and trichiasis have been benefited by contact lenses. The cosmetic indications are discussed.

The author describes Zeiss lenses, and describes the method of individual fitting of contact lenses. Tolerance to contact lenses varies greatly. The author feels that with cut plastic lenses it is possible to insure at least four hours a day of comfortable wear. He emphasizes the importance of careful selection of candidates for the wearing of contact lenses.

Benjamin Milder.

Duke Elder, Sir Stewart. **Eye strain.** Practitioner 158:377-382, May, 1947.

The author defines "eye strain" as the effort of the visual apparatus to clarify vision by ineffectual adjustments. Among the factors which cause eye strain, the author emphasizes faulty illumination and the fineness of the work done. More important, however, are ocular defects which produce eye strain. Chief among these are error of refraction and presbyopia and also accommodation, convergence, muscular impairments and aniseikonia. Eye strain is commonly the result of efforts to compensate for relatively small ocular defects. The more ready appearance of asthenopic symptoms in people who are subject to other strains and stresses, both physical and psychic, is emphasized. Treatment is principally

optic, but the author warns against the indiscriminate correction of errors of refraction which are not producing symptoms. Benjamin Milder.

Eyles, Marianne. **Functional home exercises in cases of eyestrain.** Am. J. Ophth. 31:45-48, Jan., 1948. (3 figures.)

Fink, W. H. **The vergence test—an evaluation of the various techniques.** Am. J. Ophth. 31:49-57, Jan., 1948. (2 figures.)

Foddis, Antonio. **Concerning central scotomata encountered in certain secondary cataracts.** Boll d'ocul. 26:87-97, Feb., 1947.

In the 1943 volume of the same journal (no. 8-10, p. 479) Focosi discussed the visual disturbances observed in certain cases of secondary cataract; the present paper is devoted to a mathematical analysis of the phenomenon. (4 figures.)

K. W. Ascher.

Fuchs, Adalbert. **Myopia inversa.** Arch. Ophth. 37:722-739, June, 1947.

In occasional eyes changes occur at the disc which resemble the nasal conus of myopia but which are something quite different. In these cases, on the nasal side of the optic nerve one finds changes which look exactly like those on the temporal side of the optic nerve in cases of high myopia, namely, large atrophic zones of the choroid (circumpapillary atrophy), which extend toward the nasal side more than toward the temporal side. As such eyes are myopic, the author proposes to call these changes "myopia inversa." The distribution of the vessels is nearly always inverted. Pronounced supertraction of the temporal margin of the disc is not ordinarily present. Fourteen cases of this condition are described in detail with sketches of the disc.

John C. Long.

Iribas, Gregorio, **Contact lenses in ophthalmology.** Arch. Soc. oft. hisp.-amer. 7:797-807, Aug., 1947.

No new viewpoints on contact lenses are presented. The author prefers fitting with Obrig's trial set of plastic lenses. He finds individual molds of the eyeball unnecessary. The mathematical data on the computation of the refractive correction from the data furnished by the trial-case refraction, the measurement with the ophthalmometer, and the distance between the correcting lens and the anterior corneal surface are presented.

Ray K. Daily.

MacDonald, J. G. **Spasm of accommodation.** Supp. New Zealand, M.J. 1947, pp. 39-42, 1947.

Spasm of accommodation simulates myopia, gives rise to annoying blurring of vision, and should be treated by the daily use of atropine. Irwin E. Gaynon.

Maione, Mario. **The action of simultaneous multiple luminous stimuli on the retinal function. (Experimental researches.)** Ann. di ottal. e clin. ocul. 72: 467-490, Aug. 1946.

Maione performed a series of experiments designed to elucidate the functional relations between various parts of the retina. Using double targets (red-green, red-white, green-white) specially calibrated with respect to luminous intensity he found that the extent of the visual field for a given color is reduced when the target presents simultaneously another stimulus of the same luminous intensity. In a second group of experiments he found that a luminous stimulus on one part of the retina weakens the action of a simultaneous luminous stimulus on another part. With a special device he studied the variation in macular visual acuity when the periphery of the retina is stimulated, and found that the more in-

tense the peripheral stimulus the less the central visual acuity.

As a working hypothesis Maione considers the retina to possess a definite energy potential, the discharge of which upon the optic nerve is determined by the characteristics of the stimuli.

Harry K. Messenger.

Moron-Salas, José. **Two problems in refraction.** Arch. Soc. oft. hisp.-amer. 7: 741-755, Aug., 1947.

Moron-Salas discusses aniseiconia, and the use of the cross cylinder. For the diagnosis of aniseiconia, he uses the Maddox eiconometer which is described in detail. Size glasses are not available in Europe, and the author attempts to equalize the size of the retinal images by the thickness and position of the lenses. The enlargement of the image increases in direct proportion to the thickness of the lens, and inversely to the radius of curvature. The apparent size of the object increases if the lens is placed with its concave surface towards the eye, and diminishes if the lens is placed with the convex surface towards the eye. In cases of unilateral myopia the aniseiconia can be reduced by reducing the distance of the correcting lens from the eye.

The use of cross cylinders is described, and attention is called to the possibility of error, pointed out by Williamson Noble, caused by the fact that vertical lines are seen more distinctly if the vertical meridian of the eye has the strongest refraction. To avoid this error the author suggests that in using the cross cylinder, patients be asked to look at letters or numbers in which curved lines predominate, such as, 3, 6, 8, 9, o, c, and g. (3 illustrations, 1 table.) Ray K. Daily.

Pannevis M. **The brightness of positive after-images.** Ophthalmologica 113:280-289, May, 1947.

The purpose of this study was to follow and define the course of positive after-images by measuring their brightness. These measurements are made by "projecting" the after-image onto a screen the brightness of which can be varied and measured. If the screen is brighter than the after-image the latter immediately changes from light to dark. This phenomenon is only an induced change in brightness and not a change from a positive to a negative after-image. The decrease in brightness, that is, the fading of a positive after-image can be expressed by a relatively simple formula. Peripheral after-images (following stimulation of a peripheral retinal area) are less intense and fade out more quickly than central ones. The area of a central scotoma often proves incapable of producing after-images. During the recovery of central vision the more peripheral portion of the scotomatous area regains its capacity of producing after-images sooner than the more central portions.

Peter C. Kronfeld.

Park, G. E. **Reading difficulty (dyslexia) from the ophthalmic point of view.** Am. J. Ophth. 31:28-34, Jan., 1948. (2 tables, 9 references.)

Weidmann W. **The sharpness of the subjective visual images.** Ophthalmologica 114:33-43, July, 1947.

The various physiological aberrations and imperfections of the emmetropic eye lead to a degree of blurring of the retinal images that is comparable to that produced by an ametropia of about 2 diopters. Nevertheless, the subjective visual images are sharp and there is no subjective awareness of the fact that the retinal images consist of or, at least, are outlined by diffusion circles. With a simple experimental arrangement the author has studied the effect of partly overlapping diffusion circles (DC) upon the subjective

impression. If two DC of different brightness overlap partly on the peripheral retina, no summation of the two stimuli occurs in the area of the overlap. Instead, the stronger (brighter) stimulus suppresses the weaker one. Barely eccentric DC suffer the same fate if they overlap partly with a central (macular) DC. Similar rules apply to colored DC: The more brightly colored DC extinguishes the weaker stimulus in the area of the overlap. Summation occurs only if two DC of the same color and brightness overlap. Another consequence of the physiological interactions between DC or double stimulations of retinal areas is the apparent enlargement by the radius of the DC of any bright object seen against a dark background, due to the suppression of the darker DC. These phenomena account for the subjective sharpness of visual images.

Peter C. Kronfeld.

5

DIAGNOSIS AND THERAPY

Bailliart, P. **Reflections on ophthalmoscopy.** Ann. d'ocul. 180:449-456, Aug., 1947.

The redness of the normal fundus depends on the quantity and quality of its reflected light which enters the observer's eye. The choroid, including its vessels and pigment, acts as a colored screen which absorbs most light except red. The interposition of fluids or solids between the choroidal screen and the transparent retinal screen changes the fundus color values in retinal detachment. Monochromatic light including red-free causes the nerve fibers, interstitial tissues and vessels to appear more distinct and of a different color because these tissues are less permeable to light of short wave length.

In the ordinary electric ophthalmoscope, the observer uses a wide range of wave length. Retinal pigment epithelium loss increases distinctness because of the increased light which penetrates the choriocapillaris, the reflected color appearing brighter. Absence of the choriocapillaris renders only the larger vessels and interspaces visible with a variable amount of pigment which may appear gray, black or brown. Detached pigment epithelium migrates to the nearest retinal vessels, following the course of the interstitial intra-ocular fluid which is from the choroid to the vitreous. The fundus appears more dull and slightly opaque after the absorption of pigment from the retinal pigment epithelium.

Magnifications of 10 to 14 diameters are afforded by direct ophthalmoscopy. The central retinal artery is about 90 μ in diameter and vessels as small as 20 to 30 μ are visible under favorable conditions. The normal granular appearance of the fundus is ascribed to the hexagonal shape of the cells of the pigment epithelium, about 15 to 30 μ in diameter. The crystalline appearance frequently observed in perimacular exudation is caused by the increased fluids in the underlying choriocapillaris. In estimating fundus depth lesions are best aligned with the blood vessel planes. The larger vessels are in the nerve fiber layer and the smaller vessels extend to the internal granular layer. Pigment epithelium lesions are external to the retinal vssels. In myopia tension causes the retinal pigment layer to reflect more light and the fundus to appear more transparent and the details more distinct. The partial or total loss of the pigment epithelium tends to make the fundus appear lighter and brighter. Unfortunately, quantitative and qualitative changes in the interstitial fluids of the fundus, which play an important part in disease, cannot be studied in histologic sections. The fundus in life and death is quite different. Only with the ophthalmoscope can the cellular and interstitial tissues in health and disease be observed and interpreted.

Chas. A. Bahn

Boyd Law, T. **Intraocular infection and penicillin.** M. J. Australia 2:298, Sept. 6, 1947.

The author presents one case of a woman who had unilateral cataract surgery; the ultimate result was a slight prolapse of the pillars of the iris which was treated with trichloracetic acid. Visual acuity was 6/12 with correction. When next observed 14 months later there was an infection of the anterior chamber of the eye which had gained access along one of the prolapsed pillars. Intramuscular injections of penicillin were given, first 50,000 units and then 15,000 units every 4 hours, penicillin drops were instilled in the eye (1,000 units per millilitre) every 15 minutes for 5 hours, then every hour, and atropine was instilled. The eye did not respond. A kerotome incision was made and some of the penicillin solution was used to wash out the anterior chamber with a lachrymal syringe. This was repeated the next two days. Intramuscular injection of penicillin was continued until she received 1,000,000 units and penicillin drops were instilled several times daily. The eye responded rapidly and the patient was discharged 17 days later.

When next examined five months later, the pupil had contracted slightly, the eye was free of inflammation, and the lens capsule in the pupillary area was only slightly more dense than before the infection. A discussion was done and, through the gap obtained, a good view of the fundus showed no evidence of any damage in the posterior segment of the eye. Corrected visual acuity was 6/24.

Theodore M. Shapira.

Grignolo, Antonio. **Vivicillin for eye affections.** Boll. d'ocul. 26:179-188, March, 1947.

In 1944, Enoch and Wallersteiner described the inhibitory action on penicillin-resistant microorganisms of an antibiotic they called vivicillin, a suspension of living filaments of Penicillium notatum. A similar, possibly even identical, preparation was obtained from B. babudieri from the Instituto Superiore di Sanita in Rome and was used for treatment of blepharitis ulcerosa as well as squammosa, of catarrhal and of purulent conjunctivitis, of pseudomembranous, angular, and lymphatic conjunctivitis, keratitis, corneal ulcers, dacryocystitis, iridocyclitis, infected ocular wounds and postoperative infections. The application was either local, in drops, eye bath, or compresses, or general, by intramuscular injection. Excellent results were obtained in ulcerous blepharitis, which recurred nevertheless. Conjunctivitis caused by streptococci, staphylococci, Morax-Axenfeld diplobacilli, and infected wounds of the eye responded favorably. Lymphatic keratoconjunctivitis, dakryocystitis, gonorrheal conjunctivitis, Koch-Weeks conjunctivitis, corneal ulcers, and iridocyclitis did not respond to this therapy.

K. W. Ascher.

Panzardi, Domenico. **Penicillin in the prophylaxis of postoperative infections of the eyeball.** Boll. d'ocul. 25:501-519, Oct.-Dec., 1946.

The writer reports in tabulated form the results obtained in 55 intraocular and 25 extraocular operations on eyes in which the cultures had shown the presence of the staphylocci, streptococci, the micrococcus catarrhalis, the pneumococcus, the xerosis bacillus, the Morax-Axenfeld diplococcus and the Koch-Weeks bacillus. The use of penicillin in collyrium or ointment every four to six hours for one to three days destroyed the germs of the conjunctiva more completely than any other drug. Even after this short treatment cultures were sterile for 4 to 8 days which is long enough to prevent secondary infection of the wound. The tolerance of the eye to penicillin was good

for the duration of the postoperative treatment. However, the prophylaxis of surgical infections can be completed by the internal use of a sulfamide a day before and the two days after operation. (Bibliography.) Melchiore Lombardo.

Seidenari, Renato. **An ophthalmoscope lamp for retinal detachment.** Ann. di ottal. e clin. ocul. 72:491-494, Aug., 1946.

For facilitating the finding of retinal tears Seidenari presents a simplified electric ophthalmoscope for examination of the fundus by the indirect method. The light source is much more powerful than in the ordinary electric ophthalmoscope. Chromatic aberration is almost completely eliminated by the use of two condensing lenses with an interposed diaphragm.

Harry K. Messenger.

6

OCULAR MOTILITY

Martínez, Luis, Jr. **A case of fixed strabismus.** Am. J. Ophth. 31:80-81, Jan., 1948. (2 figures.)

McGuire, W. P. **The surgical correction of paresis of the superior oblique.** Am. J. Ophth. 31:65-77, Jan., 1948. (6 figures, 49 references.)

Smith, James W. **The problem of strabismus in childhood. With special reference to convergent strabismus in infancy and early childhood.** Am. J. Ophth. 31:85-89, Jan., 1948. (7 references.)

Verhoeff, F. H. **Problems concerning convergence.** Tr. Am. Acad. Ophth. pp. 15-19, Sept.-Oct., 1947.

If each eye moved independently, bifixation would be a simple matter if and when it became advantageous, and a special convergence mechanism would be unnecessary. The two eyes move precisely together as though mechanically connected, though the exact manner of the operation of this function is practically unknown. When an eye is directed downward and inward by the conjugate mechanism without the help of convergence, it undergoes relative extortion. When the inward movement is produced by the convergence mechanism, the eye undergoes intorsion. Convergence is, therefore, accomplished by the internal rectus muscles together with reduced innervation or inhibition of their antagonists. An eye can move further inward by conjugate action than by convergence. After maximal symmetrical convergence has been obtained through bifixation of an object in the midline, one eye at a time can be turned still further inward by carrying the fixation to the left for the right eye and vice-versa for the left, while bifixation is still maintained. Convergence is more restricted than conjugate motion because the convergence mechanism has only the internal rectus to turn an eye whereas the conjugate mechanism has in addition the help of the other ocular muscles, notably the superior and inferior rectus muscles. The other factors involved are: insufficient inhibition of the external rectus and the utilization of two different physiologic mechanisms, each with its separate muscle fibers and/or innervation.

Convergence is primarily involuntary although more or less voluntary control is frequently acquired, but is not used in ordinary vision. Convergence can seldom be disassociated from accommodation. The convergence necessary for bifixation is normally accomplished through accommodation, distance sense, and disparateness of the fixation object images. These factors cannot be completely disassociated. The deviation of an occluded eye when viewing a distant object through a concave lens proves that accommodation causes convergence. The distance sense hampers the convergence effect of accommodation because the fixated object con-

tinues to appear distant. The effect of nearness can be demonstrated by looking with one eye occluded at a near object through a convex lens which prevents accommodation. The occluded eye converges, but far from enough, although the convex lens makes the object appear nearer than it actually is.

When the convergence effect of accommodation is the same for each eye separately, it is probably also the same when both eyes are used. This is not true for the distance sense because the distance of the near object does not appear the same with one eye occluded as with both eyes open. The effect of disparate images can be studied with a stereoscope or with two dots on a card. When these approach each other by convergence, or relative divergence, with strong attention the two images unite and stay united without effort on the part of the observer. Thus the effect of accommodation or distance sense on convergence cannot be completely nullified.

Conscious concepts of depth are not produced by disparate images but unconsciously there may be depth perception which is associated with convergence or divergence. Binocular fixation is inversely proportionate to the image differences and in very near vision produced by efforts of accommodation and distance sense. In ordinary vision, convergence is involuntary and is produced partially by a sensory factor which is entirely subconscious.

Perlia's nucleus is involved in convergence but its method of function is not understood. Apparently it equalizes stimuli to the internal rectus muscles. Perlia's nucleus is apparently connected with the probable centers of pupillary contraction and accommodation. The association between convergence and accommodation is, generally speaking, hereditary and not acquired. In many patients with convergence strabismus since infancy, accommodation causes increased convergence. There is apparently no divergence center. Chas. A. Bahn.

7

CONJUNCTIVA, CORNEA, SCLERA

Arriaga Cantullera, José. **Sulfanimides and trachoma.** Arch. Soc. oft. hisp.-amer. 7:787-796, Aug., 1947.

The author reviews the literature, and reports his own investigations. One study comprises a group of 34 children in the first and second stages of trachoma treated in an orphanage. They were given a sulfa preparation internally, and a sulfa ointment locally. At the end of 20 days, 19 were discharged as cured, and the other 15 were treated for ten days longer; at that time they too were clinically cured. Reexamined at the end of one year, 30 were found cured, with smooth tarsal conjunctiva, and pale eyes. Two had follicles, without subjective symptoms and two had no follicles, but presented signs suggestive of trachoma, such as lacrimation, conjunctival congestion, and abnormalities in the tarsal vessels. In summary, 19 patients were cured with 30 to 40 grams of the drug, and 15 required from 45 to 55 grams. In an ambulatory group of patients treated in the same manner, the results were inferior to those obtained at the orphanage, which seems to indicate that other factors, such as hygienic surroundings, or proper nutrition play a part in the results obtained.

Another investigation concerned the effect of Irgafen, a sulfa preparation which, because of its affinity for blood plasma, produces a higher blood concentration with smaller doses. It was used in 60 patients in various stages of trachoma. The dose of Irgafen was half of that used with the other sulfa drugs. Of Irgafen 20 grams were administered during a period of three weeks; 10 grams were given in the first week, and after a week's interval 10 grams were given during the third

week. Tabulated data show that 68.33 percent of the patients were cured, and 21.24 percent improved. One patient, who failed to respond to the continuous administration of 40 grams of the drug, was given a subconjunctival injection of Irgamid. The injection was so painful, and the reaction of the lids so marked, that the patient did not return for further therapy. Seen three months later she was found cured. One patient was sensitive to sulfa drugs, and the treatment had to be abandoned. Arriaga concludes that the sulfa drugs act not only on the trachomatous complications and secondary infections, but exert a direct curative effect on the trachomatous process itself. (Bibliography.) Ray K. Daily.

Casari, G. F. **A case of aphthous conjunctivitis.** Rassegna ital. d'ottal. 16:377-385, Sept.-Oct., 1947.

A 38-year-old woman developed aphthae of the oral and vaginal mucosa, together with a polymorphous cutaneous erythema and a bilateral acute conjunctivitis. The condition was recurrent, but healed completely. The etiology was considered to be a tuberculous allergy.

Eugene M. Blake.

Colombo, G. L. **Rickettsial corpuscles in numular conjunctivitis.** Ann. d'ocul. 180: 470-474, Aug., 1947.

In a previous article the author reported the observation of rickettsial bodies in three cases of epidemic numular conjunctivitis, which term is preferred to epidemic keratoconjunctivitis.

The condition was exceptionally frequent in Italy during 1946 and was observed especially in returned prisoners from Germany and India. The characteristic symptoms include spontaneous pain, inflammation and swelling of the preauricular glands as well as catarrhal conjunctivitis with marked edema and follicculosis especially in the semilunar fold and caruncle. The inferior conjunctiva is usually more inflamed and contains more follicles. The conjunctiva of the upper lid is relatively normal. In this respect this conjunctivitis differs from another rickettsial disease, trachoma. The exudation is catarrhal.

The technique used for biologic cellular examination includes grattage after cocainization. The scrapings containing the epithelial cells are placed on several slides, and after fixation in ether and methyl alcohol are stained with Giemsa-Romanowski stain. The epithelial cells have violet nuclei and rose-pink protoplasm, while the rickettsial bodies are blue. The rickettsial bodies vary from 2 to 3 μ and the grouped masses from 200 to 300 μ in size. The latter appear as triangular caps on the nuclei or slightly separated as single or divided groups.

The author has not observed similar findings in conjunctival inflammations caused by other rickettsial diseases, which include trachoma, conjunctivitis of the new-born, and swimming pool conjunctivitis. The clinical differences strongly suggest that several types of the rickettsial group are involved. All differ from bacteria in morphology, in staining reaction, and chemically, in their agglutinin, precipitin, and amboceptor reactions. Clinical and pathological differences between the bacterial and rickettsial diseases are more or less marked. The conjunctival exudates in the latter consist almost exclusively of small monocular leucocytes.

The presence of rickettsial bodies has been observed by the author in numerous cases of numular keratoconjunctivitis which is considered a pathologic and clinical entity. Chas. A. Bahn.

Coverdale, Howard. **Ocular lesion associated with dendritic ulcer.** Supp. New Zealand M. J. p. 31, 1947.

Ten cases are presented illustrating the

association of dendritic ulcer with herpes facialis, superficial punctate keratitis, disciform keratitis, keratitis profunda, and iridocyclitis. Irwin E. Gaynon.

Godfrey-Smith, R. A. **Reiter's syndrome.** M.J. Australia 2:574-575, Nov. 8, 1947.

The author adds another report to the growing list of cases of Reiter's disease, a syndrome that consists of non-specific urethritis, polyarthritis and cojunctivitis. The association of this syndrome with bacillary dysentery has been suggested. F. H. Haessler.

Grossmann, E. E. **Treatment of corneal ulcer with blood and blood plasma.** Arch. Ophth. 37:779-781, June, 1947.

The cornea is avascular and derives its nourishment by dialysis from the perilimbal plexus. For this reason, healing of corneal infections may become sluggish and prolonged. It is also notable that frequently lesions of the cornea clear up only after vascularization has occurred. In view of the lack of an adequate nutrient supply system in the cornea, it would appear logical to apply the needed nutrient elements directly to the cornea in the form of drops of either whole blood or plasma. Gratifying results have been obtained when blood was used in paste form in several cases of indolent decubitus ulcers and in infected wounds. Six cases of corneal disease are briefly described, in which treatment consisted of the application of either blood plasma or whole blood. Good results were obtained. John C. Long.

Jayle, G. E. **Transfixing grafts of the cornea in the infant and adolescent.** Arch. d'opht. 7:148-155, 1947.

Jayle reviews the history of corneal grafts from the time of von Hippel in 1888 to the present time. He concludes that the current success of the operation as contrasted with earlier failures is due to minor changes in technique, to improvement in anaesthesia and akinesis, and to the great improvement in control of bacterial infection, rather than to any fundamental changes. The author then describes in detail his own operative technique and offers two illustrative cases to show the indications for operation and the handling of complications. Among all the possible complications he stresses the relative importance of glaucoma and advocates trephining for its control and even as a means of prophylaxis in certain cases. He notes that successful grafts are possible even in the very young. Phillips Thygeson.

Klauder, J. V. **Treatment of interstitial keratitis with particular reference to the results of penicillin therapy.** Am. J. Syph., Gonor. and Ven. Dis. 31:575-599, Nov., 1947.

Seventy-two patients with interstitial keratitis were treated with penicillin.

The addition of penicillin to the therapy of interstitial keratitis does not give results superior to other forms of treatment, such as fever-chemotherapy without penicillin and no treatment eliminates the devastating effect of the disease. (5 tables, references.) Bennett W. Muir.

Scuderi, G. **Leishmaniasis of the eyelid associated with keratitis.** Rassegna ital. d'ottal. 16:335-356, Sept.-Oct., 1947. (See Section 15.)

Shuttleworth, F. N., and Benstead, J. G. **Primary meningococcal ophthalmia.** Brit. M. J. pp. 568-569, Oct. 11, 1947.

Attention is drawn to the importance of recognizing the meningococcus as a primary cause of conjunctivitis.

Two cases in Leeds school children are described. One patient was eventually treated with local application of sulfacetamide and the second with penicillin with

good results. Some aspects of the literature are discussed.

Theodore M. Shapira.

Stern, H. J. **Acute ocular manifestations of riboflavin deficiency.** Ophthalmologica 114:103-106, Aug., 1947.

A white woman, 52 years of age, presented herself in the Eye Clinic of the Hadassah University Hospital in Jerusalem because of redness, burning and itching of both eyes of several days' duration. Her diet had been very low in riboflavin for many months. Ophthalmological examination revealed marked congestion of the bulbar conjunctiva and of the marginal vascular plexus of the cornea. From the latter fine radial vessels invaded the subepithelial layers of the cornea for as much as 3 mm. The peripheral rim of the cornea was slightly edematous. Under riboflavin treatment by mouth (5 mg. three times daily) the eye improved dramatically.

Peter C. Kronfeld.

Vancea, P. **Electrometric variations of the tissue pH in trachoma.** Arch. d'ophth. 7:156-160, 1947.

Vancea reports on the variations in tissue pH observed in 16 cases of trachoma before and after treatment, as recorded by the ionometer of Brehmer. He found the normal tissue pH values to vary from 7.90 to 8.10 according to the part of the conjunctiva studied. In contrast, the average pH of the 16 trachomatous conjunctivas of the upper cul-de-sac measured 7.42; in the same individuals the average pH of the unaffected bulbar conjunctivas was 8.01. After follicular expressions the pH of the trachomatous conjunctivas rose to an average of 7.95 which is considered normal. Vancea concludes that under the influence of trachoma virus there occurs an acidification of the affected tissues which disappears under treatment. This return to normal pH precedes the actual healing of the disease.

Phillips Thygeson.

Venco, Luigi. **Considerations on the various phases of the process of union of homoplastic corneal transplants.** Ann. di ottal. e clin. ocul. 72:513-545, Sept., 1946.

From his clinical observation of 67 homoplastic transplants Venco distinguishes five phases or stages in the union of the implant with the recipient cornea. These phases arise at varying intervals after the keratoplasty and vary greatly in their severity. Complications, whether operative or postoperative, are excluded from consideration.

The first phase ("hydration of the implant") occurs invariably. At the first dressing both the implant and the recipient cornea are found to be opalescent and obviously swollen. The hydration usually disappears, at least macroscopically, within the first ten days.

The second phase ("inflammatory reactions") includes the usual phenomena of ocular inflammation which may vary greatly but usually subside in 10 to 20 days. These are linked with the process of cicatrization of the corneal wound, with the interaction between the implant and the surrounding tissue, and with the "ergic" status or reactive capacity of the individual. Vascularization of the recipient cornea is more or less constant in this stage, but ordinarily the newly formed vessels do not extend into the implant.

The third or "postvital" phase occurs in 18 to 24 days and seems to mark the limit of the survival of the implant, which henceforth is subject to new metabolic relations. Union between it and the cornea has been established. The phenomena which occur in this stage are of capital importance for the success of the keratoplasty and are attributed to the inevitable regressive processes of autolysis and autodigestion of dead tissue. In this phase the implant may become vascu-

larized and more or less opaque, and the changes are reversible only in part. The larger the implant the more severe these regressive changes are likly to be. Venco believes that frequent instillations of dilute hydrogen peroxide are of value in combating the tissue anoxia in this stage.

The fourth phase, which is inconstant, comprises various "tissue phenomena" attending the gradual transformation undergone by the implant in its new seat. These changes, manifested clinically by vascularization or loss of transparency, are usually not attended by inflammation and may occur months after the keratoplasty. In general, if the transplant is successful at the end of a year it is likely to continue so, barring those changes included in the fifth phase.

The fifth phase of "remote disturbances," is likewise inconstant, but frequently occurs because the implant behaves as a locus minoris resistentiae. The implant is prone to be affected by dystrophies, inflammations, and other morbid processes. (50 references.)

Harry K. Messenger.

8
UVEA, SYMPATHETIC DISEASE, AQUEOUS

Campos, Raffaele. **A case of choroidal angioma with ossification of the lamina vitrea.** Boll. d'ocul. 26:145-170, March, 1947.

A 12-year-old boy with an angioma (nevus flammeus) of the right side of his face was admitted for the purpose of an extraction of his right lens for traumatic cataract. When five years old he was hit in that eye and this trauma caused an apparently uncomplicated traumatic cataract. Uncertain light projection was the only suspicious sign, and a linear extraction was performed with abundant hemorrhage. Bleeding continued and the eye was enucleated 16 days after the extraction. Four weeks after the enucleation of the right bulbus, an inflammation, most probably sympathetic ophthalmia, developed in the left eye. This inflammation healed within seven weeks under local mydriatic and dionine treatment, with application of leaches, and chinophenyl and urotropin injections followed by mercury ointment as for secondary lues. Blood Wassermann and tuberculin tests were negative. An extensive description of the histopathologic findings is supplemented by six photomicrographs. Near the optic nerve head of the enucleated eye, uveal angiomatosis with fibrous and bony tissue formation was noted. Degenerative processes of the lamina vitrea such as Kuhnt-Junius disease and angioid streaks are discussed. (36 references.)

K. W. Ascher.

Laval, Joseph. **Subretinal hemorrhage simulating sarcoma of the choroid.** Am. J. Ophth. 31:82-83, Jan., 1948. (2 figures.)

Lees, V. T. **A case of metastatic osteosarcoma in the choroid.** Brit. J. Ophth. 31: 713-716, Dec., 1947.

The author presents a case of the first recorded instance of metastatic osteosarcoma in the eye. The occurrence of intraocular metastatic sarcoma is unusual. The postmortem specimens showed such a distinctive cell pattern of trabeculae of osteoid tissue with the tumor cells in the interstices, that it was possible from that alone to diagnose bone sarcoma without reference to the history of osteosarcoma of the knee for which amputation had been performed. O. H. Ellis.

Lemoine, P. **Acute iritis and allergy.** Arch. d'opht. 7:161-166, 1947.

The author notes that there has been an increasing tendency to consider allergy as a cause of ocular inflammations of uncertain etiology. He then reviews the theories of the mechanism of allergy, with particular reference to the liberation

of histamine, and suggests that allergy may be concerned in acute iritis and that it may indeed be the cause of the initial symptoms in the majority of cases in spite of primary involvement with an infectious agent. On the basis of this hypothesis Lemoine subjected 30 patients to antiallergic therapy consisting of a series of intravenous injections of hyposulfate of sodium. He kept a control group on the customary local therapy alone. In the group treated antiallergically there was rapid diminution in inflammation, relief from pain, and rapid improvement in vision. No signs of intolerance to the drug were noted. From 9 to 12 injections were usually administered. He concludes that the therapeutic results obtained favor his hypothesis. Phillips Thygeson.

McPherson, S. D., Jr., and Woods, A. C. **The significance of the intracutaneous test for hypersensitivity to uveal pigment.** Am. J. Ophth. 31:35-45, Jan., 1948. (7 figures, 4 tables.)

Samuels, B. **The problem of sympathetic ophthalmia.** Irish J. M. Sc. pp. 610-621, Oct., 1947.

The etiology, pathology, pathogenesis, diagnosis and treatment of sympathetic ophthalmia is discussed. Secondary glaucoma in the sympathizing eye should be treated by repeated paracentesis.

Irwin E. Gaynon.

Sédan, J. **Large unilateral stromal hypoplasia of the iris.** Ann. d'ocul. 180:466-469, Aug., 1947.

This constitutional anomaly usually involves the lower part of iris and the pupil is round. In the case reported the temporal quadrant of the iris was hypoplastic and the pupil was flat on the temporal side.

A dark brown triangular area, in the temporal quadrant of an otherwise blue iris, was observed in a Polish woman aged 23 years. The brown area was practically level with the remaining iris and contained several concentric folds. The temporal pupillary flatness persisted in mydriasis. Otherwise both eyes were structurally and functionally normal. This type of pupillary flatness is usually traumatic. No change had been observed in the iris and pupil by several ophthalmologists who had examined the patient since birth. The lesion is probably congenital and not progressive. (1 figure.)

Chas. A. Bahn.

9

GLAUCOMA AND OCULAR TENSION

Chandler, P. A., and Johnson, C. C. **A neglected cause of secondary glaucoma in eyes in which the lens is absent or subluxated.** Arch. Ophth. 37:740-771, June, 1947.

A form of secondary glaucoma in aphakic eyes and in eyes with dislocated lenses is discussed, in which the causative factor is apparently a block between the anterior and the posterior chamber. This block may arise from a membrane partly or wholly inflammatory, from the herniation of vitreous through the pupil acting as a plug, or from adhesion of the iris to an intact hyaloid membrane.

Treatment consists of the re-establishment of communication between the chambers by the use of a mydriatic, by discission of a pupillary membrane, by transfixion of the iris or by iridectomy. Treatment should be begun early before permanent peripheral anterior synechias are formed. A block of the pupil by vitreous in an aphakic eye, or one with posterior dislocation of the lens, with resultant increased pressure in the posterior chamber, is the probable cause of large accumulations of vitreous in the anterior chamber. In aphakic eyes in which the pupil is completely blocked by a membrane, it is advisable to do preliminary transfixion of the iris before undertaking

a discission of the membrane. Fourteen illustrative cases are presented.

John C. Long.

Cristini, Giuseppe. **The action of Roentgentherapy on the sympathetic centers of the medulla in glaucoma.** Riv. oto-neuro-oftal., 22:124-147, March-April, 1947.

Nine cases of glaucoma are reported in patients 41 to 70 years of age. Seven of the patients were male. The vision, tension, conditions of the fundus, the condition of the fields, and their changes after treatment are given in detail. A resume of the result obtained is given with a discussion on the effect on three cardinal symptoms of glaucoma: hypertension, optic atrophy and campimetric changes. It is concluded that irradiation of the medullary sympathetic centers and the ciliospinal center of Budge leads to results as satisfactory as after treatment now used in similar cases. (16 figures, bibliography.) Melchiore Lombardo.

François, J. **Glaucoma and cataract.** Ann. d'ocul. 180:457-465, Aug., 1947.

Cataract may cause or be caused by glaucoma, or their co-existence may be coincidental. The probable duration of each is measured in part by changes in the visual fields and the pupils which are important diagnostically.

In chronic glaucoma with beginning cataract a preliminary iris inclusion operation is preferred. The lens extraction can follow if and when the attendant risks are justified.

If an eye that has been operated upon for chronic glaucoma has an operable cataract, the decision to remove the cataract depends upon the surgical risks involved. Obviously, higher risks are justified if necessary to afford or maintain slight sight. Intracapsular extraction, especially if preceded by capsular micropuncture, is less apt to be followed by secondary uveitis. Suction, even in the hands of those who can use it efficiently, has the disadvantage of requiring a deeper anterior chamber than forceps. Generally speaking, when vision in the better eye is reduced to 20/100 because of cataract, lens extraction is advisable. Interference with a filtering scar in a lens extraction is usually ill advised; incisions should be lateral or inferior to the filtering scar.

In chronic glaucoma with operable cataract, if tension is reasonably low a lens extraction with a complete iridectomy usually involves the least risk. The two stage operation has the disadvantage of double exposure to both trauma and infection as well as their complications such as uveitis, vitreous loss, and lens dislocation. Only the removal of the lens, because of the reduction of the volume of the intraocular contents may permanently reduce the tension. If tension is above 35 mm. Hg a two stage operation is preferred with a minimal interval of six months between operations.

In co-existent glaucoma and cataract, miotics usually must be supplemented sooner or later by surgery. The earlier the surgery is done the better and operations which may have to be repeated, such as cyclodialysis, cyclodiathermy, iridectomy, and sclerotomy should be avoided. Surgery with filtering cicatrices and iris inclusion is preferred to operations of the Elliot and Lagrange type. Surgery should be directed against glaucoma primarily and secondarily against cataract. Cataract extraction in very hard eyes can only result in grave complications, such as extensive vitreous loss and intraocular hemorrhage. Intracapsular extraction is usually preferable if efficiently conceived and performed. Three illustrative cases are presented. Chas. A. Bahn.

Lavine, O., and Langenstrass, K. H. **A new drainage operation for the relief of glaucoma.** Am. J. Ophth. 31:78-80, Jan., 1948. (4 figures.)

Mulock Houwer A. W. **Leucoma adherens and glaucoma.** Ophthalmologica 113:303-308, May, 1947.

Mulock Houwer reports a case of secondary glaucoma after gonorrheal keratoconjunctivitis in a native of the Dutch East Indies. The upper-temporal sector of the cornea was very thin and ectatic (apparently a keratectasia after a large gonorrheal ulcer). Two tags of pigmented tissue with fringes projecting into the anterior chamber were attached to the posterior surface of the ectatic portion of the cornea. Mulock Houwer interprets these findings as follows: in the large ulcer that occupied the upper-temporal sector of the cornea, a small perforation occurred. Because of the presence of posterior synechias the iris prolapse remained very small. After an absence of the chamber for several days the corneal perforation became water tight, the chamber was restored and the anterior synechias broke, leaving only tags of iris tissue on the posterior surface of the cornea. During the absence of the chamber peripheral anterior synechias formed, and gave rise to secondary glaucoma. The author's main point is that the peripheral and not the central anterior synechias are the cause of secondary glaucoma after corneal perforation.

Peter C. Kronfeld.

Mulock Houwer A. W. **The pathology and therapy of corneal fistulas.** Ophthalmologica 113:309-315, May, 1947.

The article is based upon the author's very extensive experience with cases of corneal fistula following severe keratoconjunctivitides (mostly gonorrheal) in natives of the Dutch East Indies. His conclusions are very similar to those of Kronfeld (Am. J. Ophth. 23:1014, 1940) based on the latter's experiences in North China. The main fact to be kept in mind is that the fistulous eye depends upon the fistula for maintenance of a normal intraocular pressure. The normal outflow channels have been closed and the fistula has become the safety valve of the eye. The fistula can only be closed by giving the eye other channels of outflow. This is best accomplished by one or two cyclodialyses after which the fistula usually becomes obliterated. Kronfeld prefers Wootton's combined iridectomy and cyclodialysis followed by excision and keratoplastic repair of the fistula.

Peter C. Kronfeld.

Natale, Amadeo. **Evaluation and mechanism of the destructive effect of ocular hypertension.** Arch. d'opht. 7:129-147, 1947.

This complete and well documented review of the subject of the pathogenesis of glaucoma does not lend itself well to abstracting. The review considers first the clinical significance of increased intraocular pressure and the methods of measuring it. The relation of intraocular pressure to venous and arterial pressures and to the pressure of the spinal fluid is considered. Natale concludes that the figures commonly given for the intraocular pressure are too high. He notes the lack of correlation between the degree of pressure rise and the visual functions. Next in order are considered angioscotometry and its significance, the theories of the origin of the aqueous, provocative tests, and the significance of extraocular nervous factors and such other extraocular factors as hypertension and edema. Gonioscopy and aqueous veins are also discussed and, finally, the diagnostic value of observations on the papillomotor reflex.

Phillips Thygeson.

Redslob, Edmondo. **The treatment of hydrophthalmia.** Ann. di ottal. e clin. ocul. 72:449-454, Aug., 1946.

The treatment of hydrophthalmos must generally be surgical. The operation of choice is a perforating diathermy coagu-

lation of the ciliary body, as described by Vogt, which requires less precision than the usual decompressive procedures and can be done rapidly under local anesthesia. Hydrophthalmos is frequently a manifestation of hereditary syphilis and general anesthesia may be fatal because of dysfunction of the liver. Redslob employs a simpler technique than Vogt's: he makes a series of eight diathermy punctures around the limbus, two in each quadrant, 2 mm. from the cornea. He does not incise the conjunctiva but makes each perforation through both conjunctiva and sclera, with a needle about one millimeter long, which is applied for one or two seconds. When the needle is withdrawn a trace of clear liquid (watery vitreous) may be seen to exude. This augurs well for the success of the operation. He thinks that the operation is effective not only because it inhibits the secretion of the aqueous but also because it produces a kind of fistulization.

Redslob has used this method in about 50 cases of glaucoma of every kind, and has not observed the least complication. On the day following operation the tension may be elevated, but two or three days later it falls and may remain at a normal level or even lower. The operation has proved ineffective in hemorrhagic glaucoma, but in simple glaucoma the results are excellent.

Harry K. Messenger.

Reese, A. B. **The significance of the base pressure in primary glaucoma.** Am. J. Ophth. 31:25-27, Jan., 1948.

Talbot, Craeme. **Alternative operations to corneo-scleral trephining in treatment of glaucoma.** Supp. New Zealand M. J. pp. 37-38, 1947.

Cyclodialysis may be done in eyes with chronic simple glaucoma when the tension is below 40, in aphakia, and when the disease is not quite controlled with miotics. Delayed re-formation of the anterior chamber is seldom met with in cyclodialysis. Cataract formation and late infection is reduced in cyclodialysis in comparison with trephining.

Irwin E. Gaynon.

10

CRYSTALLINE LENS

Clapp, C. A. **Some medico-legal aspects of traumatic cataract.** South. M. J. 40: 998-1000, Dec., 1947.

Fifteen percent of 300,000 eye injuries each year are associated with lens opacities. Penetrating wound and contusion cataracts should be observed for a minimum of three months to be sure the opacity is complete. If complete loss of vision is present, the cataract should be removed. Concussion cataract may be diagnosed by the rosette formation. Malingering should be tested for.

Irwin E. Gaynon.

Focosi, Marcello. **Answer to the note of Dr. Foddis concerning the central scotomas produced by changes in the posterior lens capsule of aphacic eyes.** Boll. d'ocul. 26:98-102, Feb., 1947.

A patient operated on for senile cataract by extracapsular extraction, with round pupil, had 10/10 corrected vision; one year later, corrected vision was only 3/10 and a relative central scotoma for red was present. This scotoma disappeared after discission of the secondary membrane and vision returned to 10/10. The author asked Professor Vasco Ronchi for an explanatory discussion which is reprinted in extenso. Ronchi agrees with the explanation previously given by Focosi that the central scotoma in these cases is due to a deterioration of the retinal image, attributable to the irregular opacification of the posterior lens capsule.

K. W. Ascher.

François, J. **Glaucoma and cataract.** Ann. d'ocul. 180:457-465, Aug., 1947. (See Section 9.)

Jones, Edgar. **Comments on hypoparathyroidism and cataract formation.** Am. Practitioner 2:167-169, Nov., 1947.

Lack of parathyroid hormone allows calcium in the aqueous to penetrate the lens capsule which results in the formation of cataracts after exposure to ultraviolet light. This may occur after thyroidectomy. Two cases are reported. One patient did not wear glasses and developed bilateral cataracts. The second patient wore glasses which presumably gave protection against exposure to ultraviolet light and did not develop cataracts.

Irwin G. Gaynon.

Stallard, H. B. **Cataract.** Practitioner 158:383-393, May, 1947.

The etiology of cataract is discussed briefly. Important factors are the biologic effects of senescence, local disturbances in the metabolism of the lens that result from specific diseases and the effect upon the lens of such general metabolic disturbances as vitamin deficiencies and endocrine dysfunctions. Lens changes occur in 96 percent of persons over 60 years of age. The degree to which the patient is incapacitated in relation to his particular type of work is the factor which determines when operation should be performed. Unilateral mature cataracts should be kept under observation and operation performed at the first signs of onset of hypermaturity. The author advocates the use of corneo-scleral sutures to close the wound. Ninety-six percent of patients operated on for cataract recover useful vision. Benjamin Milder.

Pittar, C. A. **Intracapsular cataract extraction.** Supp. New Zealand M. J. pp. 13-17, 1947.

A method of intracapsular cataract extraction is described. The author uses keratome and scissors section, peripheral iridectomy, and extraction and seals the conjunctival flap to the episcleral tissues by forming a coagulum with plasma.

Irwin E. Gaynon.

Vos, T. A. **"Extraction en carré" of secondary cataracts.** Ophthalmologica 113: 319-320, May, 1947.

The author describes the following method for the partial extraction of secondary cataracts: a central square "window" is cut into the secondary cataract by means of two discission knife-needles. First, the two vertical sides of the window are cut with a discission knife introduced through the temporal part of the limbus. With another needle-knife introduced at 6 o'clock the two horizontal cuts are made. Finally, the square piece is removed through a small keratome incision from below. "The greatest advantage of the method is that traction on iris or ciliary body is avoided." The author does not state how many times he has used this method or what his results have been. Peter C. Kronfeld.

Wolfe, O. R. **Twenty years experience with the Barraquer technic of cataract extraction.** J. Internatl. Coll. Surg. 10:398-403, July-Aug., 1947.

A conjunctival flap, keratome section and enlargement of the incision is made with scissors. Conjunctival sutures are placed in the 10, 12 and 2 o'clock positions. The Barraquer vacuum forceps is applied to the lens capsule. The lift on the lens is made forward toward the center of the cornea, while counter pressure is made just below the limbus on the vitreous thereby performing a combined extraction. The erisphake is the best means of grasping the capsule in intumescent and immature cataracts.

Irwin E. Gaynon.

11
RETINA AND VITREOUS

Bjork, Stina. **Haemodynamic factors and retinal changes in hypertensive diseases.** Acta. Med. Scan. suppl. 175, pp. 1-165, 1946.

This monograph summarizes a study on 228 patients of three years' duration. In an attempt to uncover information about the origin and development of the hypertensive diseases, the patients were divided into two major age groups, from 14 to 40, and from 41 to 65.

The study consisted of a blood pressure measurement (after Korotkoff) and an analysis of the circulation (after Broemser and Wezler-Boger). The eye examination consisted of a measurement of vision and a refraction, ophthalmoscopic examination, measurement of the caliber of the retinal vessels (after Lobeck) and determination of the diastolic pressure of the central retinal artery (after Bailliart).

The 117 patients with essential hypertension, were found to have a narrower arterial caliber than the 59 with normal circulation. There was no significant difference in the caliber of the vessels in essential hypertension with and without retinopathy. The 34 patients with nephritis with or without retinopathy did not show a significant difference in arterial caliber when compared with normal subjects. The 11 patients with diabetes mellitus with hypertension and retinopathy did not show any significant differences in the factors which determine blood pressure when compared to findings in patients showing the same retinal picture with hypertension alone. The seven cases of thrombosis of the central retinal vein with hypertension show the same haemodynamic factors as cases of essential hypertension without fundus changes.

The author feels that the recording of the diastolic pressure of the central retinal artery yielded no information of importance beyond that obtained by recording the diastolic blood pressure in the brachial artery.

The development of fundus changes is due to a disturbance of nutrition in the retina. This is brought about by the early loss of elasticity of the large vessels arising from the heart. The appearance of a gradual increase in the total peripheral resistance with a simultaneous decrease in the cardiac output then causes a gradual diminution of the blood supply to the retina, with a local anoxemia. (18 figures, 18 tables.) H. C. Weinberg.

Couadau, A., and Planques, P. **Ophthalmoscopy in malignant arterial hypertension.** Rev. oto-neuro-oftal. 22:27-31, March-April, 1947.

In individuals over 50 years of age with chronic essential hypertension there are found the usual permanent lesions due to changes in the arteriolar and capillary walls, marked elevation of retinal arterial tension, and spasmodic exudative lesions such as hemorrhages, exudates, and edema. Occasionally one finds central vein thrombosis and almost total spastic arterial closure. In malignant arterial hypertension the eye changes occur between 25 and 50 years of age. Here the dangerous prognostic picture is neuroretinitis, in addition to hemorrhages, exudates, and spastic arterioles.

Edward Saskin.

De Ruyter, J. **The pathogenesis of lesions involving the ganglion of the optic fascicle.** Ophthalmologica 113:276-279, May, 1947.

The author's main point is that in a number of diseases which have been designated as retrobulbar neuritis the lesion is actually in the ganglion cell layer of the retina and not retrobulbar. If it were retrobulbar it should not be called neu-

ritis because the optic nerve is not a nerve, and also because the pathological process is usually not inflammatory. It has been definitely established that in methyl alcohol intoxication in man the multipolar ganglion cells of the retina are primarily affected. In tobacco and ethyl alcohol poisoning as well as in luetic optic atrophy the primary site of the lesions in the third neuron may also be in the ganglion cell layer of the retina. The author tries to correlate this apparent vulnerability of the ganglion cells with their ascorbic acid content (the other retinal layers containing practically no ascorbic acid). "In case of the development of a lesion of the optic fascicle due to tabes, we will try to improve the defective cell respiration by putting the required vitamins at the disposal of the cells. It must still be elucidated if ascorbic acid gives better results than the vitamins of the B group." Peter C. Kronfeld.

Doucet, P. **Softening of the retina in sectors and its relation to detachment.** Arch. d'opht. 7:167-170, 1947.

Doucet considers the various theories of the origin of retinal detachment, including traction by vitreous strands and retinal holes due to cystoid degeneration and choroidal atrophy. Cases have occurred in which white retinal streaks with obliterated vessels and atrophy of nerve tissue have been noted. The author reports two observations illustrating this type of retinal change. In his first case a man of 33 years with 16 diopters of myopia gradually lost vision in the right eye over a period of several years. There was a large flat detachment of the retina that involved the area about the macula, with a sector-like vascular disturbance and gross retinal lesions that consisted of spots of retinal atrophy.

In the second case a man of 37 years with a history of active tuberculosis had a detachment in the left eye following a tuberculous iridocyclitis with multiple iris tubercles. The detachment was sector-like in character and had a single radial tear at 2 o'clock. This was closed by operation. After operation the lesion could be seen to be essentially a degeneration of the retina consecutive to an incomplete arterial thrombosis. The area of retinal disturbance continued to increase, however, and the detachment later recurred.

The author concludes that in both these cases an arterial lesion was at fault, resulting in multiple lenticular plaques of retinal atrophy. He believes that arteritis unquestionably plays a role in the production of certain cases of retinal detachment. Phillips Thygeson.

Fischer, F. P., and Moorrees, H. G. **"Camp eyes" and solar retinopathy.** Ophthalmologica 114:10-15, July, 1947.

During 1945 and 1946 two types of disturbances of central vision made their appearance in the Dutch Eye Clinics: (1) the cases of "camp eyes" in persons that had been released from the Japanese camps for civilians and prisoners of war in the Dutch East Indies and had returned to Holland, and (2) cases of solar retinopathy in residents of Holland who during the partial solar eclipse of 1945 had exposed their eyes to an excessive dose of sunlight.

Fischer and Moorrees were struck by the similarity between the two diseases. Fischer had had considerable experience with severe cases of solar eclipse retinopathy (results of the eclipse of 1912) and Moorrees had been an internee in one of the Japanese camps for Dutch civilians on Java from 1942 to 1945. There he had daily contacts with early and advanced stages of "camp eyes."

The permanent residues of both diseases are very similar indeed. The central area is riddled with small scotomas which produce annoying metamorphopsia, but are compatible with a visual acuity up to

20/40. Ophthalmoscopically, the pigmentation in the macular region is irregular (most noticeable in red-free light), and the normal reflexes are absent.

The question arises how a fairly diffuse macular lesion such as is entailed in solar retinopathy can lead to multiple small scotomas which break the central area up in many little islands. To answer this question, Fischer and Moorrees invoke the theory of Hartridge according to which the retinal cones are normally arranged in clusters.

"Camp eyes" is undoubtedly a disease of undernourished people living in the tropics. Malnutrition of the same or greater severity such as must have prevailed in many parts of Europe did not produce "camp eyes." Since life in the Dutch East Indies entails more exposure to sunlight than life in Central or Western Europe, the authors feel justified in attributing the retinal damage in "camp eyes" to the action of the tropical sun upon a tissue that has become sensitized to light by a dietary deficiency such as is present in pellagra. The authors thus consider "camp eyes" primarily a retinopathy and not an optic nerve lesion. Treatment is effective only in the earliest stages of the disease. Peter C. Kronfeld.

Jona, S., and Camerini, R. **Therapy of retinitis pigmentosa by irradiation of Budge's ciliospinal center.** Riv. oto-neuro-oftal., 22:66-84, Jan.-Feb., 1947.

The writers consider spasm and hyaline degeneration of blood vessel walls to be important factors in the pathogenesis of retinitis pigmentosa. They report various means to control spasm and mention the surgical procedures upon the cervical sympathetic system. They tried inhibition of the cervical sympathetics by irradiation. In five out of seven patients of the same family the treatment was followed by an improvement either in visual power or in visual field. A hyaline degeneration of vessel walls was excluded in the five patients. It is the writers' opinion that irradiation therapy has the advantage over surgical therapy that it may be repeated. (Bibliography.)

Melchiore Lombardo.

Katzin, H. M., and Blum, John. **Transplantation of vitreous. A preliminary report.** Brit. J. Ophth. 31:760-766, Dec., 1947.

The authors review the literature on transplantation of the vitreous and report the results of experiments of vitreous transplant in rabbit eyes. The vitreous can usually be successfully transplanted. This is better than replacement with saline. It is, however, not without complications such as retinal detachment, traumatic cataract and fibrous tissue proliferation. Vitreous haze, thought to be due to alteration in physico-chemical properties of the injected vitreous, was present in a high percentage of the transplants, but usually cleared completely. (16 references.) O. H. Ellis.

Miller, A. J., and Cuttino, J. T. **On the mechanism of production of massive preretinal hemorrhage following rupture of a congenital medial-defect intracranial aneurysm.** Am. J. Ophth. 31:15-24, Jan., 1948. (7 figures, 30 references.)

Oxilia, Efisio. **Vascular anomalies of the retina: prepapillary arterial loop.** Ann. di ottal. e clin. ocul. 72:408-427, July, 1946.

A case is described and pictured of a prepapillary arterial loop of three spiral twists projecting two millimeters from the retina into the vitreous in the left eye of a 42-year-old woman. One limb arises from the disk, and the other is connected with a vessel on the retina. The distribution of the vessels, which are moderately tortuous, is irregular. The lower nasal quadrant is supplied at least in part from

the superior nasal branch of the central retinal artery, and a cilioretinal artery is present on the temporal side.

Oxilia reviews the literature on congenital vascular anomalies of the fundus since 1858, and of four hypotheses prefers that advanced by Little in 1881, according to which the loop is due to the exaggeration of the tortuosity of a single retinal vessel during the period of development.

Harry K. Messenger.

Redslob, E. **The pathogenesis of retinitis pigmentosa.** Ophthalmologica 113: 290-302, May, 1947.

Redslob reports the case of a female infant, 14 months of age, who shortly after vaccination against smallpox lost most or all the sight in both of her eyes. The pupils were in the state of amaurotic fixation. The fundi showed severe retinal ischemia. After six weeks of treatment with vasodilators and arsenicals the vision returned and the pupils resumed their normal activity. The discs, however, remained pale, the retinal vessels markedly narrowed and the eyegrounds retained the appearance of "pallor" that made Redslob think of arterial spasm in the choroid in addition to the retinal angiospasm. Ten years later he saw the child again. According to the parents, she had developed normally, had learned to read and write and did well in school. She herself complained of poor vision at night. Her corrected central vision was 0.5 in each eye, the visual fields were tubular and the fundi showed the picture of a typical advanced pigmentary degeneration of the retina.

Redslob reviews the theories concerning the pathogenesis of pigmentary degeneration of the retina. He concludes that these degenerations must be divided into two main groups, the so-called independent forms which are not due to heredity but to injuries, infections, intoxications; and the second group in which heredity is the basis of the retinal degeneration as well as of the associated neurological and other disturbances. The case reported in the paper belongs to group one.

Peter C. Kronfeld.

Stearns, S., Friedman, E., Lugitch, M., and Hoffman, S. H. **Lipemia retinalis.** New England J. Med. 238:16-17, Jan. 9, 1948.

This, the sixty-third case of lipemia retinalis to be reported, occurred in a four and one half-year-old girl. There was an associated diabetic acidosis and a blood cholesterol of 1010 mg. per 100cc. The pupils were equal and active and the lenses were clear. In each eye the fundus was pale and the vessels were cream-colored ribbons. Arterioles and veins were indistinguishable.

Irwin E. Gaynon.

Wasmund, C. W. **A study of the angle of bifurcation of retinal vessels.** Am. J. Ophth. 31:12-15, Jan., 1948.

12

OPTIC NERVE AND CHIASM

Levin, S., Trevett, L. D., and Greenblatt, M. **Syphilitic primary optic atrophy.** New England J. Med. 237:769-772, Nov. 20, 1947.

This is a review of 54 cases seen at the Boston Psychopathic Hospital during the years 1921-1944. Gradual visual loss was the first manifestation of trouble in 63 percent. The serologic reactions in untreated cases is negative only rarely. Pupillary abnormalities were present in 49 out of 51 (Argyll-Robertson in 36 of these). Tabetic features were mild, and no patient had marked ataxia. Visual fields showed moderate irregular constriction. The spinal fluid generally was strongly abnormal (Group III, paretic type). Without treatment there was frequent visual loss of 1/200 or less in both eyes within twelve months, which empha-

sizes the need for prompt treatment. Chemotherapy is no guarantee that optic atrophy will not occur. Treatment does not necessarily improve vision, but there is hope that it will keep it from deteriorating. The optic atrophy may respond well provided treatment is started soon enough. Artificial fever is an important addition to therapy. (1 table, 1 figure, references.) Bennett W. Muir.

McLean, J. M., and Ray, B. S. **Soft glaucoma and calcification of the internal carotid arteries.** Arch. Ophth. 38:154-158, Aug., 1947.

In 1932 Knapp reported cases of atrophy of the optic nerve with shallow cupping, defects of the visual fields which tended toward altitudinal hemianopsia and persistently normal tension. He was able to demonstrate roentgenographically the calcification of the arteries at the base of the brain in all 10 cases. The authors report a similar case in a man aged 61 years. The patient had had various diagnoses of glaucoma in spite of low intraocular pressure and had had an iridectomy done in one eye. Roentgenograms of the skull were normal and failed to disclose any unusual sclerosis of the carotid arteries. An exploratory craniotomy was done. Both optic nerves were longer than usual and ran up over the internal carotid arteries. Both nerves appeared atrophic. At the point where the nerves crossed the arteries they were flattened in ribbon-like fashion. The internal carotid arteries beneath were sclerotic, and each had a calcified plaque in its wall directly under the nerve. On direct observation, these calcified plaques could be seen hammering against the optic nerves with each pulse beat. It was felt that nothing constructive could be done. The patient made an uneventful recovery with no change in the visual status. John C. Long.

Salgado Benavides, E. **A contribution to the study of the non-pathologic optic papilla.** Arch. Soc. oft. hisp.-amer., 7:756-770, Aug., 1947.

Eleven physiologic variations of the optic disc are described and illustrated; they include a disc with an epipapillary membrane projecting above its level; an apparent folding of the nasal over the temporal portion of the disc, produced by a thin membranous formation, over the physiological excavation of the disc, perforated by the retinal vessels; myelinated nerve fibers; hyaline membranes enveloping the central vessels; and unusually large excavations, one of which approaches the size of a coloboma of the disc. A case of a papilla, in which the excavation is divided into two portions by a vertical band of fibrous tissue is, according to the author, the third case of this type to be reported in literature. Ray K. Daily.

Vail, Derrick. **The blood supply of the optic nerve and its clinical significance.** Am. J. Ophth. 31:1-12, Jan., 1948. (References.)

13
NEURO-OPHTHALMOLOGY

Bachstez, E., and Baumgärtel, K. **Sources of error in the examination of the pupil.** Wien. klin. Wchnschr. 59:666-669, Oct. 10, 1947.

For the attainment of consistency and uniformity in the results of pupillary examination it is necessary not only to avoid gross errors of method but also to bear in mind the complex factors that determine the behavior of the pupils. It is the latter especially with which the authors concern themselves.

Ideally the source of light and the spot on the retina that is illuminated should be constant and the retina should be in a known state of adaptation. It is essential that the retina be dark-adapted, that the patient look into the distance to com-

pletely relax accommodation, that each eye be tested separately, and that the light fall on the fovea. Contraction to light is a true reflex, convergence contraction is an accompanying movement similar to the narrowing of the pupil when the lids are pressed together.

The dilatation which follows contraction should not be disregarded. Inhibition of the sphincter can be brought on by fear, surprise or a sudden thought. Redlich's symptom (widening of the pupil when the hands are firmly pressed together) is an example of this kind of inhibition. The sensory reflex can come from the region supplied by the trigeminal nerve and from other parts of the body, notably the skin. Auditory stimuli and the phases of respiration also act on the state of the pupil. A "paradoxical reaction," i.e. light seeming to dilate the pupil is always due to one of these outside causes.

A number of examples are cited to show how errors in diagnosis arise. The pupil is never in a state of rest. The evaluation of pupillary findings is most difficult in neurologic patients because of the many neuro-vegetative disturbances to which such patients are subject.

B. T. Haessler.

Cojazzi, L., and Sala, O. **Researches on the interference between the optokinetic nystagmus and caloric and postrotatory ones induced simultaneously in man.** Riv. oto-neuro-oftal. 22:50-65, Jan.-Feb., 1947.

The writers report the phenomena of interference which manifest themselves in man after optokinetic, caloric and postrotatory nystagmus are provoked. Normal individuals were examined. The optokinetic nystagmus was induced by the rotation of a cylinder with white and black stripes set in motion electrically with constant speed. For the caloric stimulation they used Veits's method and for the rotatory Buys-Fischer's. The optokinetic nystagmus constantly inhibited a provoked vestibular nystagmus of opposite direction and replaced it. The suppression of the labyrinthine nystagmus lasts as long as the optokinetic stimulus in an opposite direction is active; if the latter ceases the vestibular nystagmus reappears with its former characteristics. The normal phasic development of post-rotatory nystagmus is not at all modified by the interference of the optokinetic. When the calorific nystagmus has subsided for one or two minutes a "facilitation" is instituted for the optokinetic nystagmus towards the side to which the preceding caloric nystagmus had been directed. (Bibilography.)

Melchiore Lombardo.

Ferrata, Luigi. **Ocular changes in Paget's disease.** Ann. di ottal. e clin. ocul. 72:557-565, Sept., 1946.

A 53-year-old woman affected with Paget's disease for four years had diminution of vision, decrease of normal winking, exophthalmos, neuroparalytic keratitis (hypesthesia, loss of epithelium, and opacities), and papilledema with possible optic atrophy. These manifestations are all ascribed to mechanical factors arising from extensive osteitis deformans at the base of the skull. There was marked narrowing of the sphenoidal fissure. (References.)

Harry K. Messenger.

Focosi, M., and Maggioni, G. **Ophthalmoplegic hemicrania of Charcot from aneurism of internal carotid artery.** Boll. d'ocul., 25:537-551, Oct.-Dec., 1946.

A boy, six years of age, had vomiting without nausea in the early morning followed by intense headaches, especially in the right fronto-orbital region. This condition lasted for one day and was followed by ptosis of the right upper lid. The eyeball deviated outward, and the excursions of the eyeball inward, upward and downward were abolished. The pupil was

dilated and the accommodation was paralyzed. These symptoms gradually disappeared. A few months later they reappeared and arteriography of the brain revealed a round dilatation of the internal carotid artery in the clinoidal region. The etiology, pathogenesis and location of the lesion are discussed at length. (4 figures, bibliography.) Melchiore Lombardo.

Hughes, E. B. C. **The visual fields in indirect injury of the optic nerves.** Tr. Ophth. Soc. U. Kingdom. 65:35-46, 1945.

Visual field defects were found to fall into distinct groups in indirect injuries to the optic nerve, the so-called typical group and those of widely different types.

Indirect injuries of the optic nerve usually present instantaneous loss of vision, and appearance of primary optic atrophy in about three weeks, with minimal recovery in the first four weeks. The visual field defect involves the inferior part of the field of the affected eye. The depression field occasionally spreads to the upper half of the field. The upper nasal quadrant was least frequently affected by this depression. Three cases presented arcuate scotomata of the nerve fiber bundle which seemed to be associated with vascular lesions of the optic nerve.

In the operative treatment of these cases one must consider the removal of bone fragments, collections of blood within the nerve sheath, and local subdural haematomata. (8 figures.)

Beulah Cushman.

Lijó Pavia, J. **Retino-hypophysary syndrome. Treatment with gonadotropine. Four new cases.** Rev. oto-neuro-oftal. 22:5-9, Jan.-Feb., 1947.

This paper represents further investigation of a previously reported syndrome that embraces an unusual ophthalmoscopic picture, diminished central vision, atypical alterations of the visual fields, radiographic changes in the sella turcica and improvement with hormonal therapy. The present series consists of three women in the menopause and one male child eight years of age. There were sector defects and macular changes with typical sellar thinning. The central vision was always subnormal, ranging from 0.2 to 0.7. Hormonal injections were followed by only slightly improved vision but resulted in an increase in the sense of well-being. (4 figures.) Edward Saskin.

Lutt, C. J. **Denial of blindness and Argyll Robertson pupils without syphilis.** Bull. Los Angeles Neurol. Soc. 12:189-191, Dec., 1947.

The author reports an interesting case of denial of blindness with the clinical symptoms of meningovascular syphilis. The latter was unverified. At autopsy it was found that the pupillary immobility to light was due to a vascular lesion in the mesencephalon. The nystagmus and the cerebellar ataxia were explained on the basis of cerebellar softening and blindness was clearly due to softening of both occipital lobes following occlusive vascular changes. As not all patients with cortical blindness have the delusion that they can see, this was ascribed to the mental state of the patient, who confabulated and showed visual agnosia before becoming completely blind. This case confirmed the fact that the clinical symptoms of meningovascular syphilis are not a specific manifestation of the spirochete, but of the anatomical site of the lesions.

O. H. Ellis.

Marín Amat, M., and Marín Enciso, M. **Visual symptoms as the first subjective manifestations of hypophyseal tumors.** Arch. Soc. oft. hisp.-amer. 7:815-817, Aug., 1947.

A report of the data in a case of supracellar tumor with blindness and optic atrophy of the right eye, and one-sixth

visual acuity and incomplete optic atrophy of the left eye is presented. (2 illustrations.) Ray K. Daily.

Marmion, D. E., and Sandilands, J. **Opsoclonia: a rare ocular sign in polioencephalitis.** Lancet 2:508-509, Oct. 4, 1947.

A description is given of a case of probable polioencephalitis exhibiting a bizarre type of nystagmoid movement of the eyes. It is suggested that this is probably identical with that previously described under the name "opsoclonia" by Orzechowski in 1927.

Theodore M. Shapira.

Marucci, Luigi. **The psychic restitution of the pupillary reflex when fatigued to light, as studied with the pupillographic method of Loewenstein and Borsotti.** Ann. di ottal. e clin. ocul. 72:546-556, Sept., 1946.

A series of pupillograms is shown in which the restitution of the light-fatigued pupillary reflex occurs when the subject is stimulated psychically, as by a loud and unexpected noise. The pupillograms of patients with various neurologic and ocular disturbances are also shown, whereby the diagnostic and prognostic importance of this psychic restitution is demonstrated. The phenomenon is found to be dependent on the integrity of the sympathetic nervous system. (14 figures.)

Harry K. Messenger.

Nielsen, J. M. **Sensory perception through vision, a synesthesia.** Bull. Los Angeles Neurol. Soc. 12:195-196, Dec., 1947.

The author reports a case of epilepsy in a young adult following an injury at two years of age to the right occipital lobe. Her aura was the appearance of a large dark object in her blind left field. In this homonymous hemianopic field the presence of objects and a faint light were "felt" with either eye—a sensory response, a form of synesthesia. It was thought that the impulse reached the right thalamus and registered as a tactile impression. O. H. Ellis.

de Ocampo, Geminiano. **Latent nystagmus following head injury.** Arch. Ophth. 37:775-779, June, 1947.

A man, aged 24 years, a Filipino veteran of Bataan, received an injury to the left occipitoparietal area from fragments of an artillery shell. Eight months later it was observed that with the eyes in the primary position for far vision, there was no definite nystagmus. With the eyes right, spontaneous, transient, jerky horizontal nystagmus of both eyes to the right was present. With eyes left, a similar nystagmus, of lesser intensity, was noted. Caloric tests showed vestibular hyposensitivity, but the rotatory test revealed a stronger or longer state of irritability on the right side.

Various theories of the causation of nystagmus are discussed. The peripheral sensory stimuli and the state of stability of the lower coordinating centers, as well as the balance of the innervating influence of the higher voluntary and involuntary centers, must be considered as a whole in the explanation of the mechanism of latent nystagmus, and probably of all nystagmus. John C. Long.

Rubino, A. **"Arachnitis," "Endocraniosis" and Opticochiasmatic arachnoiditis.** Riv. oto-neuro-oftal. 22:85-102, March-April, 1947.

A married woman, 37 years of age, had had headaches since girlhood and, for the previous ten years, gradually failing vision. At the examination the vision of the right eye was found to be reduced to the recognition of hand movement and of left eye to 1/50. There was optic atrophy, the discs had slightly indistinct margins, the retinal arteries were contracted and

the veins enlarged. Absolute upper hemianopsia and absolute central scotoma were present in the right eye. In the left eye the hemianopsia was relative, and the central scotoma was relative for white and absolute for colors. Radiography showed a thickening of the skull especially in its frontal region, a calcification left of the midline and signs of chronic pansinusitis. The Pirquet reaction was strongly positive. A diagnosis of optico-chiasmatic arachnoiditis with meningo-endocraniosis was made. At the operation a right frontal flap was made. A marked thickening of the bone was found, the dura was found to be very thin and adherent to the bone. The optic nerves were reduced to half-normal size. The anatomic-clinical and etiopathologic relation that occurs between optico-chiasmatic arachnoiditis and primary arachnitis as well as endocraniosis is discussed. This is the third case reported in the literature. A classification of the various clinical forms of optico-chiasmatic arachnoiditis of the group of meningo-endocranioses is proposed. Melchiore Lombardo.

14

EYEBALL, ORBIT, SINUSES

Bianchi, G. **Two cases of cavernous agioma of the orbit.** Rassegna ital. d'ottal. 16:317-334, Sept.-Oct., 1947.

Two cases of cavernous angioma of the orbit are reported. The difficulty of exact diagnosis of the nature and site of such tumors is pointed out. The author recommends a comparison of the white blood cells found in the general circulation with those obtained by exploratory puncture of the angioma. The latter is characterized by a definite increase in the eosinophiles and basophiles, and the presence of immature cells. Histological examination of the tumors confirmed these findings. Accumulation of lymphocytes appear to initiate the formation of the fibrous tissue of the tumor. The lumen of vessels showed an increase of white cells and a decrease of the red. Good results were obtained in each case by removal of the tumors through Krönlein incisions. (5 figures.) Eugene M. Blake.

Hope-Robertson, W. J. **Pseudotumour of the orbit.** Supp. New Zealand M. J. pp. 18-30, 1947.

A pseudotumour of the orbit in a 43-year-old man is described. The pathology, differential diagnosis and treatment is discussed and a plea is made for biopsy as an aid to diagnosis. (5 figures.)
Irwin E. Gaynon.

Kaplan, Morris. **Boeck's sarcoid. Report of case with an unusual precipitating factor.** Am. J. Ophth. 31:83-85, Jan., 1948.

15

EYELIDS, LACRIMAL APPARATUS

Bloch, F. J. **Minor anomalies in position of the eyelashes.** Arch. Ophth. 37: 772-774, June, 1947.

Aberrant eyelashes may grow upward either subcutaneously or subconjunctivally. The subconjunctival growth is much the more important as the cilium may pierce the conjunctiva and rub upon the cornea. Both of these anomalies are explained on a mechanical basis. The sprouting cilium encounters an obstacle and is bent backward. Two cases are reported, one of cilium incarnatum externum and one of cilium incarnatum internum. John C. Long.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D
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News items should reach the editor by the 12th of the month

DEATHS

Dr. Elmer Cleo Ambrose, Trenton, Missouri, died October 15, 1947, aged 55 years.

Dr. Louis Storrow Greene, Washington, D.C., died November 12, 1947, aged 74 years.

Dr. Oscar Wentworth King, Coral Gables, Florida, died October 16, 1947, aged 63 years.

Dr. Albert Howell Mann, Texarkana, Arkansas, died October 16, 1947, aged 48 years.

Dr. Elmer Eason McKeown, Denver, Colorado, died October 7, 1947, aged 67 years.

Dr. Joel Whitaker, Indianapolis, Indiana, died October 13, 1947, aged 70 years.

ANNOUNCEMENTS

AMERICAN BOARD EXAMINATIONS

The American Board of Ophthalmology announces that practical examinations will be given in Baltimore from May 20 to 25, 1948, and in Chicago from October 6 to 9, 1948.

Written qualifying tests will be held annually, probably in January of each year. Applicants for the January, 1949, written qualifying tests must be filed with the secretary, Dr. S. Judd Beach, Cape Cottage, Maine, before July 1, 1948.

DIRECTORY SUPPLEMENT AVAILABLE

A supplement of diplomates from January, 1947, to January, 1948, will be sent gratis to all purchasers of the directory of the American Board of Ophthalmology. This supplement is arranged alphabetically and geographically. No biographic material is included.

Diplomates are urged to keep the executive office, Cape Cottage, Maine, informed of all changes of address, so that the files can be kept up-to-date.

ARMY POSITIONS OPEN

The U. S. Army Medical Corps now has a number of excellent positions which can be filled by physicians who have completed their formal board requirements (residence phase) but who need one or two years of practice limited to their specialty. Seven openings in eye, ear, nose, and throat have been announced; and three openings in ophthalmology. Eligible physicians are asked to communicate with The Surgeon General, U. S. Army, Washington 25, D.C., giving the following information: name, address, age, nationality, marital status, dependents, with age of each, medical school and graduation date, internship and date, specialty and geographic location desired, contemplated length of service, and details of prior military service.

MISCELLANEOUS

CINCINNATI HAS EYE LABORATORY

The department of ophthalmology of the University of Cincinnati College of Medicine is establishing an eye laboratory under the direction of Dr. Donald J. Lyle. At present the work of the laboratory is concerned with the examination of eyes for diagnosis and the preparation of specimens for study and collection. Physicians of Ohio, Indiana, and Kentucky will have access to the services and facilities of the laboratory which is temporarily located in Pavilion A of the Cincinnati General Hospital. The Eastern Hills Lions Club made the first gift to support the laboratory.

FUCHS'S "HISTOPATHOLOGY OF THE EYE"

The second volume of *Histopathology of the Eye* by Adalbert Fuchs is now available. It can be obtained from the publisher, Franz Deuticke, Helferstorferstrasse 4, Vienna, Austria. The price is $17.00.

SOCIETIES

BETTER VISION INSTITUTE

The increased radio activity for 1947 was outstanding among the reports at the meeting of the Better Vision Institute in New York on January 16. A total of 524 radio stations throughout the United States and Canada have requested the new series, "Eyes on the Ball."

Another significant 1947 project was the development of a new series of 24 educational brochures covering every aspect of eye science and service intended for the use of professional persons and for distribution to schools, libraries, and museums.

MEXICAN SOCIETY FORMED

The Sociedad de Oftalmologia de Guadalajara (Mexico) was organized on November 27, 1947, for the development of scientific investigation in ophthalmology, improvement of the members, and the development of measures for prevention and cure of blindness. The honorary president of the new society is Dr. Enrique Avalos; Dr. Elias Mendoza Gonzalez is acting president; Dr. Manuel Romo, vice-president; Dr. Antonio Diaz Geurrero, treasurer; and Dr. L. Nuñez Leal, secretary.

READING MEETING

Dr. William J. Hertz of Allentown, Pennsylvania, spoke on "Office Procedures in Ophthalmology and Otorhinolaryngology Based on 40 Years' Experience," at the January 21 meeting of the Reading Eye, Ear, Nose, and Throat Society.

Cleveland Ophthalmological Club

At a recent meeting of the Cleveland Ophthalmological Club, the following officers were elected: Dr. John E. L. Keyes, president; Dr. George King, vice-president; and Dr. Roscoe J. Kennedy, secretary-treasurer.

During the fall and winter months, the club has had many interesting programs. At the September meeting, Dr. John M. McLean, New York, spoke on "Vertical Factors in Strabismus." This lecture was illustrated with many excellent slides showing various conditions encountered and the results obtained.

Dr. Alson E. Braley, New York, was the guest speaker at the November meeting. His paper was on "Virus Diseases of the Cornea."

Residents in ophthalmology from the Cleveland hospitals were guests of the club at the January meeting. They presented the following interesting and instructive program: "Sturge-Weber Disease: A Case Report," Dr. Luebert Docter; "Use of Di-isopropyl Fluorophosphate in Selected Cases of Glaucoma," Dr. J. H. Graham; "Cataract Associated with Myotonic Dystrophy: A Case Report," Dr. H. H. Hardesty; "Zonular Cataract: A Case Report," Dr. J. I. Moreland; "Eale's Disease: A Case Report," Dr. Howard Possner; "Oculoglandular Tularemia Treated with Streptomycin: A Case Report," Dr. J. E. Springer.

Chinese society celebrates founding

The Chengtu Eye, Nose, Ear, and Throat Society celebrated its tenth anniversary on December 20, 1947. Dr. T. H. Lan, professor of biochemistry, West China Union University, was the guest speaker. He spoke on "Biochemistry of the Blood in Patients Suffering from Malignant Tumors." The history and progress of the organization were reviewed by Dr. K. C. Lang and Dr. E. Chan.

N.S.P.B. conference

The 1948 conference of the National Society for the Prevention of Blindness will be held at the Radisson Hotel, Minneapolis, Minnesota, April 5 to 7.

Brooklyn program

At the 103rd regular meeting of the Brooklyn Ophthalmological Society, Dr. Charles E. Iliff presented a paper on "The Use of Beta Irradiation in Ophthalmology." The discussion was by Dr. Ira I. Kaplan. The following were presented for election to membership: Dr. David A. Anderman, Dr. Martin Bodian, Dr. Regina Gilroy, and Dr. Charles Labriola.

Research Association meeting

The Association for Research in Ophthalmology, Inc., will hold its annual meeting in Chicago on June 21 and 22. The place of the meeting will be Thorne Hall, Northwestern University Medical School, 303 East Chicago Avenue.

Personals

Dr. Dunphy appointed Williams Professor

Dr. Edwin B. Dunphy has been named the Henry Willard Williams Professor of Ophthalmology at Harvard University. This is one of the older chairs of ophthalmology in American universities. Dr. Dunphy's predecessors and their years of office are: Dr. Oliver Fairfield Wadsworth, 1899-1903; Dr. Miles Standish, 1909-1914; Dr. Alexander Quackenboss, 1920-1923; Dr. George Strong Derby, 1923-1931.

Dr. Dunphy succeeded Dr. J. Herbert Waite as executive head of the department of ophthalmology at Harvard University Medical School in 1940, as clinical professor of ophthalmology. Dr. Dunphy continues as executive head of the department, with the new title Henry Willard Williams Clinical Professor of Ophthalmology.

Lectures in Chicago

Dr. Adalbert Fuchs gave a series of lectures at the University of Illinois, Chicago, on January 30 and 31 and February 1.

Dr. Post gives Gifford Lecture

Dr. Lawrence T. Post of St. Louis presented the fourth annual Sanford R. Gifford Memorial Lecture to members and guests of the Chicago Ophthalmological Society, at the Murphy Memorial Auditorium, Chicago, on January 26. The subject of his address was "Practical Considerations in the Diagnosis and Treatment of Strabismus."

Cleveland newcomer

Dr. Russell Nichol has recently opened offices for the practice of ophthalmology in Cleveland, Ohio. Dr. Nichol was formerly a member of the staff of the Eye Institute, College of Physicians and Surgeons, Columbia University, New York.

Professor Lindner speaks at Gill

On the evening of February 24, Prof. Karl Lindner, chief of the eye clinic, University of Vienna, Vienna, Austria, spoke at the Gill Memorial Eye, Ear and Throat Hospital, Roanoke, Virginia. His subjects were: "Therapeutics on Diseases of the Eye," and "New Eye Operations."

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 31 APRIL, 1948 NUMBER 4

SOME CONFUSING FACTORS IN THE DIAGNOSIS OF PARALYSIS* OF THE VERTICALLY ACTING MUSCLES†

THE JACKSON MEMORIAL LECTURE

FRANCIS HEED ADLER, M.D.
Philadelphia, Pennsylvania

During his career, Dr. Edward Jackson wrote over 600 articles. The list of subjects covers the entire field of ophthalmology. Beginning in 1882, the first paper listed in his bibliography is "A Comparative Study of the Action of Certain Mydriatic Alkaloids," and the last entry, in 1926, is entitled "What Is Cancer?" This should allow any Jackson Memorial lecturer plenty of freedom in the choice of a subject, even if he wished to confine himself to one of Dr. Jackson's interests. I have elected to discuss some of the difficulties encountered in diagnosing vertical ocular muscle paralyses. I find some of Dr. Jackson's best writing and many of his original ideas are contained in his papers on strabismus. Everyone interested in operations on the ocular muscles should read his paper on the "Principles Controlling Operative Interference in Squint," published in the *Transactions of the Section on Ophthalmology* of the American Medical Association in 1902, and "Operations on the Extraocular Muscles," published in the *Ophthalmic Record* of 1923. Both of these papers are splendid, and each would today make a truly great Jackson Memorial Lecture, as in fact they did when Dr. Jackson himself presented them in his characteristic style and in that unforgettable voice of many decibels.

Paralysis of a lateral or medial rectus muscle seldom causes any difficulty in diagnosis. The signs and symptoms generally follow those described in the textbooks. This is not true of paralysis of the vertically acting muscles. Although textbooks describe the typical strabismus, the theoretic diplopia fields, and the characteristic reactions to the embarrassment, such as face turning and head tilting, which one should encounter for each muscle paralyzed, in many instances when patients are examined, the findings cannot be made to fit the picture of a single paralyzed muscle.

On reviewing a series of case histories of ocular muscle paralyses, it was found that in a number the data indicated a paralysis of two muscles instead of one, which caused confusion in making a diagnosis. This was borne out by an analysis of the varying angle of strabismus in the oblique positions of gaze, measured by the cover test and the fixation fields, and by the characteristics of the diplopia fields. These cases could be divided into two groups. (1) Those in which the two muscles seemingly paralyzed could not have been caught by any one single lesion. The muscles of these cases were either (a) the superior rectus of one eye together with the superior oblique of the opposite eye; or (b) the inferior rectus of one eye together with the inferior oblique of the opposite eye. (2) Those in which a single lesion could have caused the paralysis of

* The terms "paralysis" and "paresis" have been used interchangeably as it seems to labor the point to distinguish between varying degrees of weakness of a muscle for the purpose of this article.

† Delivered on October 15, 1947, at the convention of the American Academy of Ophthalmology and Otolaryngology, Chicago, Illinois.

both muscles. The explanation of the cases in this group is obvious. If, for example, both elevators or both depressors of one eye

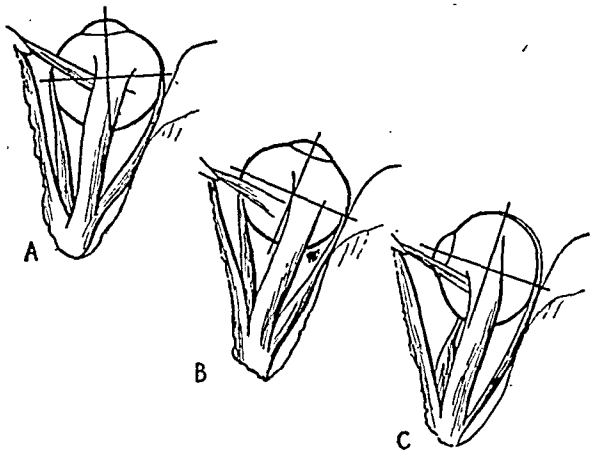


Fig. 1 (Adler). The right eye seen from above, showing the direction of pull of the superior rectus when the eye is in (A) the primary position; (B) abducted 23 degrees; (C) adducted 67 degrees.

are paralyzed, it is probable that they have been caught by a local process in the orbit such as scar formation or a tumor; or the nuclei of origin of the nerves supplying the two muscles have been involved by a lesion such as a hemorrhage in the pons.

The explanation of the cases belonging to Group 1 is not so obvious, since there is no place in the body where a single lesion could involve both of the muscles affected. It is the purpose of this paper to try to explain the cases in this group and to report some illustrative examples of cases belonging to the second group.

Group 1. The cases belonging in this group seem to have a paralysis of a superior rectus of one eye combined with a paralysis of the superior oblique of the opposite eye, or else an inferior rectus of one eye combined with an inferior oblique of the opposite eye. Since no single lesion in the body can produce such a combination of paralyzed muscles, what is their explanation?

The textbook description of paralysis of each of the ocular muscles is based on the varying action of each of the muscles in the different positions of gaze. When the eyes are in the primary position, the superior rectus, for example, will mainly effect an elevation of the globe. To this must be added a slight degree of intorsion and adduction (fig. 1A). When the globe is abducted 23 degrees so that the visual line coincides with the line of pull of the muscle, its contraction will produce nothing but elevation (fig. 1B). If the globe is adducted 67 degrees from the primary position (a degree of adduction never attained normally) contraction of the muscle produces intorsion and adduction (fig. 1C). The muscle's chief effect on the globe in one position of gaze becomes secondary or disappears altogether in another position, while a previously subsidiary effect now becomes predominant. This applies not only to the superior and inferior recti, but to the two obliques as well.

It is a simple matter to predict the strabismus and the diplopia fields which should occur in paralysis of any muscle, based on a knowledge of its action. This picture is based, however, on the effect which the paralyzed muscle has on the movements of this eye alone, and does not take into account the fact that the effect is never confined to the action of the paralyzed muscle alone but influences other muscles in the same eye and, under certain conditions, other muscles in the opposite eye, as well. This is always true when the paralyzed eye is used for fixation, following Hering's law of voluntary movements.

Hering's law states that in all voluntary movements of the eyes, the innervation sent down from the cortex is equally distributed to the muscles of both eyes concerned in that direction of gaze. When a subject voluntarily moves his eyes up and to the right, an equal innervation is sent to the right superior rectus and to the left inferior oblique. An equal inhibition is also sent to the corresponding antagonists of these muscles, according to Sherrington's law of reciprocal innervation. When a muscle is paretic, it requires more nervous energy to effect its movement than if it were normal. In patients with a paralyzed muscle, therefore, an

excessive innervation is sent not only to the paretic muscle, but to the yoke muscle in the opposite eye as well. If the right superior rectus is paretic and the patient looks up and to the right, with the right eye fixing, an excessive innervation will be sent to this muscle and to the left inferior oblique. This

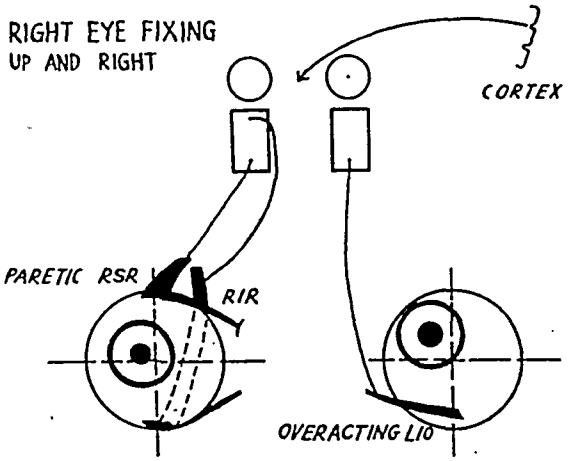


Fig. 2. (Adler). Diagram showing the secondary deviation of the left eye on looking up and to the right when the right superior rectus is paralyzed and the right eye is fixing. An excessive innervation is sent down from the cortex to both the right superior rectus and the left inferior oblique, causing overaction of the latter. Compare with Figure 3 in which the nonparalyzed eye is fixing.

latter muscle will therefore overact so that the left eye will move up too far (fig. 2). If the left eye is the fixing eye, however, the strabismus will be due entirely to the lag in elevation of the right eye. Under these conditions, the angle of strabismus will be less than when the right eye was fixing (fig. 3).

This is the principle that underlies secondary deviation, which is one of the causes of incomitance in paralytic squint. Incomitance in the angle of squint in paralysis of a muscle is due to two factors: (1) To the failure of the paralyzed muscle to move the eye in the field of its action, and (2) to the overaction of the yoke muscle when the paralyzed eye fixes.

In all cases of paralysis of sufficient severity to break up binocular vision, the eyes become dissociated and either the paralyzed or the nonparalyzed eye is used habitually for fixation. White (Tr. Am. Ophth. Soc., 31:551, 1933) believed that the paralyzed eye was usually the fixing eye in cases of congenital paralysis.

Many different factors determine which eye will be used to fix. Visual acuity is sometimes a factor, and the eye with the better acuity may be chosen. This is not always the

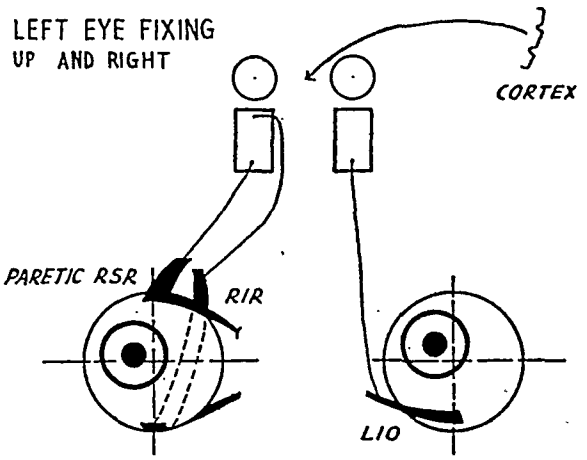


Fig. 3 (Adler). Looking up and to the right when the nonparalyzed left eye is fixing. The primary deviation is less than the secondary deviation in Figure 2.

case, however, and one may see patients in whom the paralyzed eye is used for fixation in spite of the fact that it has poorer vision than the nonparalyzed eye. Fixation with the paralyzed eye increases the strabismus due to secondary deviation. Some authors believe this is the reason why fixation is so frequently carried out by the paralyzed eye, since this increases the distance between the double images and therefore makes them less annoying to the patient.

In addition to the effect on the yoke muscle when the paralyzed eye is used for fixation, the effect on the antagonist of the paralyzed muscle must also be considered. Whenever there is a paralysis of a muscle, the antagonist in the same eye is able to move the globe in its direction of action with less effort than it does normally, since it lacks the restraining effect of the normal tonus of the now paralyzed muscle. This may seem to deny the existence of reciprocal innervation,

but does not necessarily do so. The relaxation which a muscle undergoes during contraction of its antagonist is only partial and considerable tonus is still retained. This is lost, however, when the muscle is actually paralyzed. If the right superior rectus is paralyzed, for example, the right inferior rectus can now move the eye down and to the right with less than normal effort. When

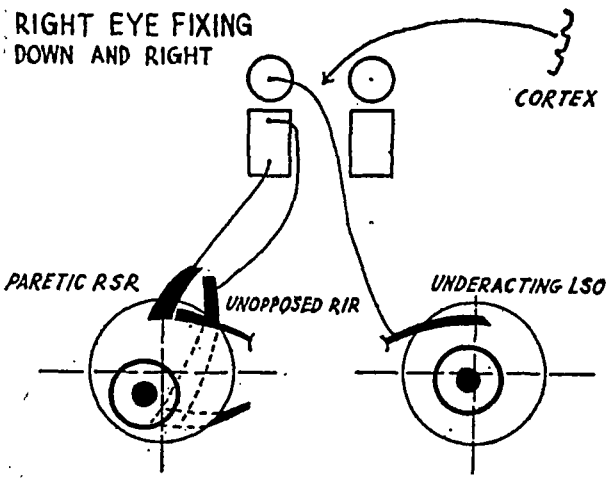


Fig. 4 (Adler). Looking down and to the right. The right superior rectus is paretic and the right eye is fixing. The right inferior rectus moves the eye down with less than the normal amount of innervation, since the opposing tonus of the right superior rectus is gone. Less innervation is sent to the left superior oblique, therefore, and the left eye fails to move down and to the right as far as it should. Compare with Figure 5.

the individual uses the right eye for fixation down and to the right, the innervation required for the right inferior rectus will be less than normal. A subnormal stimulus is sent, therefore, to the yoke muscle of the right inferior rectus; that is, the left superior oblique, and this muscle will underact with the result that the left eye will not be carried down as far as it should be (fig. 4). When the nonparalyzed left eye is used to fix in looking down and to the right, both eyes will move down almost equally well and there will be little strabismus (fig. 5). When the right eye is used to fix, therefore, the left superior oblique will appear to be paralyzed in gazing down and to the right. This has been called inhibitional palsy of the contralateral antagonist by Chavasse. This term is confusing, as well as being rather burdensome. Since it depends on the underaction of a muscle due to the principles embodied in Hering's law in the same manner that the overaction of a yoke muscle does, it would seem simpler to refer to it by the term "underaction." Unfortunately, some authors, especially Chavasse, use this term to indi-

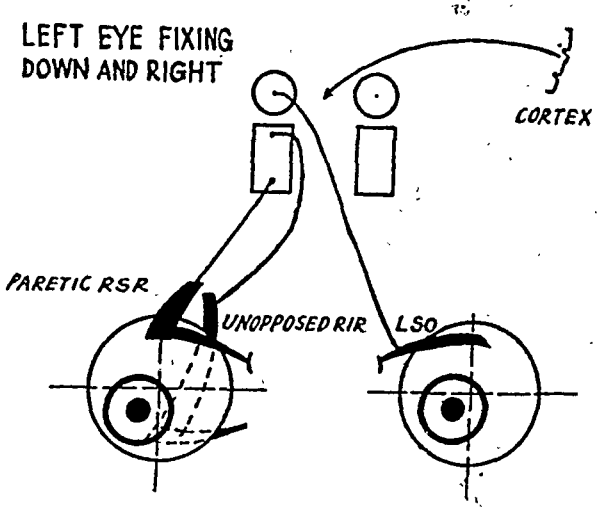


Fig. 5 (Adler). Looking down and to the right. The nonparalyzed eye is fixing and moves down normally. There is no underaction of the left superior oblique.

cate a contracture of the antagonist of a paralyzed muscle. When contracture of a muscle occurs, it is shortened and the squint produced by its shortening is comitant in all directions of gaze. Such a muscle is not underacting, and the term "underaction" of a muscle should be used only for the condition I have described above. As a matter of fact, we are quite ignorant of the changes which have taken place in muscles which are said to be contractured. This condition is seen clinically in severe paralysis of long standing, but to my knowledge no histologic examinations have been made of such muscles to determine whether they are fibrotic and shortened or hypertrophied.

Lancaster and others have emphasized the fact that the ocular muscles are at least 10 times as powerful as they need to be to effect the full rotation of the globe in the

direction of their action. It is evident on theoretic grounds that each muscle has to contract only one fourth of its length in order to move the globe its full amount in that direction; whereas, most of the other muscles of the body contract to one half their resting length. Assuming that the circumference of the adult globe is 72 mm., a

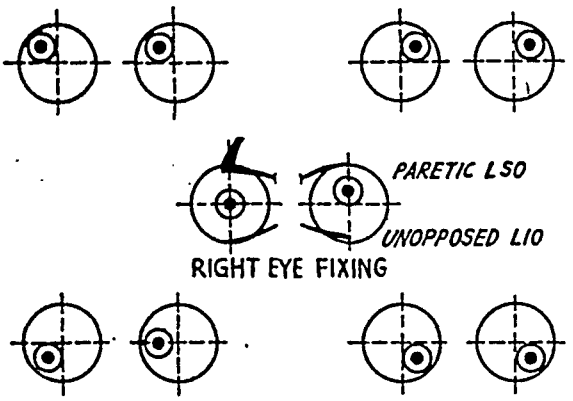


Fig. 6 (Adler). Showing the angle of strabismus in the primary and oblique positions of gaze in paralysis of the left superior oblique muscle when the nonparalyzed right eye is used for fixation.

rotation of 1 mm. equals an angular movement of 5 degrees. The external rectus need contract only 9 mm., therefore, in order to produce an abduction of the globe of 45 degrees, which is the limit of movement of the eye laterally. Since the muscle is over 40 mm. long, this necessitates a shortening of less than one fourth of the muscle's length.

It is clear that the strabismus found in the various positions of gaze will be quite different, depending upon whether the nonparalyzed or the paralyzed eye is habitually used for fixation. The typical strabismus given in textbooks for each paralyzed muscle assumes fixation by the nonparalyzed eye.

A comparison may now be made between the strabismus found when the nonparalyzed eye is used to fix with that found when the paralyzed eye is fixing. As an example, a paralysis of the left superior oblique muscle may be used. Figure 6 shows the positions assumed by each eye in the primary and the oblique directions of gaze when the nonparalyzed right eye is used for fixation. In the primary position, the left eye is too high due to the loss of tone of the superior oblique. The greatest vertical separation between the eyes occurs when the gaze is down and to the right, due to the weakness of the left superior oblique. In all other oblique positions of gaze, the eyes are in alignment.

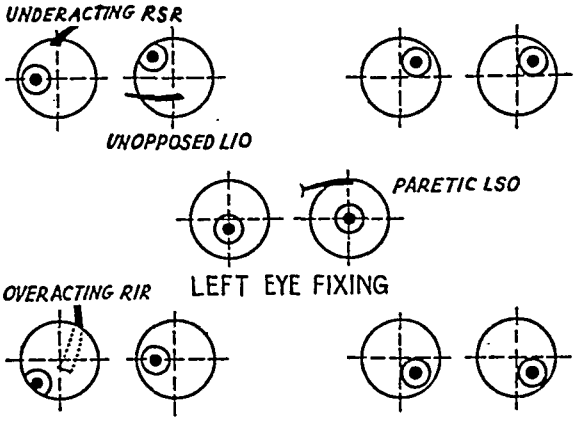


Fig. 7 (Adler). Showing the angle of strabismus in the primary and oblique positions of gaze in paralysis of the left superior oblique muscle when the paralyzed left eye is habitually used for fixation. Compare with Figure 6.

Figure 7 shows the strabismus in the various positions of gaze when the left, paralyzed eye is the fixing eye. In the primary position, the right eye will be too low and the angle of squint will be greater than when the nonparalyzed eye is fixing. The greatest separation of the visual axes will be in gaze down and to the right, and the angle of squint in this position will be greater than when the nonparalyzed eye was the fixing eye. This is due to the fact that the left eye fails to move down as far as it should and the right eye moves down too far due to overaction of the yoke muscle, the right inferior rectus. On gaze up and to the left and down and to the left, the eyes will be in alignment, but on looking up and to the right, the strabismus will increase again. The right eye fails to move up as far as it should in this direction, while the left eye is fixing. This is due to the fact that the left inferior oblique can move the left eye up and to the right with less innervation than normal, since the left

superior oblique is paralyzed. A weaker innervation, therefore, goes to the right superior rectus which underacts and this eye fails to move upward to the full extent. It will lag behind and appear to be paralyzed. If the left eye is covered, the right eye will be able to move up its full extent, showing that it is not really paretic.

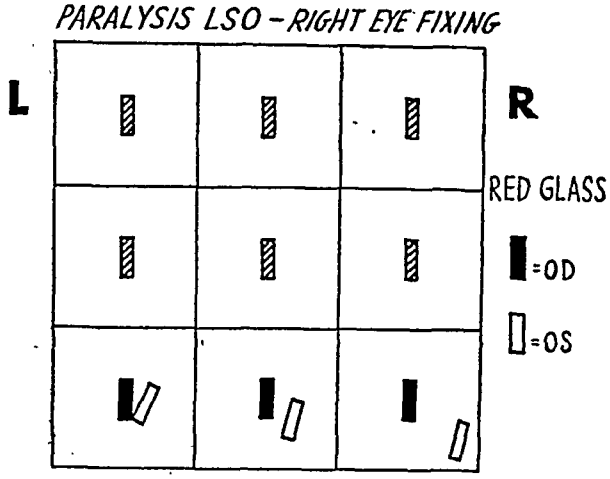


Fig. 8. (Adler). Simplified diplopia fields of paralysis of the left superior oblique as given in textbooks and found in patients when the nonparalyzed eye is used for fixation. Compare with Figure 9.

Whenever a superior oblique is paralyzed and this eye is used for fixation, one may have an underaction of the superior rectus muscle of the opposite eye. Similarly, if a superior rectus muscle is the paretic muscle, the opposite superior oblique will underact if the eye with the paretic muscle is used for fixation. The same condition will be found in paralysis of either the inferior rectus or the inferior oblique of either eye. One muscle is the paretic one, the other underacts according to Hering's law.

Corresponding to the differences in the angle of strabismus in various positions of gaze, one finds differences in the diplopia fields, depending on whether the paretic or nonparetic eye fixes. When the nonparalyzed eye is the fixing eye, the diplopia fields will generally be those given in the textbooks. When the paralyzed eye is habitually fixing, the diplopia fields will indicate two paralyzed muscles. Figure 8 shows the diplopia fields as given in textbooks when the left superior oblique is paralyzed. Figure 9 shows the diplopia fields frequently encountered, indicating both a paralysis of the left superior oblique and a paralysis of the right superior rectus. This type of diplopia field is found if the paralyzed left eye is the fixing eye. The involvement of the right

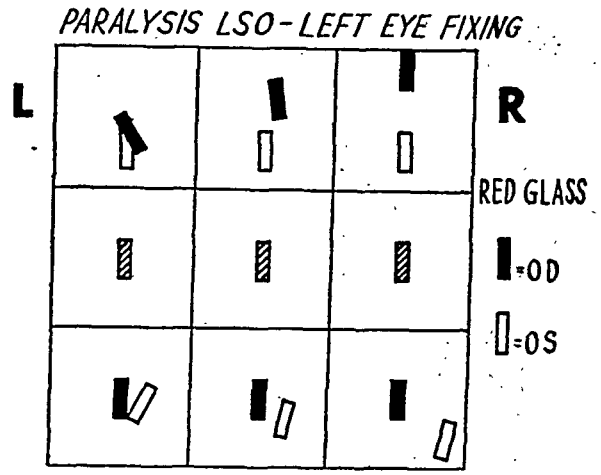


Fig. 9 (Adler). Simplified diplopia field in paralysis of the left superior oblique muscle found in patients who habitually choose to fix with the paralyzed eye. The fields indicate a paralysis of the left superior oblique and a paralysis of the right superior rectus.

superior rectus is due to underaction of this muscle and not to actual paralysis. This type of diplopia field is quite common. It should cause no confusion, if it is properly interpreted.

The varying angle of strabismus and the diplopia fields alone are not sufficient to enable one to tell which muscle is actually paralyzed and which muscle is merely underacting. I have called attention elsewhere (Arch. Ophth., 36:661, 1946) to the methods by means of which one may make a differential diagnosis in most cases between paralysis of these two muscles. Occasionally, it is not possible to decide which is the paralyzed muscle. Whenever patients are seen in whom two muscles appear to be paralyzed, and these muscles are a superior or inferior rectus of one eye, combined with a superior or inferior oblique of the opposite eye, one should recognize that one or the other muscle

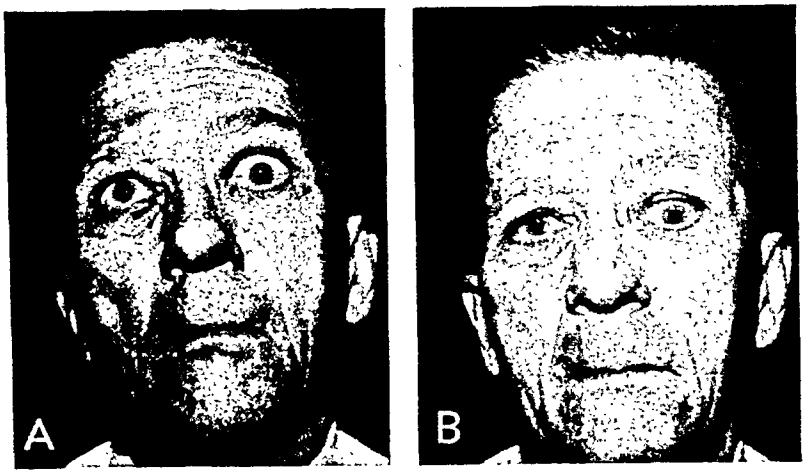


Fig. 10 (Adler). *Case 1.* Paralysis of the left superior rectus and left inferior oblique. (A) Left paralyzed eye fixing. (B) Right nonparalyzed eye fixing.

is actually the paretic muscle while the other is underacting due to habitual fixation with the paretic eye.

Group 2. The second group of cases are those in which the two muscles paralyzed are caught by a single lesion in the pons or the muscles themselves are involved in the orbit. The muscles paralyzed may be the elevators or the depressors of one eye or both superior obliques. Cases of supranuclear paralysis and paralysis due to myasthenia gravis have purposely been omitted from this discussion.

Anatomists are generally agreed that the muscles for elevation of the eye; that is, the superior rectus and the inferior oblique, have their nuclei of origin in the extreme anterior portion of the ipsilateral third-nerve nucleus. These cells all lie very close together and may easily be caught by small lesions in this region, such as a hemorrhage. Patients with a unilateral paralysis of the superior rectus and inferior oblique, either with or without ptosis, due to a small hemorrhage in this region, are frequently seen. (Kirby, D. B.: Arch. Ophth., 35: 199 (Mar.) 1946).

Case reports

Case 1. Mr. C. L., aged 65 years suddenly began to have vertical diplopia without any antecedent injury or illness. Examination showed a paralysis of the left superior rectus and left inferior oblique. Figure 10A shows the position of the eyes in the primary position when the left paralyzed eye is fixing, which is habitually the case. The right eye is elevated 25 degrees (secondary deviation) and the left upper lid is tucked due to overaction of the left levator consequent to the paresis of the left superior rectus. In Figure 10B, the nonparalyzed eye is fixing and the left eye is down 15 degrees.



Fig. 11 (Adler). *Case 1.* Angle of squint in the four oblique positions of gaze with the left paralyzed eye fixing. (A) Overaction of the right superior rectus. (B) Overaction of the right inferior oblique. (C) Underaction of the right inferior rectus. (D) Underaction of the right superior oblique.

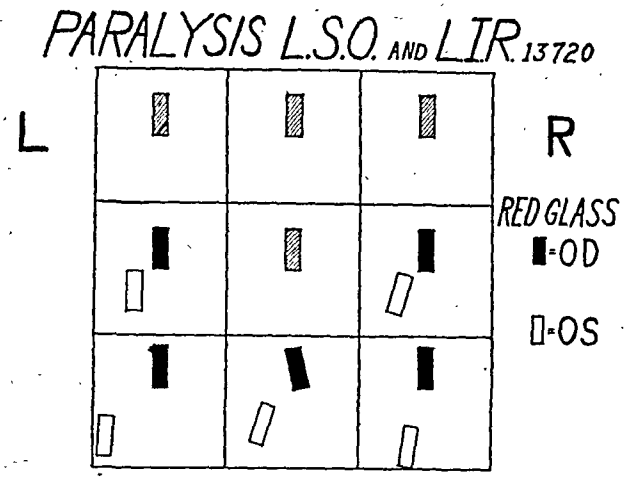


Fig. 12 (Adler). *Case 2.* Diplopia fields in paralysis of the left superior oblique and left inferior rectus. Right eye fixing.

Figure 11A shows the eyes up and to the right. The left eye is fixing, and the right eye overshoots due to overaction of the right superior rectus, the yoke muscle of the paretic left inferior oblique. In Figure 11B, eyes are up and to the left. The left eye is fixing and the right overshoots, due to overaction of the right inferior oblique, the yoke muscle of the paretic left superior rectus. In Figure 11C, the eyes are down and to the right. The left eye is fixing, and the right fails to move down as far as it should, due to underaction of the right inferior rectus, the yoke muscle of the left superior oblique. In Figure 11D, the eyes are down and to the left. The left eye is fixing and the right fails to move down as far as it should due to underaction of the right superior oblique, the yoke muscle of the left inferior rectus.

Studies of this patient showed nothing except advanced arteriosclerosis and hypertension. He has been under observation for a year. The final diagnosis is "paralysis of the left superior rectus and left inferior oblique due to a lesion, probably vascular, in the left third nucleus."

Case 2. Mr. J. A., aged 31 years, had an auto accident in June, 1946, and suffered severe contusion of the brain. There was no injury to the face. He has had vertical diplopia since then. Vision is 6/7.5 in each eye, with correction. There is no detectable strabismus except on covering so that the eyes are dissociated. The strabismus indicates a paralysis of the left inferior rectus and the left superior oblique. This is borne out by the fields of fixation on the Hess apparatus and the diplopia fields.

Figure 12 shows the diplopia fields. Figure 13 shows the fixation fields measured on the Hess charts, indicating a paresis of the left inferior rectus and superior oblique and

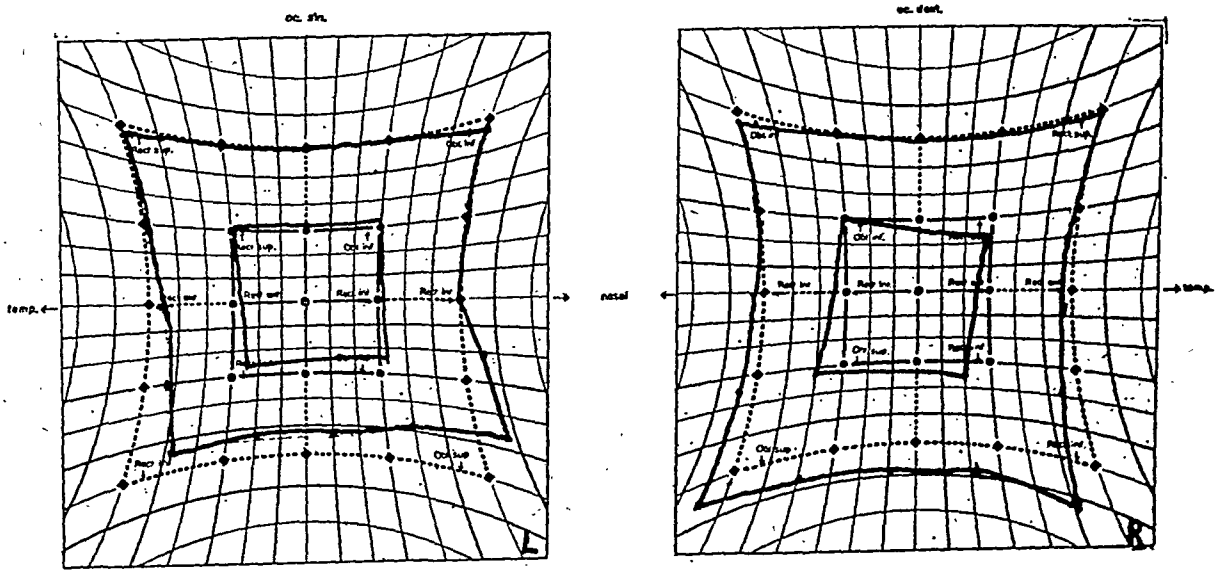


Fig. 13 (Adler). *Case 2.* The fixation fields on the Hess chart, showing a paresis of the left inferior rectus and the left superior oblique and overaction of the right superior oblique and right inferior rectus.

an overaction of the right superior oblique and inferior rectus.

A diagnosis was made of paralysis of the depressor muscles of the left eye due presumably to a hemorrhage in the pons involving the cells of the inferior rectus and superior oblique which lie close together.

Case 3. Mr. J. Van D., aged 34 years, was in an auto accident four weeks prior to examination and was struck on the right side of his head. Since then he has had diplopia when looking to either side below the horizon. He carries his head with chin depressed on chest. The eyes are straight in all positions except on looking down and to the right or left. The strabismus, fixation fields, and diplopia fields suggest a paralysis of both superior oblique muscles, greater on the right side.

Figure 14 shows the diplopia fields taken at the initial examination. All studies were negative. A diagnosis was made of hemorrhage in the pons catching the fourth nerves as they cross one another before emerging from the pons. Five months later the patient was reëxamined and found to have made a complete recovery of the left superior oblique and marked improvement in the right superior oblique. The fixation fields

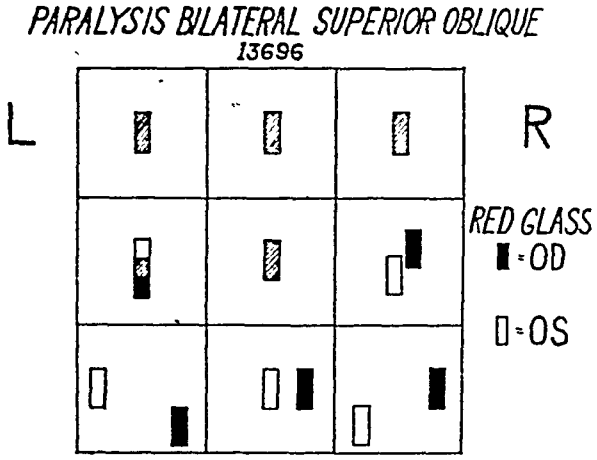


Fig. 14 (Adler). *Case 3.* Diplopia fields indicating bilateral paralysis of the superior obliques. On dextroversion, the right eye assumed fixation, and in levoversion, the left eye.

(fig. 15) failed to reveal any weakness of either superior oblique, but showed a marked overaction of the left inferior rectus. Evidently the right superior oblique had recovered to the extent that it could now move the right eye its full extent down and to the left, but the excessive innervation required to do this caused the yoke muscle, the left inferior rectus, to overact.

Case 4. Mrs. J. D., aged 56 years, had a paralysis of right superior rectus and inferior oblique due to a metastatic tumor in

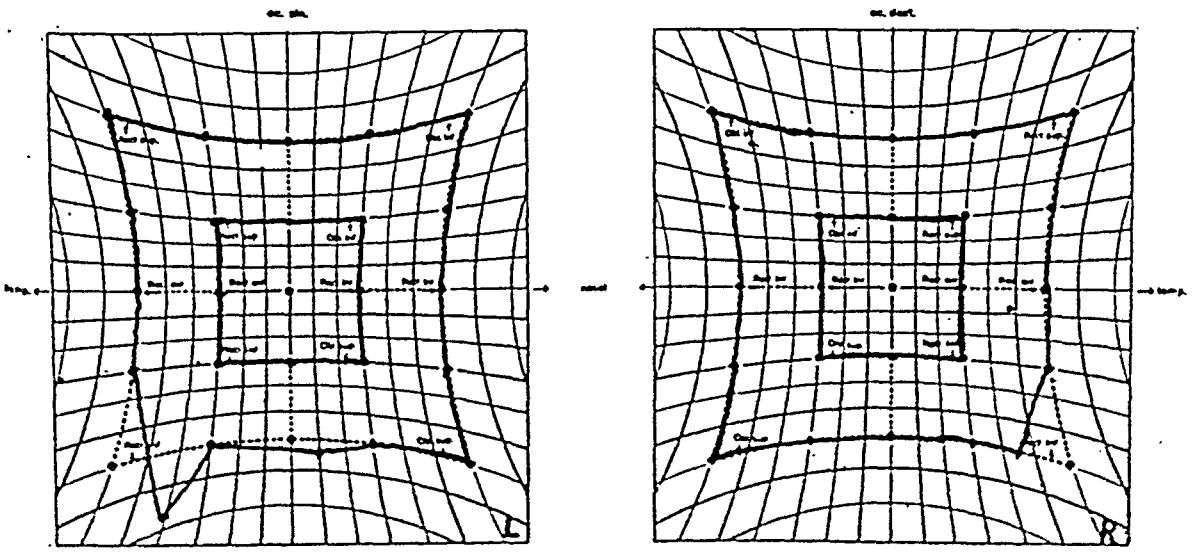


Fig. 15 (Adler). *Case 3.* Fixation fields made five months after first examination. At this time, both of the obliques had recovered, leaving no residual difficulty except overaction of the left inferior rectus.

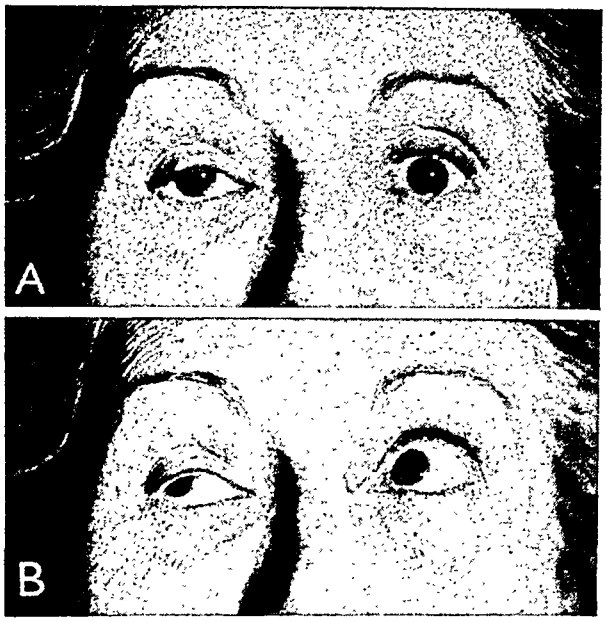


Fig. 16 (Adler). *Case 4.* Ptosis and right hypotropia due to a mass in the right orbit, preventing upward rotation of the right eye. (A) Eyes in the primary position. (B) Looking up and to the right.

the right orbit. For the past six months, this patient has complained of increasing diplopia on looking upward. Examination showed a mass in the right orbit, freely palpable, and an enlarged lymph node above the right clavicle. The right breast, which contained a tumor, was removed along with the enlarged lymph node. The diagnosis of the breast tumor was carcinoma, and the lymph node was diagnosed as a metastatic lesion from this. It was presumed that the mass in the right orbit was also a metastatic lesion which had involved the globe so that upward rotation was impaired. Figure 16 shows the appearance of the patient, and Figure 17 shows the fixation fields, indicating a paralysis of the right superior rectus and the right inferior oblique.

Summary

In a number of cases of paralysis of the vertically acting muscles, the diagnosis is made difficult because two muscles appear to be paralyzed. These cases fall into two groups. (1) Those in which no single lesion could involve both muscles. The muscles seemingly affected are either the superior rectus of one eye together with the superior oblique of the opposite eye, or the inferior rectus of one eye together with the inferior oblique of the opposite eye. In these cases, only one muscle is actually paralyzed, while the seemingly paralyzed muscle in the opposite eye is underacting on the basis of Hering's law. It is evident that the description given in textbooks of paralysis of each of the vertically acting muscles is inadequate

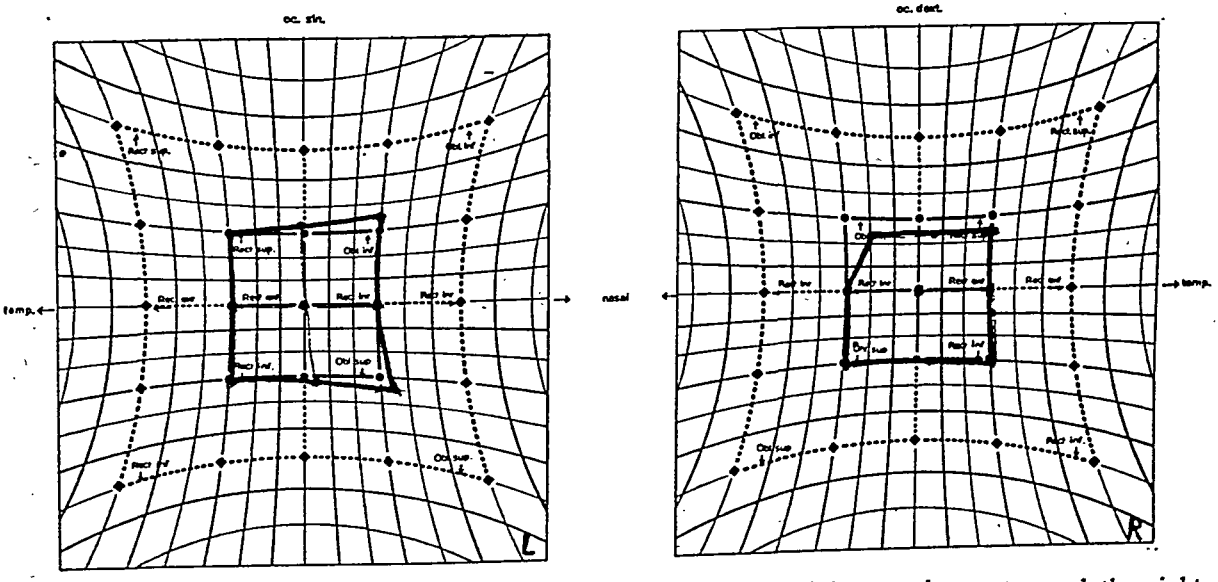


Fig. 17 (Adler). *Case 4.* Fixation fields show paralysis of the right superior rectus and the right inferior oblique and overaction of the left inferior oblique. There is also an overaction of the left superior oblique for which I have no explanation.

in that it only considers the effect the one paralyzed muscle might have on the strabismus and diplopia fields. When the paralyzed eye is habitually used to fix, the effect of a paralysis of one muscle extends to the activities of other muscles in the same and in the opposite eye and this leads to a picture which can be very confusing if the situation is not understood and kept in mind when these cases are analyzed.

In the second group of cases a single lesion involves the elevators or the depressors of one eye or both superior obliques. This is quite understandable on anatomic grounds and should lead to no confusion. The elevators and depressors of one eye can be caught in the orbit by scars and growing tumors, or the nuclei of origin of their nerves may be damaged by small lesions in the pons. The two fourth nerves may be caught as they cross each other before emerging on the posterior face of the brain stem.

313 South 17th Street (3).

THE PROBLEM OF SYMPATHETIC OPHTHALMIA*

THE MONTGOMERY LECTURE

BERNARD SAMUELS, M.D.
New York

The term sympathetic ophthalmia designates a disease which is always bilateral. It breaks out first in an eye the external tunic of which has been penetrated, called the exciting eye, and afterwards in the uninjured eye, called the sympathetizing eye. That a disease in one organ should excite an identical disease in a symmetrical organ is, in any event, a most extraordinary phenomenon in human pathology. To remove it still farther from the common order is the fact that the agent that causes it has never with certainty been identified. Hippocrates mentioned, in one brief sentence, that when an eye has been lost from injury the fellow eye often becomes blind. Strange to say this truth received but passing notice through all the centuries until William MacKenzie, in 1835, brought the importance of it to the attention of the modern world. Since then an immense body of writings has dealt with the subject.

The disease is characterized anatomically by the appearance in the pigmented and highly vascular uvea of an infiltration composed of three elements: lymphocytes, epithelioid cells, and giant cells, known as the specific infiltration of sympathetic ophthalmia (fig. 1).

ARTIFICIALLY MADE OPENINGS OF GLOBE

Before going further into the minutiae of the infiltration it would seem timely to speak of the artificially made openings of the globe and of the incarceration of uveal tissue therein, with all of which the problem of sympathetic ophthalmia is inextricably bound up.

ACCIDENTAL OPENINGS

By far the greater number of accidental openings take an anteroposterior direction and many of them are located in the center of the cornea. A small opening in the center is not complicated by a prolapse of the iris and hence is considered to be less dangerous than one in the periphery into which the iris would more readily fall.

A prolapse of the iris, large or small, in a corneal wound is particularly hazardous

* Delivered before the Irish Ophthalmological Society, at Trinity College, Dublin, Ireland, May 12, 1947.

because it lies naked on the cornea which, when the lids are apart, is the most exposed field of the globe. Unless the iris is excised the wound remains open a long time and the prolapse can only disappear by necrosis.

Singularly, an exposure of the iris as a whole after a most extensive perforating wounds of the sclera over the ciliary body are more dangerous than analogous wounds elsewhere because of the greater tendency of the uveal tract to prolapse. Particularly disastrous are ruptures at the limbus because here the root of the iris, either alone or with the ciliary processes, is most likely to become

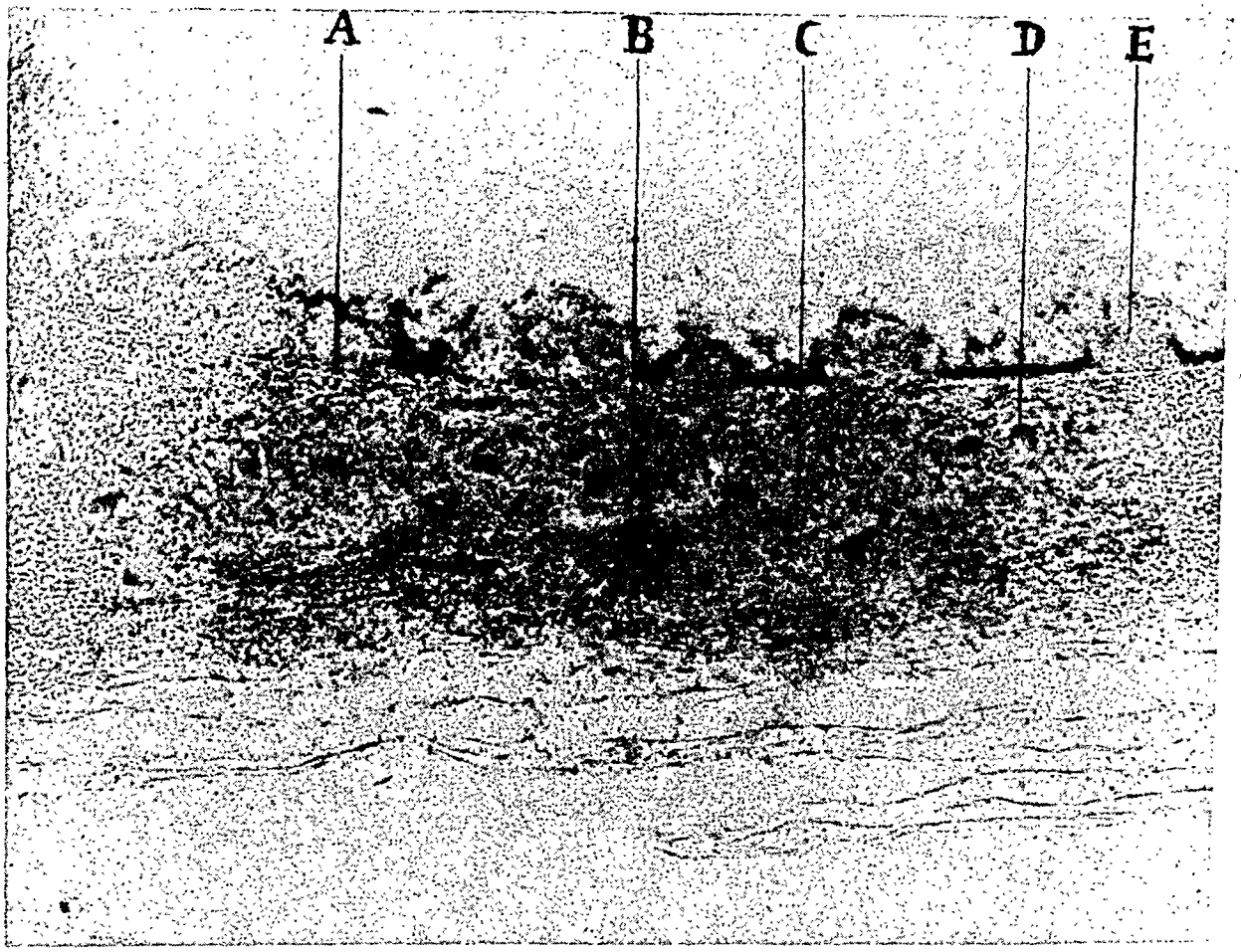


Fig. 1 (Samuels). In this specimen from the choroid, the entire pathologic anatomy of sympathetic ophthalmia is shown. (A) Lamina vitrea. (B) Lymphocytes. (C) Epithelioid cells. (D) Giant cells. (E) Galen's foci.

serpiginous ulcer is seldom followed by sympathetic ophthalmia. The iris is not constricted or strangulated as in a small opening and, as the iris and the limbus are heavily inflamed, there is soon produced a fibrinous exudate which seals off the exposed area in the first step of what will in time become a staphyloma of the cornea.

The regions of the ciliary body is appropriately called the "dangerous zone." Punctured, incised, contused, and lacerated incarcerated, whether injured or not. In general, the larger the perforation, the longer it remains open; and the more extensive the uveal prolapse, just so much greater is the hazard.

A few cases of sympathetic ophthalmia are reported as having been brought on by a contusion over the ciliary body without rupture of the sclera. Probably in some of these cases the blow produced ruptures in the conjunctiva and sclera too minute to be seen.

SURGICAL OPENINGS

Surgical openings, except those made for corneal transplantation, generally take a frontal direction parallel to the anterior surface of the iris. The surgery of today, instead of lessening the possibilities of sympathetic ophthalmia, has vastly increased them. Formerly the field of intraocular operations was restricted to the periphery of the cornea and the limbus. It now embraces every zone of the surface of the eyeball from the center of the cornea to the neighborhood of the optic nerve. While no incision is ever made directly over the ciliary body, yet diathermy here is one of the methods employed for glaucoma.

Among the earlier operative procedures that had to be abandoned is iridodesis which Critchett devised in 1858. He sought to obviate the large opening of an optical iridectomy and the loss of pupillary reaction by drawing the periphery of the iris into a small incision in the cornea above, leaving the pupillary border within the chamber. A thread was tied around the protruding iris to prevent its slipping back. No thought seems to have been given to the danger of the procedure until Graefe, in 1863, published a case of bilateral inflammation and blindness following its used, which he believed had been caused by traction on the incarcerated iris from within the globe but which must have been due to sympathetic ophthalmia.

In recent years Key's method for the repair of iridodialysis by suturing the root of the iris to the periphery of the cornea was soon abandoned as unsafe after the report of a case of sympathetic ophthalmia. Evisceration of the contents of the globe is not considered to be free of danger for it is not possible to scrape off the uveal tissue that lines the walls of the emissaria.

As regards operations for the removal of cataract, the flap incision at the periphery of the cornea is considered safest from the standpoint of sympathetic ophthalmia. Graefe's linear extraction, in which the incision lies back of the limbus where a conjunctival flap is not easily obtained, fell into disrepute after several cases of sympathetic ophthalmia were reported. An idea prevails that the intracapsular operation is less dangerous than the extracapsular. It is true that the occurrence of lens capsule and lens matter in the wound, with consequent delay in healing, is obviated by the intracapsular method but when an actual prolapse of the uvea has happened one method must be as dangerous as the other. I recently examined a globe in which, after an intracapsular operation, there was a large prolapse of the iris and ciliary processes. There was no purulent infection. The specific infiltration was extensive and in pure form. The fellow eye became violently inflamed six weeks after the operation and was blind almost from the start.

Sympathetic ophthalmia may occur after operations for glaucoma whether the opening is small, as in a trephine operation, or large, as in a modified Lagrange. All parts of a globe affected with long-standing glaucoma are more or less degenerated and inflamed so that a fistulous opening, with or without prolapse of the iris, is often not possible. The very low tension that sometimes sets in and which may be thought to be due to filtration may, in fact, represent a postoperative iridocyclitis with fine deposits on Descemet's membrane. Such a globe is at the threshold of atrophy and is as dangerous for sympathetic ophthalmia as if it had never been glaucomatous. It is borne out by experience that as long as an eye remains hard after an operation the probability of sympathetic ophthalmia is remote.

The possibility of sympathetic ophthalmia following operations for detachment of the retina is practically never considered in spite of the numerous openings that are made into the sclera and choroid. These two structures are membranous and lie in close apposition so that there is no reason for the choroid to prolapse. Rather it shrinks from the wound

by its own elasticity and, moreover, the openings are immediately closed by tissues at the end of the operation.

In point of surgical procedures contributing to sympathetic ophthalmia, cataract extration heads the list and next come operations for glaucoma. They are all near the "dangerous zone," and cataract operations

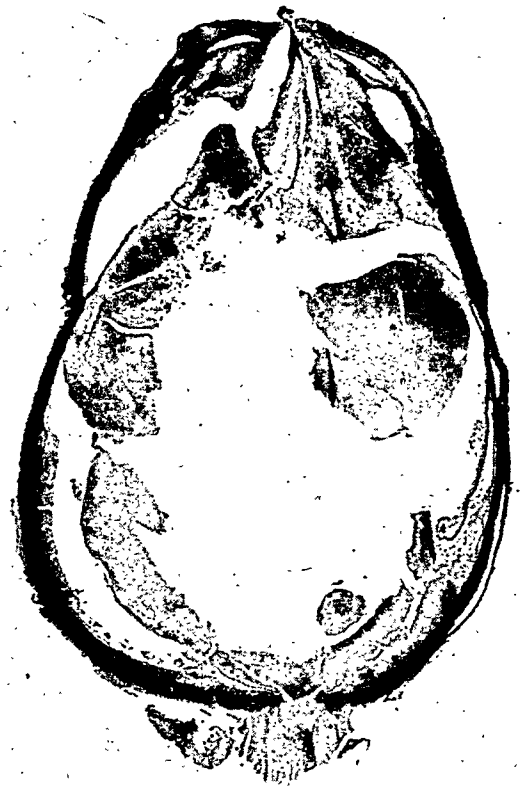


Fig. 2 (Samuels). Open panophthalmitis with purulent destruction of papilla. Sclera is intact.

require the largest of all incisions. There is no standard operation in ocular surgery that has not had marked against it a case of sympathetic ophthalmia or infection. That the occurrence of sympathetic ophthalmia has not kept pace with the ever-increasing number and complexity of operations is certainly due to good surgery and thorough antisepsis. A factor not to be overlooked in the causation of postoperative sympathetic ophthalmia is a tendency on the part of a surgeon to delay too long the enucleation of an eye that has not healed properly. In a hospital a case or two of sympathetic ophthalmia may occur and then be followed by an interval of freedom which lasts as long as the memory of the lesson taught by this experience remains fresh. That the danger of sympathetic ophthalmia was fully realized by surgeons in World War II is evident from the statistics of the Army Institute of Pathology in Washington. Until recently there had been received only 16 globes that had developed sympathetic ophthalmia following training and combat injuries.

Role played by the healing process of a perforation

There is nothing remarkable about the scar tissue that heals a perforation and in so doing distorts the globe and causes it to become soft. One cannot say that the fellow eye will become inflamed but it may. In the cases in which this occurs two separate pathologic conditions are found in the injured eye: (1) the consequences of the injury itself and, (2), without discernible cause, the specific infiltration in the uvea.

Complications in the healing process

1. *Endophthalmitis Septica.* Pyogenic bacteria may be introduced into the vitreous body by the instrument or enter later. Here they multiply and elaborate toxins which set up an exudative process from the blood vessels in the adjoining retina, papilla, and ciliary body. The pus cells, being highly motile, travel inward toward the bacteria to form an abscess of the vitreous. The iris is little affected because it is bound down to the lens capsule and, where it is exposed in the periphery, the pigment epithelium and the dilatator muscle protect the stroma from the toxins, which accounts for the aqueous and cornea remaining clear. The bacteria soon die and the pus cells become necrotic. A cyclitic membrane detaches the retina. The essential thing is that the choroid be protected from toxins by the retina and later also by the subretinal fluid. When such an

eye has caused sympathetic ophthalmia there is found in the choroid, entirely independent of the damage caused by injury or infection, the specific infiltration. Whatever the causative agent of sympathetic ophthalmia, the pus-producing bacteria do not always destroy it, if they ever do, for it is estimated that from 2 to 13 percent of all cases of sympathetic ophthalmia have originated in globes that had suffered from posttraumatic endophthalmitis septica.

2. Septic Panophthalmitis. In septic panophthalmitis, virulent bacteria in the vitreous destroy not only the retina but also the choroid. The amount of the destruction depends largely on the state of the opening (fig. 2). If it remains open—open panophthalmitis—there is less damage to the uvea because the abscess can discharge itself through the preformed opening. If the wound is closed—closed panophthalmitis—the destruction of the uvea must be great before the abscess can break through the sclera, usually at the equator, and discharge itself into the orbital tissue (fig. 3). In either case the eye shrinks to a mere stump—phthisis bulbi. Neverthless, a minute amount of uveal tissue is almost certain to be spared. The incidence of sympathetic ophthalmia after panophthalmitis I estimate to be about 3 percent.

3. *Foreign Bodies.* It is computed that particles of steel constitute 98 percent of all intraocular foreign bodies found in civilian life.* The size of such particles varies from 0.5 to 6 or 8 mm. in diameter. In most instances the point of entrance is through the cornea. Most of these foreign bodies are extracted with good results, particularly when the anterior route is used. Sympathetic ophthalmia in these cases is exceedingly rare. The penetrating wound is very small and the tissues touched by the foreign body tend to fall inward in its pathway.

Every foreign body that remains within the globe sooner or later surrounds itself with a bed of connective tissue which may be so large as to occupy half of the vitreous cavity. Eventually the bed tends to break down and discharge poisonous substances and extrude the foreign body into the cavities of the globe or outside of it. The presence of a foreign body, even while still



Fig. 3 (Samuels). Closed panophthalmitis. The sclera and orbital tissues are blended in necrosis. (C) Cornea. (O) Optic nerve.

confined in its bed, causes the eye to be more or less sensitive, and may excite irritation of the other eye, all of which may go on for years. If such an eye has been the source of sympathetic ophthalmia, it will show, aside from the consequences of the wound and of the foreign body, the specific infiltration in the uvea, as if no foreign body existed. When, concurrent with the foreign body, bacteria are introduced, it is the bacteria that cause the first inflammatory reaction and the presence of the foreign body is of no immediate consequence. Acting as a

* Gulliver, F. O.: Particles of steel within the globe of the eye. Arch. Ophth., 28:896-903, 1942.

foreign body in atrophic eyes of long standing and not of itself dangerous for sympathetic ophthalmia is a plate of bone which forms out of a connective-tissue membrane on the internal surface of the choroid or within its stroma.

Stage 1. Isolated nodules of lymphocytes appear in and around the walls of the larger veins of the choroid.

Stage 2. In the midst of the nodules of lymphocytes appear groups of large oblong cells with faintly staining nuclei and poorly

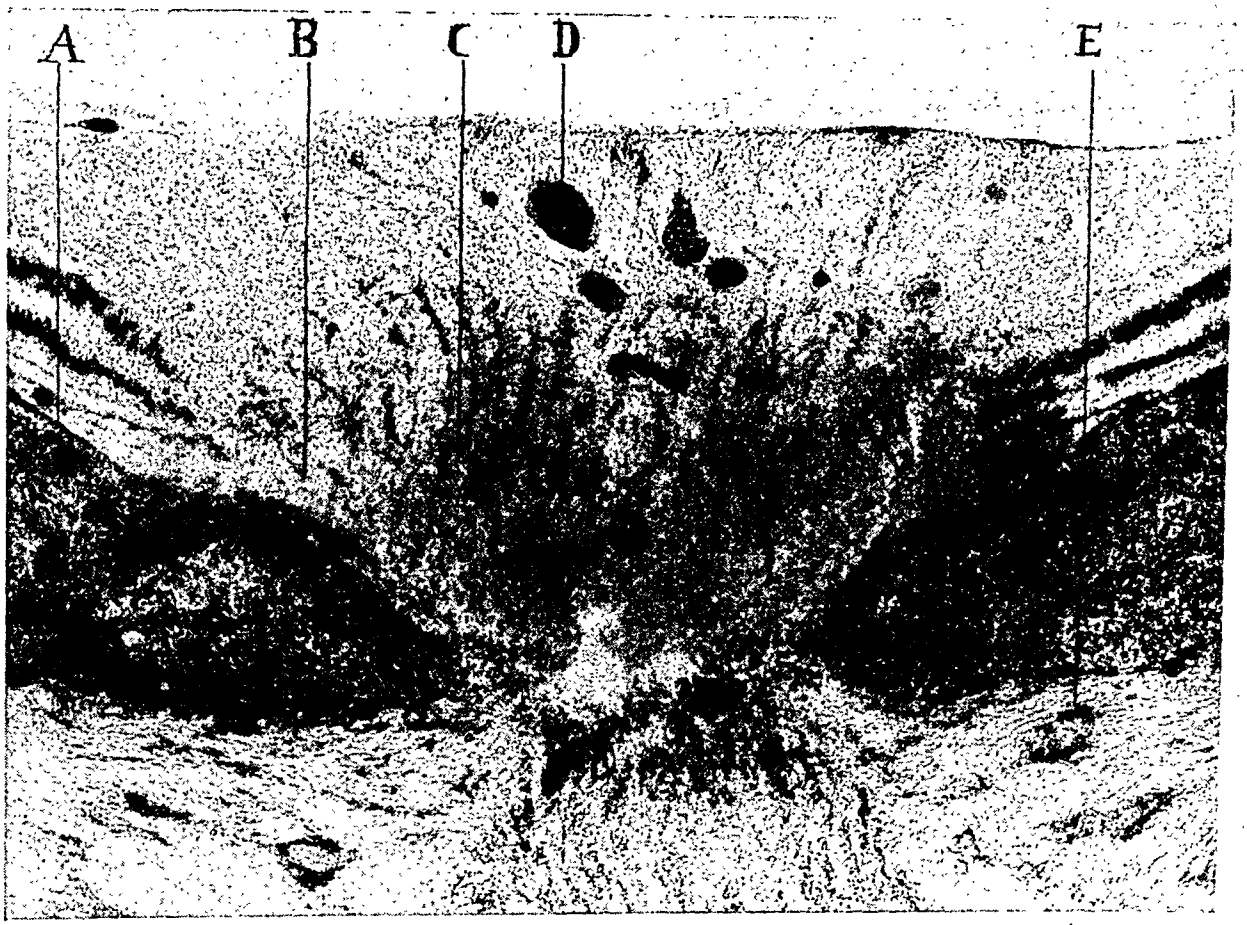


Fig. 4 (Samuels). Circumpapillary infiltration of choroid. (A) Pigment epithelium and choriocapillaris intact. (B) Low detachment of retina. (C) Papilledema. (D) Retinal perivasculitis. (E) Invasion of emissaria.

Minute anatomy of the specific infiltration of sympathetic ophthalmia

The exciting eye

In making a pathologic differentiation of sympathetic ophthalmia in the exciting eye, the posterior part of the choroid is chosen because the uvea is here the least damaged by the injury, and it is here that the infiltration is generally the more typically developed, probably because of a greater thickness of the tissue and a richer blood supply (fig. 4). The infiltration takes place in the following manner.

defined borders, known as epithelioid cells because they resemble the same cells in tuberculosis. They are believed to originate in the endothelium of the walls of the blood vessels which by this time have disappeared.

Stage 3. Later a number of epithelioid cells may merge to form a giant cell. This third element is not necessary. A typical nodule consists of lymphocytes and epithelioid cells.

In time the nodules coalesce and diffusely replace the vascular structure of the choroid, forming a layer of three or more times the normal thickness. No matter how heavy the

infiltration is, the overlying choriocapillaris remains singularly free. It may be because this layer is not composed of typical uveal tissue but is made up of a network of capillary tubes in a nonpigmented almost homogeneous stroma. In disseminated chorioretinitis, the capillary layer is always destroyed. In sympathetic ophthalmia, the pigment epithelium and the retina are not affected. Occasionally small mounds of proliferated pigmented cells develop on the internal surface of the choroid—Galen's foci—which are of no importance (fig. 1).

Externally, the suprachoroidal lamellae become infiltrated but epithelioid cells are not to be found here, at least in the first stage, because the lamellae contain no blood vessels. The infiltration travels outwardly along the uveal tissue that lines the emissaria so that typical nodules may appear on the external surface of the sclera. Indeed, the stroma of the sclera may become so invaded that the inflammation takes on the nature of a chorioscleritis. Typical nodules have been encountered at a considerable distance from the sclera among the bundles of the inferior oblique muscle (fig. 5). Not infrequently the infiltration makes its way through the emissaria that surround the nerve head and travels into the pial sheath. As a rarity nodules are seen along the walls of the retinal blood vessels in the cribriform plate. It is to be emphasized that, strictly speaking, sympathetic ophthalmia is a disease that is not confined solely to the inner eye.

In the ciliary body the nodules coalesce to form plates in the vascular layer. Here the pigment layer may be destroyed, but the nonpigmented epithelial layer is always preserved just as is the choriocapillaris. Giant cells are more often to be found in the ciliary body and when pigmented they are probably derived from the chromatophores.

In the iris, the infiltration may assume the size and shape of a tumor filling out the entire anterior chamber (fig. 6). No matter how excessive the infiltration is, it leaves the anterior limiting layer of the iris free. On the other hand, posteriorly, the pigment epithelium is broken through very early in the process and nodules of lymphocytes and epithelial cells expand along the surface of the lens. When the root of the iris is heavily infiltrated and thickened, the infiltration passes into the anterior emissaria, and files of lymphocytes, penetrating between the limbus and sclera, actually destroy many of the bundles so that the corneoscleral margin may be the most severely inflamed part of the margin. One of my specimens reveals a typical nodule in Schlemm's canal.

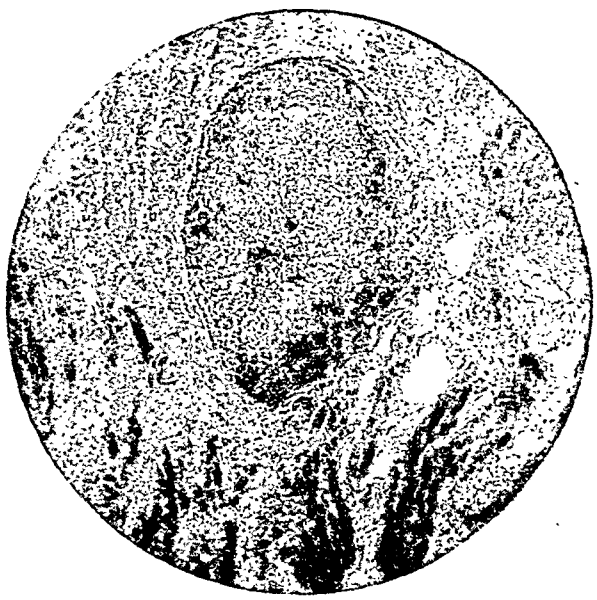


Fig. 5 (Samuels). Sharply defined sympathetic nodule among the fibers of the inferior oblique muscle.

The disease reaches its anatomic peak when the iris, the ciliary body, and the choroid are all infiltrated. The infiltration may be so exuberant as to almost fill the globe within the brief space of 5 or 6 weeks. The stages of disintegration take a long time, often years. First the giant cells disappear and then the epithelioid cells. At last the entire infiltration is replaced by a membrane of dense uncharacteristic connective tissue.

The sympathizing eye

A very short time after the infiltration forms in the injured eye it appears in the

fellow eye. Only about a dozen of the sympathizing eyes have come to histologic examination because there is no reason for enucleating one unless the patient dies or the eye causes so much pain that he prefers to have it out. In these few cases the same kind of infiltration and the same distribution in the uveal tract are found as in the injured eye. Most often it is the most anterior part of the uveal tract that suffers first. The picture is a pure one, uncomplicated by the consequence of traumatism or infection.

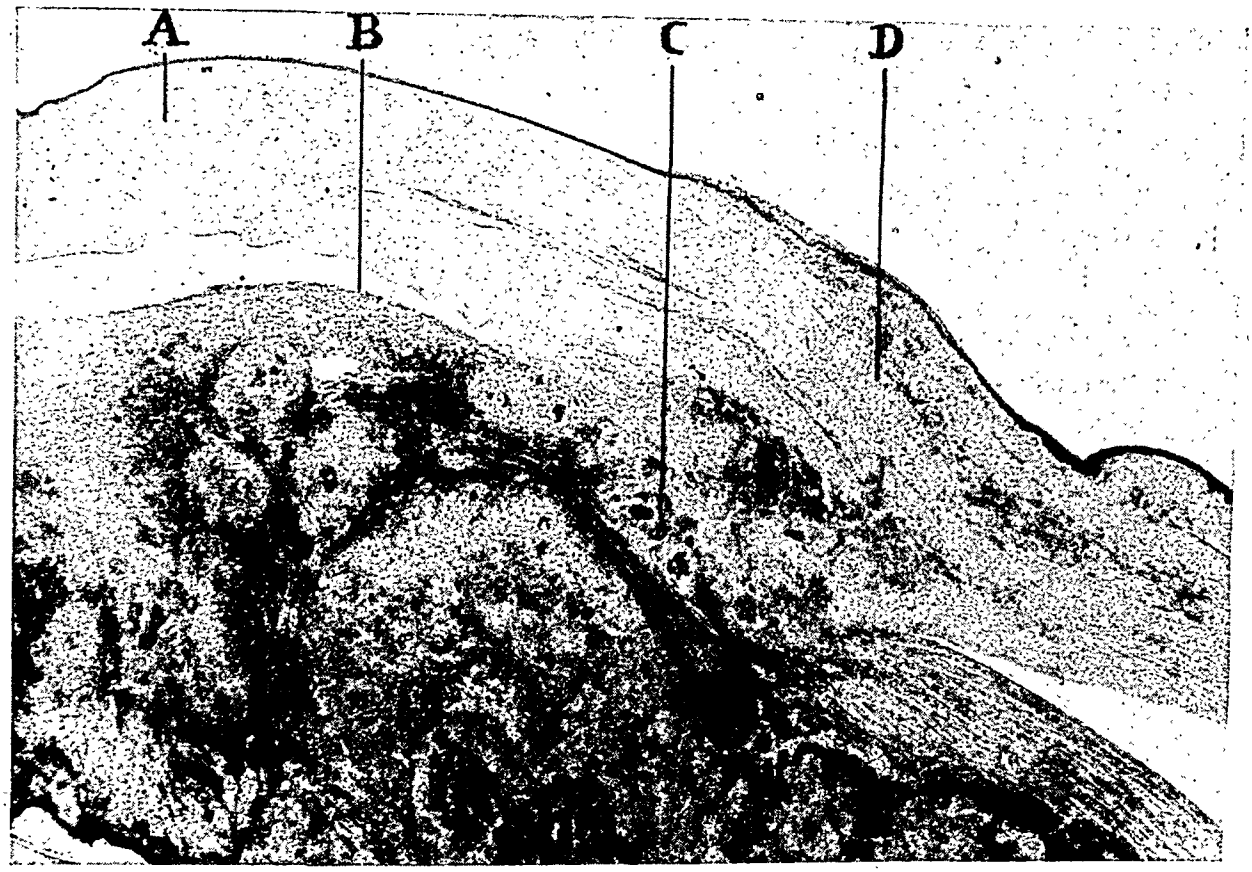


Fig. 6 (Samuels). Tumorlike infiltration of the iris and ciliary body. (A) Normal cornea. (B) Sharply defined anterior limiting layer of the iris. (C) Giant cells in island of epithelioid cells. (D) Limbus thinned and dehiscent.

Occurrence in different countries

Sympathetic ophthalmia is thought to occur with about the same frequency in the Americas, Europe, and China.* However, in India, notwithstanding the many thousands of cataract extractions that are performed annually, it is said to be practically unknown. Either the people of that country possess an exceptional degree of resistance to the disease or the agent that causes it does not exist there.

* Fuchs, A.: Ueber sympathisierende und sympathische Ophthalmie. Med. Welt., 15:313 (Mar.) 1941.

Anatomic similarity and difference between sympathetic ophthalmia and tuberculosis

Points in common

Sympathetic ophthalmia and tuberculosis are composed of the same histologic elements: lymphocytes, epitheloid cells, and giant cells. The two diseases are alike when it comes to two of their chief characteristics; namely, proneness to recurrence and exacerbation. As regards the bilateral aspect, it cannot be sympathetic ophthalmia unless both eyes are involved. However, tuber-

culosis has a well-known tendency to attack both eyes simultaneously.

Points of difference

In sympathetic ophthalmia the nodules are located in the outermost layers of the choroid; in tuberculosis in the innermost layers. A giant cell in each disease contains many nuclei but the arrangement is different. In sympathetic ophthalmia the nuclei are formed by an irregular fusion of epithelioid cells. In tuberculosis the nuclei are apt to be disposed in the form of a ring—Langhan's type—being considered the product of a proliferation of the endothelium of a capillary. Caseation takes place almost from the beginning in tuberculosis; rarely in sympathetic ophthalmia, and then in the latest stage. The necrosis that is sometimes seen in sympathetic ophthalmia is not to be mistaken for caseation. Over a tuberculous nodule, the pigment epithelium of the choroid is destroyed as in miliary tuberculosis; over a sympathetic nodule, it is preserved. Tuberculosis tends to be localized in one part of the uvea. For example, when it starts in the iris or ciliary body it remains there indefinitely. Sympathetic ophthalmia spreads rapidly to all parts.

In tuberculosis of the iris, the nodules are located in the posterior layers, and the anterior limiting layer is spared. In sympathetic ophthalmia, the nodules pierce the pigment epithelium and expand against the capsule of the lens and proliferate into the circumlental space. They may develop while the pupil is widely dilated and cause the iris to be plastered to the lens in this shape, in contrast to ordinary plastic iritis in which there are no adhesions as long as the pupil is wide. In tuberculosis of the iris, the pupil reacts over a long period. In sympathetic ophthalmia, it is almost immediately fixed. In sympathetic ophthalmia, the normal color of the iris is less altered than in tuberculosis where it assumes a dull, grayish hue from the destruction of the chromatophores.

In the ciliary body, the nodules of sympathetic ophthalmia coalesce and form plates within the vascular layer and are separated from the vitreous body by the intact nonpigmented epithelial layer. In tuberculosis, the nodules destroy both epithelial layers of the ciliary body and lie free on the surface or suspended in the zonular fibers.

In sympathetic ophthalmia, the retina is practically never involved. In tuberculosis, secondary nodules in the retina are by no means rare.

In sympathetic ophthalmia, nodules in the emissaria appear almost at the same time that they do in the choroid. A careful search should always be made for early infiltration in the emissaria. In tuberculosis, involvement of the emissaria comes much later.

The most important anatomic difference between sympathetic ophthalmia and tuberculosis lies in the behavior of the lesion of each toward the adjoining tissues. Tuberculous infiltration has a tendency to invade other tissues. If it starts in the iris it will gradually fill the anterior chamber, and when it touches the cornea and sclera it produces in them an excavation of the same size and shape as the tuberculous tumor itself and in time destroys them. Such malignancy the sympathetic lesion does not possess. It remains in the uveal tract and destroys neither the retina on one side nor the sclera on the other.

Clinical signs of sympathetic ophthalmia

1. Sympathetic irritation

While the pathologic signs in sympathetic ophthalmia are almost unfailingly characteristic, such is not the case with the clinical symptoms. Thus the photophobia, the tearing, and the failing accommodation of sympathetic ophthalmia may also be seen in the second eye when there is no more than a foreign body embedded under the epithelium of the first eye. Actually, the only sure way to exclude the possibility of inflammation in the second eye, when it is irritated, is to make an examination of the media with the

slitlamp and ophthalmoscope. Even when no evidence of inflammation is found in the second eye, mere irritation is not to be taken lightly but rather as a warning of an impending outbreak of sympathetic ophthalmia. If it be mere irritation, this will disappear in a few days after the enucleation of the injured eye.

2. True sympathetic ophthalmia

The inflammation begins in the uninjured eye slowly and at first without pericorneal injection or pain. Disturbance of vision is often the first symptom, which probably manifests itself after nodules have formed in the uvea. In an early case, fine, grayish precipitations are seen on the posterior surface of the cornea. In attempting to dilate the pupil, adhesions are found, and in the vitreous, numerous fine opacities will be visible. Sometimes, at the very beginning, the media are clear enough to permit observation of an edema of the papilla, with cloudiness of the neighboring retina—a picture that is almost never seen in other forms of uveitis. Small yellowish patches in the choroid, about the size of a druse and almost as sharply defined, are very characteristic. They often disappear without leaving a sign. Anatomically these are probably isolated nodules of lymphocytes and epithelioid cells lying deep in the choroid. The infiltration into the emissaria, with scleritis, is probably the cause of the deep-seated pain that is one of the most distressing symptoms of the disease.

The state of the pupillary border, even before the loupe and lens came into general use, was considered of the greatest importance in arriving at a differential diagnosis. In the mildest form of iritis—iritis serosa—the pupil is free. The severer form —plastic iritis—is prone to cause incomplete adhesions which, as a rule, are confined to the pupillary zone. On the other hand, in genuine sympathetic iritis, sometimes called iritis maligna, the entire posterior surface of the iris is very soon agglutinated to the capsule of the lens. Occasionally grayish nodules break out at the pupillary border and expand on the lens capsule. This is a finding that is considered the most significant clinical sign of sympathetic ophthalmia in the anterior chamber. The iris may bulge forward, not from a damming back of the aqueous but from an increase of thickness as a result of the infiltration. The manifestation of iritis maligna marks the arrival of the disease at the culminating peak of its clinical severity.

Pathogenesis of sympathetic ophthalmia

1. Various theories

For over a hundred years many conjectures have been advanced as to the pathway by which the lesion in the injured eye sets up an identical lesion in its fellow. The infiltration in the sheaths of the injured eye does not travel via the chiasma since it is not found in the sheaths of the fellow eye. Transmission by way of the optic-nerve fibers cannot explain the infiltration in those cases in which it makes its first appearance as far forward as the iris of the fellow eye. The idea that it is transmitted through continuity of the ciliary nerves fell into oblivion because no connection between the two systems has been found. The old guess that the disease is carried to the other eye in the blood stream by a circuitous route through the vessels at the base of the brain approaches more nearly the present conceptions.

2. The allergic theory

In 1909, Elschnig, in Prague, published the theory that portions of the uveal pigment from the injured eye enter the blood stream and, acting as foreign matter, set up an anaphylactic reaction in the uvea of the fellow eye. Woods, in Baltimore, has carefully developed this theory and ascertained that, in its immunologic reactions, uveal pigment has the power of producing the formation of antibodies. The bleaching of the eyebrows that is occasionally seen in sympathetic

ophthalmia seems to speak for some disturbance of the pigment metabolism.

3. THE INFECTIOUS THEORY

a. The Tuberculosis Theory. In the Meller school in Vienna, in the years prior to 1940, tubercle bacilli were demonstrated in 20 percent of the eyes removed because of posttraumatic iridocyclitis. In one case of sympathetic ophthalmia which neither clinically nor histologically was entirely typical, Meller succeeded in cultivating tubercle bacilli. He concluded that sympathetic ophthalmia is of tuberculous origin and that between sympathetic ophthalmia and tuberculosis there is no essential difference, since they are both caused by the same microörganism.

b. The Virus Theory. In a microscopic study of the pathology of sympathetic ophthalmia, embracing some 120 globes and extending over many years, I have occasionally encountered an infiltration which was confined to the site of the opening. If the uvea had prolapsed then, the infiltration was both without and within the globes (fig. 7). More often the infiltration, while

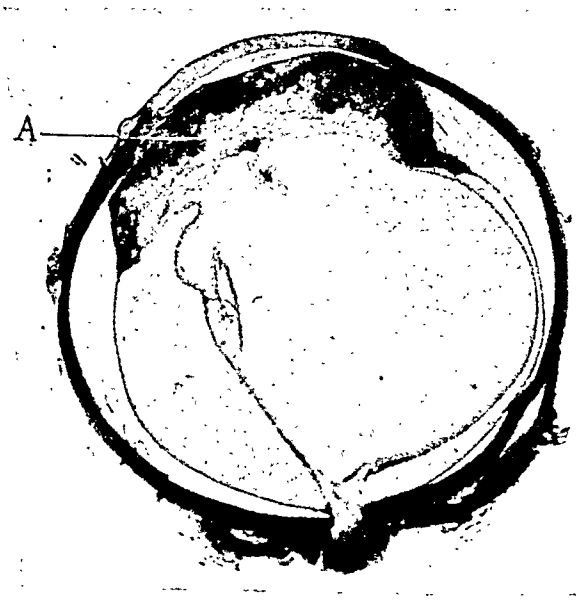


Fig. 7 (Samuels). Massive specific infiltration confined to the anterior segment of the globe at the site of the wound. (A) Cicatricial tissue caused by attempted iridectomy.

present elsewhere, was overwhelmingly heaviest at the site of the wound. Often the infiltration at the site of the wound was about equal to that in the choroid. In a few globes the infiltration here was less than

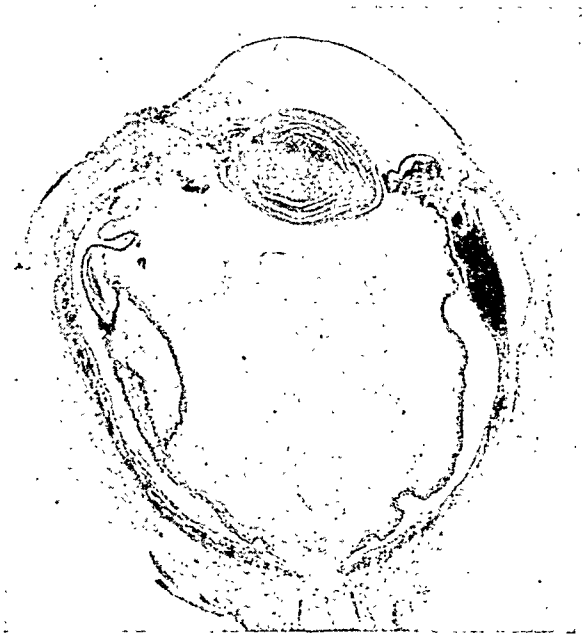


Fig. 8 (Samuels). Absence of infiltration at depressed scar of wound. Typical nodules in choroid becoming coalescent. Pial sheath of optic nerve infiltrated and also emissaria in sclera.

that elsewhere. There were still fewer globes in which it was absent at the site of the wound. The meagerness or absence of infiltration at the site of the wound could be explained by the circumstance that the uveal tissue in this location was too much damaged by the primary injury to react or else that it had been excised (fig. 8).

It is recalled that in the eye, as elsewhere in the body, an exogenous infection may occur without a primary lesion; that is, without a local accumulation of cells. It is also possible for a primary lesion to be so small as to pass unnoticed. The fact that primary lesions in the uvea at the site of the opening do occur leads me to accept the theory that sympathetic ophthalmia is a disease produced by a virus which has the perforating wound as its point of entrance. Here it lodges in the uvea and produces an

irritation which results in the specific infiltration of sympathetic ophthalmia. It spreads from this point to other parts of the uvea of the same eye and thence through the blood stream to the uvea of the other eye. That the infiltration confines itself to the uvea under all circumstances indicates a selective affinity on the part of the virus for this particular tissue.

One theory is that the virus is already in the blood and only after the uvea is traumatized does it lodge and multiply there and take on its selective affinity.

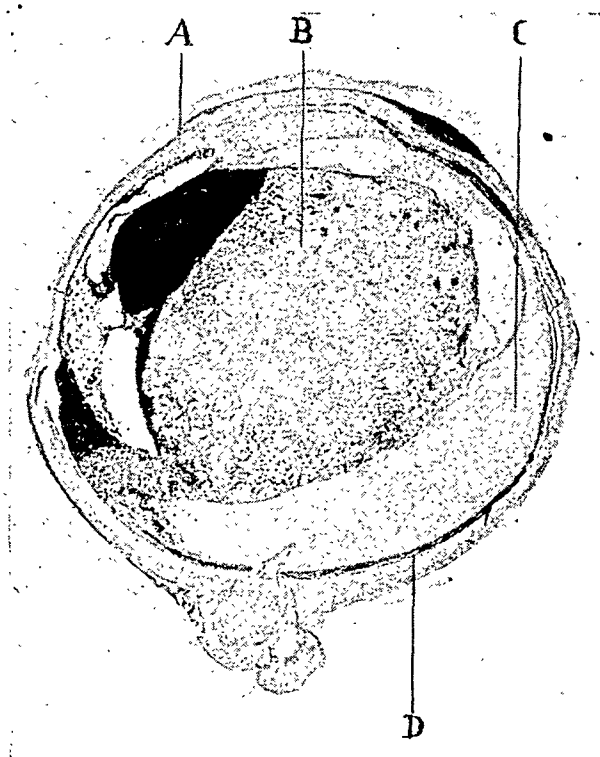


Fig. 9 (Samuels). Malignant melanoma of choroid and sympathetic ophthalmia. (A) Site of the wound. (B) Tumor with highly pigmented area next to wound. (C) Subretinal fluid. (D) Specific infiltration of sympathetic ophthalmia.

In further support of the theory of primary infection is the fact that, in the iris, the infiltration always appears to be older than in the choroid. Many times in the course of an observation, I have been able to trace the progress of the infiltration from the iris and ciliary body to the choroid and thence to the emissaria and external surface of the sclera, with as much certainty as tuberculous foci can be traced from the ciliary body to the choroid and retina.

In those cases in which sympathetic ophthalmia breaks out long after the injury, it is assumed that the virus has lain dormant in the tissues as bacteria may do in a healed alveolar abscess. Hence the infiltration in the late outbreaks has, as a rule, the appearance of being of recent origin.

A very few cases, some of them doubtful, have been reported in which a lesion similar to that of sympathetic ophthalmia is said to have broken out in one eye in connection with a malignant melanoma in the other. However, this can detract but little from the fact, so long established clinically and pathologically, that sympathetic ophthalmia is overwhelmingly associated with unnatural openings of the globe. I have recently examined a globe which exhibited both a malignant melanoma of the choroid and the specific infiltration of the choroid characteristic of sympathetic ophthalmia (fig. 9). The eye had been operated upon for absolute glaucoma and cataract. Two weeks after the operation the fellow eye became inflamed and the vision reduced. The exciting eye was immediately removed. Microscopically, it showed the specific infiltration in the choroid at a distance from the tumor. It is reasonable to suppose that the operation and not the tumor was the sole cause.

Prognosis and Treatment

I. Surgical treatment

a. Time to Enucleate

1. When the fellow eye is irritable, even if it be apparently normal, the injured eye should be removed.

2. At the discovery of deposits on the posterior surface of the cornea of the fellow eye, the injured eye should be removed.

3. In all cases in which the wound is retracted, especially if it contains uveal tissue and the eyeball is soft and tender to touch; when the vision is failing; when, in short,

there is no hope that the organ will ever again be serviceable, the time to enucleate has arrived.

Sympathetic ophthalmia has been known to set in within 48 hours after the injury, but it may not happen until years have elapsed. It is at once the gravest and the most unpredictable of all ocular diseases. The most hazardous period is during the first 2 or 3 months.

4. A globe with endophthalmitis is removed with safety at any time because the infection is confined within the fibrous tunic.

b. When Not to Enucleate

1. When the wound heals properly, the tension is good, some sight is retained, and the fellow eye shows no irritation, it is safe to wait and watch.

2. When the injured eye still has some vision after the fellow eye has become severely inflamed, the rule is to retain the injured eye, for in the end it may be the one eye that retains any sight.

3. When both eyes are violently inflamed, the enucleation of the injured eye can serve no purpose.

4. As regards panophthalmitis, Graefe reported the loss of two patients from meningitis after the enucleation of a globe with flagrant panophthalmitis. Since that time, it has been traditional in Germany and Austria never to excise such a globe until the inflammation has subsided.

Sympathetic ophthalmia has occurred during the active stage of panophthalmitis but so rarely as to justify delay. Occasionally, after the promptest removal of an injured eye the remaining one becomes inflamed. This may happen up to 20 days, which is the longest time on record. Such a retarded attack was formerly believed to have been excited by the removal of the injured eye. In these delayed cases, the virus was probably on the way but had not reached its destination at the time of the removal of the globe.

In the matter of enucleation, it is well to excise a long strip of the optic nerve and with it the surrounding tissues, not omitting to leave a long strip of the inferior oblique muscle with the globe. Radium treatment to the socket is suggested (fig. 10).

c. Complicating Secondary Glaucoma

As regards the secondary glaucoma which so frequently complicates the disease in the sympathizing eye, the surgical field is limited strictly to the clear cornea. No greater mistake can be made than to attempt to perform an iridectomy, for the iris as such no longer exists but is replaced by granulation tissue.

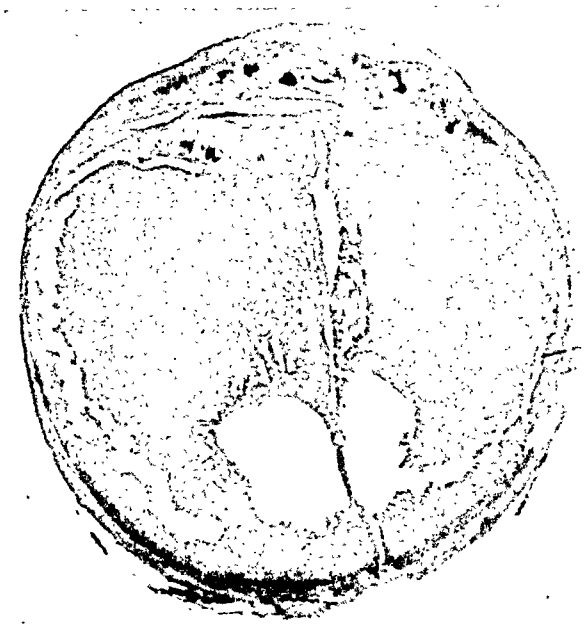


Fig. 10 (Samuels). Section shows buphthalmic eye six years after injury. Optic nerve excised within scleral canal. Heavy episcleritis. Probably much sympathetic material remained in the orbit.

Paracentesis is the sole operation permissible. The incision may be opened the following day in order to improve the general condition by the evacuation of a cloudy and toxic aqueous. This procedure may be repeated many times. The highly swollen iris with its intact anterior surface—iritis maligna—is sometimes mistaken for iris bombé which leads to an attempt to reëstablish the communication between the two

chambers by transfixion or, worse still, by iridectomy.

d. Complicating Cataract

Concerning the complicating cataract that develops in time in the sympathizing eye, the dictum is not to attempt its removal until it is certain there has been no sign of inflammation for many months, and even then the indication should be nothing less than almost total blindness. The best result is promised by opening the occluded pupil and extracting the lens matter through it. Even by this method, the pupil is apt to close over from shrinkage of the surrounding membrane.

II. Medicinal treatment

Miotics would tend to increase the central synechia, and mydriatics would be harmful on account of the tendency to glaucoma—if, indeed, these solutions can have the least effect on iritis maligna.

Starting with the salicylates and mercury in the early days, down through salvarsan and tuberculin to the sulfa preparations and penicillin, not omitting fever therapy, medicinal remedies of many kinds have been tried. A complete list would form a catalogue of the passing moods in therapeutics during many decades. From almost every remedy there has come a report of a cure, after the removal of the injured eye. No doubt a number of these cases have been reported far too soon. The sight of an eye may improve immediately after the removal of the exciting eye and then, within a month or two, there may be a return of the inflammation followed by one attack after another through years until blindness ensues. It is to be remembered that cases of spontaneous cure are on record in which the removal of the injured eye was refused.

In evaluating the efficacy of any particular medicinal treatment, it is necessary to know in what exact pathologic stage of the disease it was begun. Treatment is conceivably helpful in the first stage before too many nodules have infiltrated the choroid and invaded the sclera, but in the second and third stages, it is difficult to understand how any remedy can affect the infiltration which by this time must have replaced the normal uvea and can only end in a fibrous membrane.

57 West 57th Street (19).

Historical Miniature

Ibn Sina calls attention to the possibility of ablation of prolapsed iris but advises against it in the following words: "Sometimes there is an outpouring of material which is also directed to the other eye." His commentator, Gentilis de Fuliginio, (died 1348 in Perugia) adds: "Quia oculi sunt alligati in cruciatione nervorum." Here we have the oldest suggestion of sympathetic inflammation of the eyes and even a theory of it.

Hirschberg in *Graefe-Saemisch Handbuch*, v. 13.

A SIMPLE PTOSIS OPERATION: UTILIZATION OF THE FRONTALIS BY MEANS OF A SINGLE RHOMBOID-SHAPED SUTURE*

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Each of the many ptosis operations in current usage can be classified into one of three general types: (1) Utilization of the paretic levator, (2) utilization of the superior rectus, or (3) utilization of the occipitofrontalis. It is generally conceded that no single type of ptosis operation will serve for the best correction of all cases of ptosis. This report describes a simple yet effective technique of utilizing the frontalis. The results of 31 such operations, performed on 23 patients, are analyzed.

Techniques for utilization of the frontalis are so legion as to obviate the necessity of a detailed description of each. Those in more common usage are Machek's attachment of the lid to the frontalis by means of two strips of dermis, Reese's attachment by means of orbicularis fibers, and Derby's attachment by means of a fascia lata sling. Kitlowski[1] has modified the fascia lata sling operation in that he places a strip of fascia lata in the shape of a rhomboid between the lid and the frontalis. The technique we have used is a modification of Kitlowski's in that we have used a permanently buried suture instead of fascia lata, have avoided dissection in the lid, and have placed the suture in such a position that a satisfactory lid fold has resulted.

TECHNIQUE OF OPERATION

Two small stab incisions are made at the upper border of the brow, one 5 mm. from its nasal termination and the other approximately 3 cm. lateral to the first. Each of these incisions goes down to periosteum. Two tiny incisions are made through the skin, 2 mm. above the upper lid margin and about 2 cm. apart, placed symmetrically so that they lie about 7 mm. from the nasal and lateral canthi respectively (fig. 1). A braided white-silk suture (size from 2-0 to No. 2) on a No. 5 three-eighths curve surgical cutting needle is inserted through the upper nasal of these four tiny incisions, through the fascial ter-

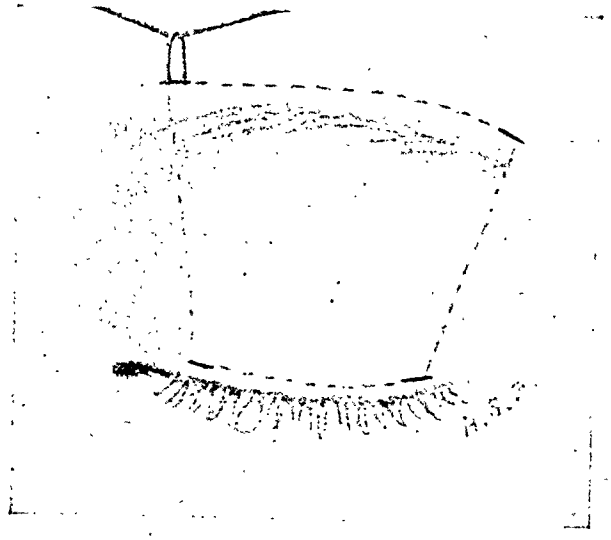


Fig. 1 (Friedenwald and Guyton). Incisions and path of suture.

mination of the frontalis above the brow (just over the periosteum of the frontal bone), and out through the upper lateral incision. From here the suture is carried down through the lid along the under surface of the orbicularis to emerge through the lower lateral incision adjacent to the lid margin; then through the dermis, 2 mm. above the lid margin, to emerge through the lower nasal incision; then along the under surface of the orbicularis to emerge through the upper nasal incision. The suture is tied with the knot in the depths of the upper nasal incision. As the suture is tied, it is pulled tight enough to elevate the upper lid 2 mm. above the desired final position (fig. 2). If there is palsy of the superior rectus, the cornea is protected for a day or

* From the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital and University.

so by whatever means the surgeon is accustomed to employ with ptosis operations. A small dressing is placed over the superior nasal incision only for one day. It is seldom necessary to hospitalize the patient more than a day after operation.

The operation is best performed under general anesthesia because local anesthesia, even in the form of a nerve block deep within

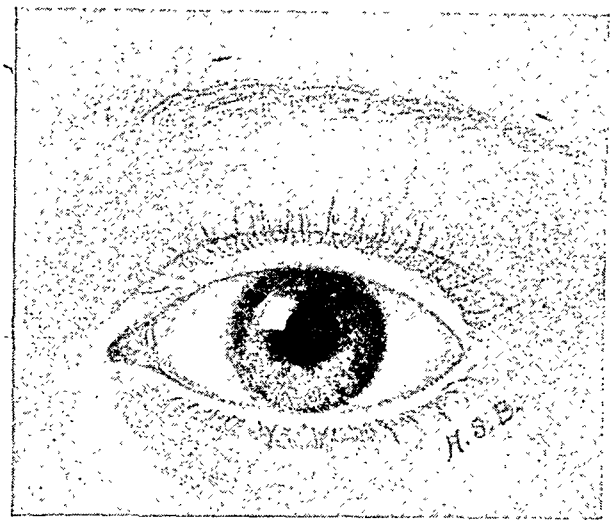


Fig. 2 (Friedenwald and Guyton). Appearance after tying suture.

the orbit, produces enough change in the resulting position of the lid to make it difficult to estimate how firmly the suture must be pulled together as it is tied.

The exact type and size of suture material may be varied considerably, depending upon what is most readily available. Smaller silk sutures, cotton sutures, braided nylon sutures, and braided tantalum sutures of various sizes have all been used with essentially equal success. The optimal size of braided tantalum for this procedure is probably 2-0. In instances where a larger braided tantalum suture was used, the path of the suture along the lid margin was subsequently visible. We have not used tantalum sutures recently because of reports of late fragmentation of tantalum wire following certain plastic procedures and of late fragmentation of tantalum mesh used in the repair of hernias.

Any size and type needle may be used so long as the needle is long enough and strong enough to be pushed through the proper paths. However, of a number of different needles we have tried, a No. 5 three-eighths curve surgical cutting needle has been the easiest to manipulate. The needle is best inserted with a strong clamp such as the Halsted.

It is most important that the suture be placed at the proper depth adjacent to the lid margin. If it is placed superficially in the fibrous layers of the chorium, it will hold firmly; or if it is placed much deeper, in the tarsus, it will hold firmly. However, it must not be placed in the loose connective tissue between skin and tarsus because it will gradually slip upward in this loose tissue with a resulting undercorrection of the ptosis.

Results of operation

Description of cases. During the past four years, 31 such operations have been performed on 23 patients; in 8 of the patients the ptosis was bilateral, while in the remaining 15 it was unilateral. In 15 cases, the ptosis was congenital; in 5 it was posttraumatic; in 2 it was a result of progressive nuclear ophthalmoplegia; and in one, it was a result of cutting the levator in a jaw-winker. Ten of the patients had had previous ptosis operations with unsatisfactory results. These previous operations included Blascovicz operations in 5 cases; a Tansley-Hunt in one; a Machek in one; a Dickey in one; a fascia lata sling (Derby) in one; and a Motais in one. In 18 instances there was complete levator paralysis, and in the remaining 13 there was doubtful or slight levator action. There was complete paralysis of the superior rectus in 13 instances, slight to moderate palsy of the superior rectus in 8, and normally functioning superior recti in the remaining 10.

Operative course. The lids tended to slip below the positions to which they were elevated for 2 or 3 weeks following operation,

but there was generally no further slip after this length of time. The actual amount of slip depended on how tight the suture was tied, there being a greater slip if the suture was tied with very tight tension than if it were tied only firmly. In general, if the suture was tied tight enough to elevate the lid margin about 1 mm. above the limbus with the eye in the primary position, the slip amounted to about 2 mm., so that the final position of the lid was excellent.

Postoperative complications were encountered in five instances.

1. In a patient with bilateral ptosis, the initial correction was excellent for each eye and continued so until four months later when the child was struck a heavy blow on one brow.

The initial operations had been performed with a 4-0 silk suture. Immediately following the blow the ptosis completely recurred, apparently indicating a break in the suture. One month following the blow the ptosis was again corrected according to the same technique and the result was again excellent and remained that way.

In three instances there were late infections around the sutures.

2. In the first of these, operations had been performed on both eyes and the initial results were excellent. Six weeks later, a chronic infection became manifest around the suture in the left lid. This infection cleared after administration of systemic penicillin without the necessity of removing the suture, but the left lid thereupon drooped 3 mm. lower than the right. Five months later another operation of the same type was performed on the left lid without complication and with an excellent result.

3. In the second of these cases, a chronic infection became manifest around the suture two months after operation. The suture was removed and the infection rapidly disappeared. The lid remained elevated in the same position it was before the infection appeared and the result remained excellent even though the suture was removed. The infection in this instance was chronic in nature, and apparently enough fibrosis had occurred along the suture tract before the suture was removed to obviate the necessity of the suture remaining in place to hold the lid in proper position.

4. In the third case the result was excellent until five months after operation, when an abscess occurred around the suture. This suture was removed and the infection quickly cleared but the ptosis partially recurred. There was still, however, a final total correction of 4.5 mm. in the position of the lid, and a good lid fold was retained.

5. The fifth complication consisted of an exposure keratitis. In this case, operations were performed on both lids of the patient with bilateral congenital ptosis and bilateral superior rectus palsy. At the time of operation, the lids were elevated too high, approximately 3.5 mm. above the upper limbus in each eye. The lower lids were pulled up over the corneas by means of sutures fastened to the forehead with adhesive for a period of one day. These protection sutures were then removed and, within two days, exposure keratitis began to develop in each eye. The patient was anesthetized, and the upper lids were grasped about 3 mm. above the lid margins with two Allis clamps and pulled downward forcibly until sufficient slip had occurred in the sutures to position the lid margins just at the upper limbus. The lids were then sutured together temporarily with two mattress sutures for each eye. These sutures were removed four days later, at which time the exposure keratitis had healed with slight residual scarring. No further keratitis developed and the final correction of the ptosis was satisfactory.

Exclusive of these five cases, in which complications occurred, and of one additional case in which the result was not recorded, the cosmetic results in the remaining 17 cases were graded as excellent in 12, good in 4, and 2 mm. undercorrected in one.

Comment

We believe that utilization of the frontalis is the type of operation best chosen for ptosis characterized by complete or almost complete paralysis of the levator and with palsy of the superior rectus, or in the presence of normally functioning superior recti if the patient has binocular vision.

The technique we have described for this operation is a simple one. It may be performed regardless of previous ptosis operations and may be repeated or followed by another type of ptosis operation should such prove necessary. We do not believe that this operation should be used in preference to a procedure which utilizes the levator, such as the Blascovicz operation, if there is appreciable function in the levator. However, in some instances a Blascovicz operation does not give a good cosmetic result even though the patient apparently does not have complete paralysis of the levator. In five such instances, utilization of the frontalis has given excellent results in four and a satisfactory result in the remaining one.

The one major point about which we are uncertain is whether this operation will prove permanently effective. It is possible that there may be some recurrence of ptosis, due either to very gradual "slip" or cutting in of the suture or to actual breakage of the suture years after the operation is performed. However, if such proves to be the case, the operation can easily be repeated or a different operation can be performed.

One of the most important aspects of this operation is the resulting lid fold. If the suture is placed parallel to the lid margin, actually in the dermis rather than in the loose subcutaneous tissue, a normal appearing lid fold usually results. We have not seen such lid folds result from other techniques of anchoring the lid to the frontalis; in fact, these lid folds are generally better than those obtained with operations utilizing the levator.

Summary

A simple, yet effective, technique of correcting ptosis by utilizing the frontalis consists of placing a single, permanently buried suture in the shape of a rhomboid connecting the dermis of the lid just above the lid margin to the fascial termination of the frontalis. The initial correction at the time of operation must be an overcorrection of about 2 mm. because the lid slips back downward about this distance within three weeks after operation.

This operation has been performed on 31 eyes of 23 patients. Postoperative complications have consisted of a broken suture following trauma to the brow in one instance, late infections around the sutures in three instances, and exposure keratitis immediately following operation in one instance. None of these complications proved serious, and the cosmetic results have been satisfactory both with regard to the final position of the lids and the resulting lid folds.

Johns Hopkins Hospital (5).

Reference

1. Kitlowski, E. A.: Personal communication.

VISUAL-FIELD INTERPRETATIONS IN CHIASMAL LESIONS*

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The greatest difficulty in visual-field interpretations is from lesions in the chiasmal region. In this area lies the optic chiasma which is made up of visual fibers from the optic nerves that enter into it anteriorly. After a rearrangement of the fibers, they leave the chiasma posteriorly as the optic tracts. It is only in this region, therefore, that it is possible to get field changes limited to one eye or to both, and varying from blindness to temporal or nasal defects and to combinations of these.

This compact area contains many structures, pathologic conditions of which may cause field defects. Above the chiasma is the diencephalon, and below are the pituitary gland and the base of the skull. Surrounding the chiasma is the circle of Willis with its many anastomosing vessels, the main cerebral arteries, the venous sinuses, some of the intracranial nerves, and the meningeal membranes with their arachnoidal granulations.

PATHWAY OF FIBERS IN OPTIC CHIASMA†

The optic chiasma is an oblong structure which measures about 13 mm. transversely, 8 mm. anteroposteriorly, and 3 to 5 mm. in thickness. According to Schaeffer[1] and other investigators, it rarely lies in the chiasmal groove which is in front of the tuberculum sellae. In 91 percent of the 125 skulls studied by Schaeffer, the chiasma lay above the diaphragma sellae so that its posterior part was partially on the dorsum sellae behind. In 4 percent, the major part of the chiasma lay upon the dorsum sellae; and in the remainder, the chiasma was in the sulcus chiasmatis.

Within the chiasma, the fibers from the optic nerves are arranged in a fairly regular pattern. Those from the inferior nasal halves of the retinas cross in the anterior part of the chiasma until almost to the other side; while the fibers from the superior nasal halves of the retinas stay on the same side of the chiasma until almost to the optic tracts and then cross in the posterior part of the chiasma. After crossing, the fibers leave the chiasma, posteriorly as the optic tracts, and form the inferior and superior nasal halves of the tracts. The fibers from the lower temporal halves of the retinas stay near the outer borders of the chiasma, while the fibers from the superior temporal halves arch toward the middle. The temporal fibers do not cross but proceed posteriorly to form the lower and upper temporal halves of the optic tracts. The macula fibers also divide into crossed and uncrossed fibers, the crossing taking place near the posterior border of the chiasma.

PITUITARY-GLAND FORMATION‡

In typical pituitary tumors, the pressure is first on the anterior border of the chiasma causing loss of the upper temporal fields. Later there is loss of the lower temporal fields. The arched fibers from the upper temporal quadrants are next involved, and lastly, those near the lateral borders, causing loss of the lower and upper nasal fields, respectively. A pituitary tumor may grow under the chiasma and press upon an optic nerve, resulting in monocular blindness before involving the other eye; or, it may grow backward and press upon an optic tract, resulting in homonymous hemianopsia. The

* Read before the New York Society for Clinical Ophthalmology, November 4, 1946.

† See illustration: Traquair, H. M.: An introduction to Clinical Perimetry. St. Louis, C. V. Mosby Co., 1931, p. 66.

‡ See illustration: Grinker, R.R.: Neurology, Springfield, Illinois, Charles C Thomas, 1937, p. 40.

suprasellar tumors usually press from above downward, often upon the posterior part of the chiasma so that the macula fibers may be involved. Third-ventricle tumors usually involve the posterior part of the chiasma and the macula fibers. As a rule, atypical field defects are due to tumors other than pituitary tumors.

Of primary interest in this area is the pituitary gland. Roughly, the gland is made up of two parts—the anterior and posterior lobes. The posterior lobe starts as an outpouching from the diencephalon and grows downward, retaining its connection with the brain by means of a stalk, the infundibulum. The anterior lobe starts as an outpouching from the posterior wall of the pharynx and grows upward and around the posterior lobe to invest it. As the base of the skull develops, the anterior lobe loses its connection with the posterior pharynx. Vestigeal remains of the buccal part of the pituitary gland may be found in the posterior wall of the nasopharynx, lining an opening sometimes present from the pituitary fossa to the base of the skull—the craniopharyngeal canal; or they may appear as a small island of primitive tissue within the sella turcica. Either of these may commence to grow and form the so-called Rathke's pouch tumor, craniopharyngeoma, or suprasellar cyst.

Anatomy of the diencephalon[§]

The gland lies within a fossa, the sella turcica, the roof of which is formed by dura called the diaphragma of the sella. This is pierced by the pituitary stalk. The optic chiasma lies above the sella turcica with the pituitary stalk in proximity to its posterior border. Just anterior to the sella turcica is the tuberculum sellae which is sometimes the seat of a meningioma giving rise to the so-called pituitary syndrome of the adult.

Lateral to the chiasma are the internal carotid arteries which here divide to form the middle and anterior cerebral arteries. These give off anterior and posterior communicating branches which join with communicating branches from the posterior cerebrals to form the circle of Willis. Aneurysms and sclerotic changes in these vessels may press upon the chiasma and cause field changes. Anterior to the chiasma are the olfactory grooves on the base of the frontal lobes of the brain. These are sometimes sites for tumors which may be difficult to differentiate from chiasmal lesions.

As previously stated, the stalk of the pituitary gland arises from the diencephalon, which here is the floor of the third ventricle. Tumors in this area may give symptoms and field changes difficult to distinguish from pituitary adenomas or from suprasellar cysts.

Anatomic differences[‖]

Sella turcica

Atypical field defects from pituitary tumors may be due to anatomic differences in the pituitary fossae. In some cases, the anterior or posterior walls may be faulty, and the tumor will naturally grow in the direction of least resistance. The direction of growth may also be influenced by the relation of the thickness of the anterior and posterior walls and also by the diaphragma sellae. The latter may be thick and strong; or it may be very thin or even missing. The opening for the hypophysial duct may be very large so that a tumor can go through without rupturing the diaphragma. In these cases, the tumor may not cause enlargement of the sella but will present as a suprasellar growth. It is also interesting to note the relation of the sphenoidal sinuses to the pitu-

§ See illustration: Grinker, R. R.: Neurology. Springfield, Illinois, Charles C Thomas, 1937, p. 40.

‖ See illustration: Schaeffer, J. P.: Anatomical Record, 28:245 (July) 1924.

itary fossa. The intervening bone may be so thin or deficient that a retrobulbar neuritis from sinus infection can readily be explained. Very occasionally a bitemporal field defect may be found in this condition. Rarely, the pituitary tumor may rupture and grow into the sinus.

Blood vessels at base of brain[¶]

In addition, anatomic variations of the blood vessels may help to modify the field changes. The anterior cerebral arteries are most commonly at fault in this respect. These usually cross over the optic nerves, but at times may cross the optic chiasma, and rarely may be found as far back as the optic tracts. Less often, the posterior communicating arteries which connect the internal carotids with the posterior cerebrals may pass over the optic tracts. In all of these locations, a tumor from below may press the chiasma against the vessels so that they may act as pressure cords with consequent destruction of visual fibers. In addition to direct pressure, a certain amount of ischemia due to interference with the local blood supply may further modify the fields.

With the field defects, there are frequently clinical signs and symptoms which are of help in localizing the lesions.

The mammillary bodies and the tuber cinereum surround the base of the stalk. These structures are part of the hypothalamus which controls the vegetative nervous system. The posterior portion seems to regulate the sympathetic system, while the anterior part regulates the parasympathetic system. Injury to these parts causes diabetes insipidus, Frölich's syndrome (adiposogenital dystrophy), disturbances in sugar and fat metabolism, disturbances in temperature regulation (particularly around the third ventricle), disturbances of emotions, and disturbances of sleep, so that there may be drowsiness, loss of sleep or sleep inversion.

[¶] See illustration: Jamieson, E. B.: Illustrations of Regional Anatomy: Section 1. Baltimore, Wm. Wood & Co., 1934, p. 43.

Tumors of chiasmal region

Pituitary adenomas

Pituitary adenomas are the most frequent tumors in the chiasmal region. To date, there has been no recorded tumor of the posterior part of the pituitary gland. The anterior portion consists of two types of cells: (1) Cells which contain granules that take either the acid stain—acidophiles, or the basic stain—basophiles. (2) Cells with large nuclei and clear-staining plasma—the chromophobes.

Tumors of the acidophile cells cause symptoms which vary according to the age of the patient. In the young, whose bones are still in the stage of growth, the outstanding features are gigantism and early development of the secondary sex characteristics. In the adult, there is acromegaly, characterized by overhanging supraorbital margins, broadening of the nose, and progressive enlargement of the hands and feet.

According to Cushing,[2] tumors of the basophile cells results in hirsutism and elevation of blood pressure, symptoms usually associated with tumors of the adrenal glands.

Abnormal growth of the chromophobe cells results in pressure atrophy of the chromophile cells. The symptoms are, therefore, due to loss of function of the latter. In children, there is infantilism; while in adults, there are increases in the body fat and loss of libido or menses.

Features common to the above tumors are enlargement or destruction of the sella turcica, field defects which progress to blindness, and primary optic atrophy. Typically, there is first a loss of the upper temporal field, then the lower temporal, lower nasal, and, last, the upper nasal field. The tumor may occasionally cause blindness in one eye before involving the fields of the other eye, or there may even be homonymous hemianopia because of involvement of the optic

tracts. Infrequently, the tumor may break through the diaphragma of the sella and cause symptoms resulting from irritation or destruction of the diencephalic region of the brain.

Craniopharyngioma

The next most common type of tumor is the craniopharyngioma. As these tumors are derived from embryonal rests, they usually occur in the young. In fact, next to cerebellar tumors, they are the most frequent tumors of childhood. The field changes are varied but more or less typical of tumors in the chiasmal region. Because of pressure on the posterior part of the chiasma, central or caecocentral scotomas are frequent. There may be primary or secondary optic atrophy or even choked discs. Frequently symptoms of involvement of the diencephalon are present. In addition, they cause destruction of the chromophile cells and give symptoms characteristic of chromophobe tumors. The sella turcica may or may not be enlarged. X-ray examination of the skull usually shows the presence of calcified plaques in the chiasmal region.

Meningioma of tuberculum sellae*

Meningiomas of the tuberculum sellae are fairly frequent. They are benign and can be removed in toto if not too large, so that an early diagnosis is important. They arise from the meninges,[3] probably from the arachnoidal granulations in the venous sinuses. They are called the chiasmal syndrome of the adult. Recently, Schlezinger[4] reported such a tumor in a girl, aged 16 years. This is considerably below the average age. These tumors usually present anteriorly to the chiasma and press directly on the optic nerves, causing atypical temporal field defects. Because of the vulnerability of the macula fibers, central and paracentral scotomas are frequent. Primary optic atrophy is constant and progressive. The sella turcica is not enlarged, because the tumor is well outside of the sella turcica.

Less common tumors

Among the less common tumors in this region are tumors of the sphenoidal ridge. These cause a progressively increasing exophthalmos, paralyses of the external ocular muscles, and atrophy of the optic nerve. X-ray examination shows increased density of the sphenoid ridge. All the findings are on the side of the lesion. The condition is sometimes known as the syndrome of the cavernous sinus.

Aneurysms of the circle of Willis have been fully described by Walsh.[5] They are characterized by unusual field changes, frequently with central or paracentral scotomas, pains in the back of the eyes, and ocular-motor paralyses, most commonly involving the third nerve. A previous episode of subdural bleeding makes the diagnosis definite.

Third-ventricle tumors are uncommon but should be thought of in patients giving symptoms and field changes suggestive of lesions around the chiasma. There are usually disturbances of the vegetative nervous system, especially the persistence of an unexplained fever. Central and paracentral scotomas are frequent.

Arachnoiditis[6] in the chiasmal region may give symptoms typical of tumor. In fact the cysts often found are a form of tumor. There is usually a history of rapidly developing blindness. The discs have the peculiar appearance of a mixed primary and secondary atrophy. A preceding history of head trauma, sinus infection, or lues is of etiologic importance. If tumors are suspected, early surgery, before irreparable blindness supervenes, is important.

Meningioma of the olfactory groove is really a frontal lobe tumor. A Foster-Kennedy syndrome, optic atrophy on the same

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* See illustration: Bailey, P.: Intra-Cranial Tumors. Springfield, Illinois, Charles C Thomas, 1933, p. 172.

side with a choked disc in the other eye, is an important sign if found. More frequently, it is absent, and occasionally it may be present in other conditions. Anosmia, loss of smell, on the side of the lesion is present.

Other tumors, such as chordomas, are rare and are usually diagnosed at operation.

Report of cases

Case 1

C. M., a woman aged 29 years, was admitted to the Brooklyn Hospital with a history of intermittent headaches of 10 years' duration. For the past six months, her vision had become progressively more blurred and her sense of smell had been lost. She also had a constant buzzing in the left ear.

X-ray examination showed an area of lessened density of the frontal bone which was almost centrally placed a little above the orbits. The sella turcica was not well defined but it was enlarged. The floor was depressed, and the posterior clinoid processes were eroded. In view of these findings, it was thought that a tumor of the sella turcica, or of the area around it, and a tumor of the frontal bone were present. The growth in the frontal bone was thought to be metastatic.

Ocular examination. There were no ocular palsies and no nystagmus. The pupils reacted to light and accommodation. There was about 5 or 6 diopters of swelling of both discs, with a few hemorrhages around the left disc but none around the right. Vision in the left eye was so poor that a 10-mm. test object was the smallest that could be used. This showed a complete loss of the nasal field with retention of a small island in the temporal field. The visual field of the right eye could be plotted with a 2-mm. test object and showed a marked concentric contraction with a loss of the nasal field. There was no evidence of secondary atrophy of either disc.

Diagnosis. As a result of this examination, it was thought that the condition was tumor of the left side of the brain, near the chiasm. For the degree of intracranial pressure and the headaches complained of by the patient, she was markedly euphoric and jocular. There was a distinct forward bulge in the middle of the forehead.

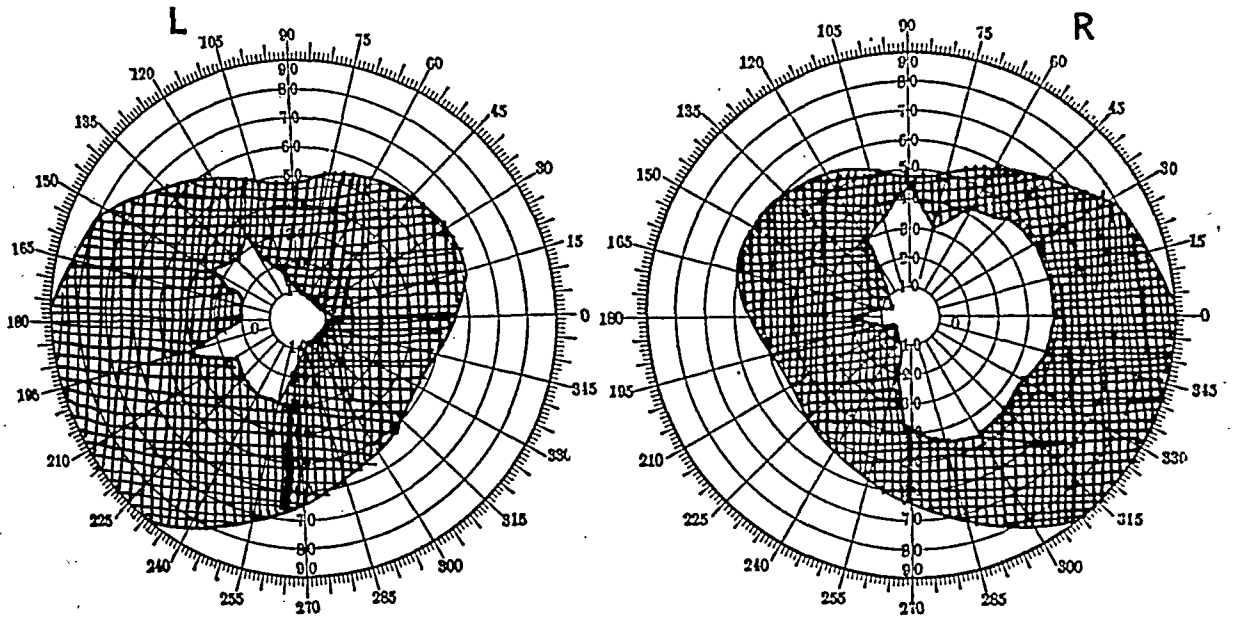


Fig. 1 (Kravitz). *Case 1.* Left: field for 10/250 mm. white; right: field for 2/250 mm. white.

The neurologist found no signs of localizing value and was of the opinion that the condition was a tumor of the frontal lobe.

A bone flap in the right frontal region was turned down and a meningioma, the size of a small orange, occupying the frontal aspect of both anterior cranial fossae, was removed.

The loss of both nasal fields was probably caused by a flattening of the chiasm against both internal carotid arteries.

Case 2

C. A., a man aged 27 years, gave a history of loss of libido for about 12 years. He was treated with glandular preparations. After a while, he complained of visual disturbances, and glasses were prescribed. For some time he continued to receive glandular therapy and, every now and then, he would have a severe headache. Vision deteriorated so slowly that he was not conscious of its loss until it was well advanced. Recently his headaches became severe and persistent and were accompanied by projectile vomiting.

Physical examination showed the patient to be short and slight of build, with no hair on the face. He had small delicate hands and feet with the voice of a preadolescent boy. He had complete loss of sexual power.

Ocular examination. Vision was 20/70 in each eye, not improved with correction. Both discs showed advanced primary atrophy. The visual fields showed practically complete bitemporal hemianopia.

A right transfrontal osteoplastic craniotomy was performed and a cyst, extending anteriorly to the chiasm, was removed. When it was opened, a large amount of yellow fluid containing fatty deposits was evacuated. Immediately below the chiasm and pressing upward into its structure was a large globular irregular mass of cholesterol. It extended into the tissue of the chiasm. Part of the wall of the cyst and as much of the cholesterol as possible were removed without severing the chiasm.

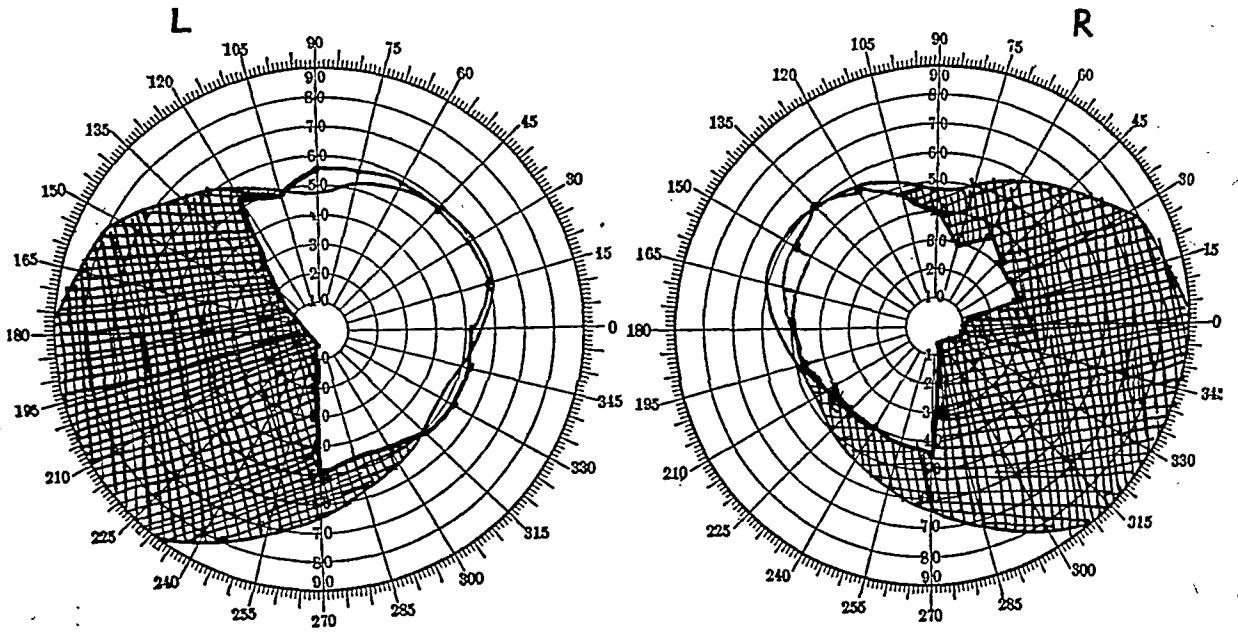


Fig. 2 (Kravitz). *Case 2.* Left and right: fields for 2/330 mm. white.

Case 3

L. T., a woman, aged 50 years, gave a history that 13 years before, she had noticed a tingling of her hands and feet. One year

later, and until about four years before admission, she began to grow larger in all dimensions. During this period, she gained about 100 pounds and her hands and feet grew so large that she had to wear men's sizes. About two years ago she began to have pains in her legs, and about six months later, she developed polyuria and polydipsia. At this time she received X-ray treatments to the pituitary gland. This was followed by a loss of vision in the left eye. Her periods started at the age of 13 years and were normal until her menopause at the age of 44 years.

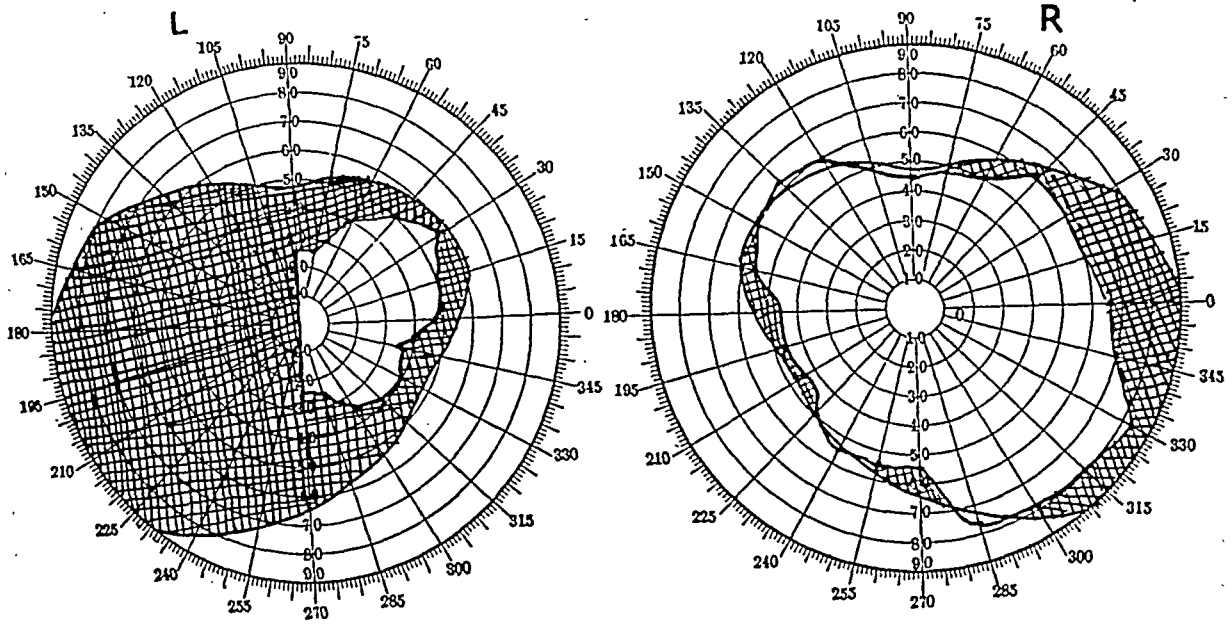


Fig. 3 (Kravitz). *Case 3.* Left: field for 40/250 mm. white; right: field for 2/250 mm. white.

Physical examination revealed a typical acromegalic type.

Ocular examination. Vision was: R.E., 13/13; L.E., perception of fingers at 12 inches. The left pupil was slightly larger than the right but both reacted to light and accommodation. The margins of the right disc were blurred, although no measurable edema was present. The disc was pale. With a 2-mm. test object, the right eye showed a moderate loss of the temporal field, most marked above. With a 40-mm. test object, there was a complete absence of the temporal field in the left eye and a concentric contraction of the nasal field. Through a transfrontal approach, an acidophilic adenoma was removed. A knuckle of this had broken through the diaphragma sellae and was pressing upon the diencephalon.

CASE 4

W. C., a Negress, aged 32 years, gave a history of failing vision for one year. About six months before, her menses stopped and she began to have occasional frontal headaches usually with vomiting. She had a continual thirst and an excessive craving for "sweets." The neurologic examination was entirely negative.

Ocular examination. Vision was: R.E., limited to perception of hand movements on the nasal side; L.E., perception of fingers at two feet. The visual fields were unreliable but suggested a right homonymous hemianopia. A month later, she developed optic atrophy in both eyes. At operation, a large suprasellar cyst was exposed and about 30 cc. of xanthrochromic fluid was evacuated. The following day, the patient was able to count fingers with either eye at five feet. It was

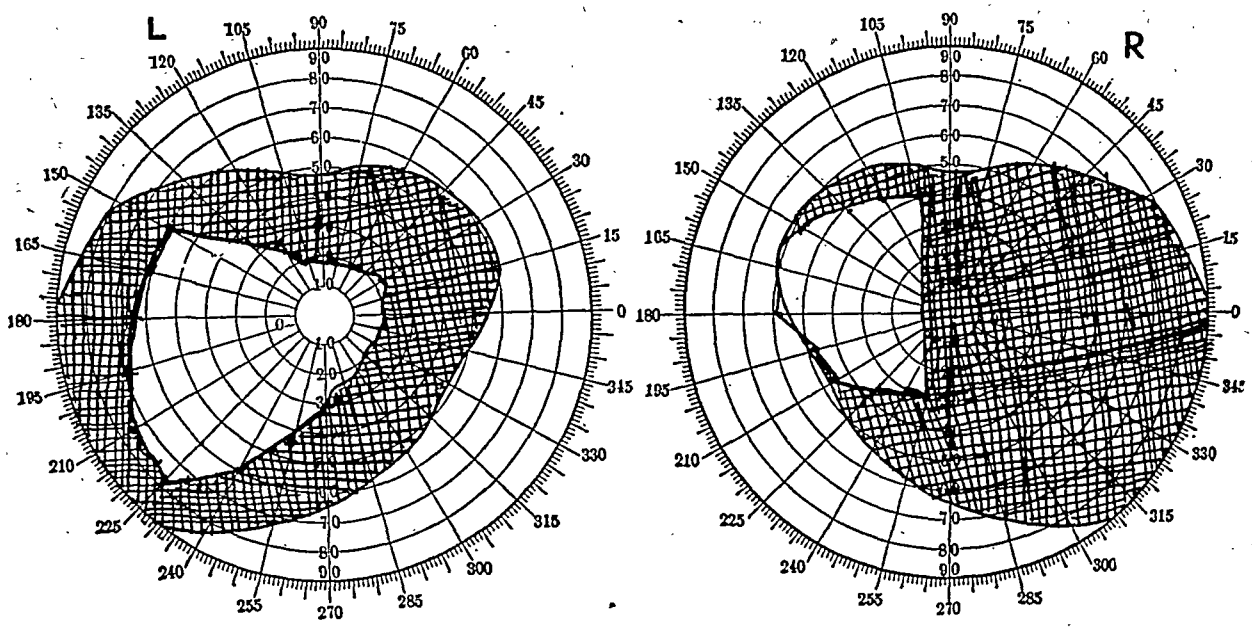


Fig. 4 (Kravitz). *Case 4.* Visual acuity in the left eye is limited to finger movements at two feet; in the right eye, hand movements.

felt that a good deal of the previous loss of vision was probably hysterical in origin.

CASE 5

J. G., a Negro, aged 34 years, gave a history that about nine years before, he began to grow in size and his features changed. About five years before, vision in the right eye began to fail and the hair on his face and pubis become more scant and his sexual power impaired. Gradually he became more lethargic so that he was unable to work. In a period of nine years, he had grown about 5 or 6 inches.

Physical examination showed a very tall, thin Negro who appeared ill and toxic. His features were typically acromegalic and his mentality was dull. X-ray studies of the

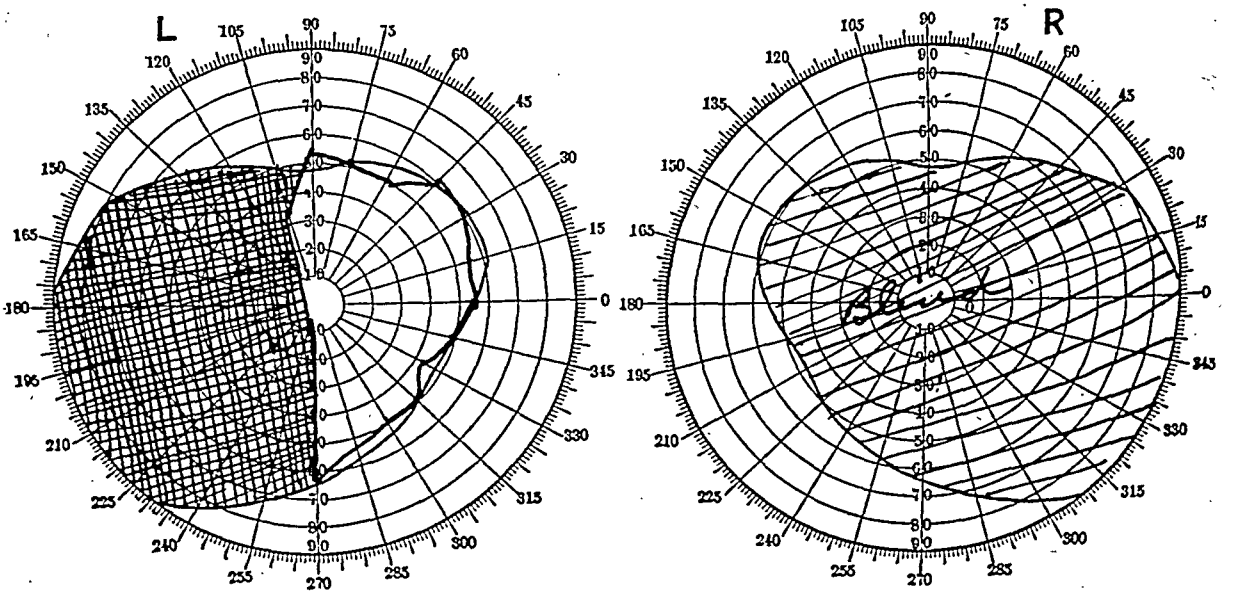


Fig. 5 (Kravitz). *Case 5.* Left: field for 2/330 mm. white. The right eye is blind.

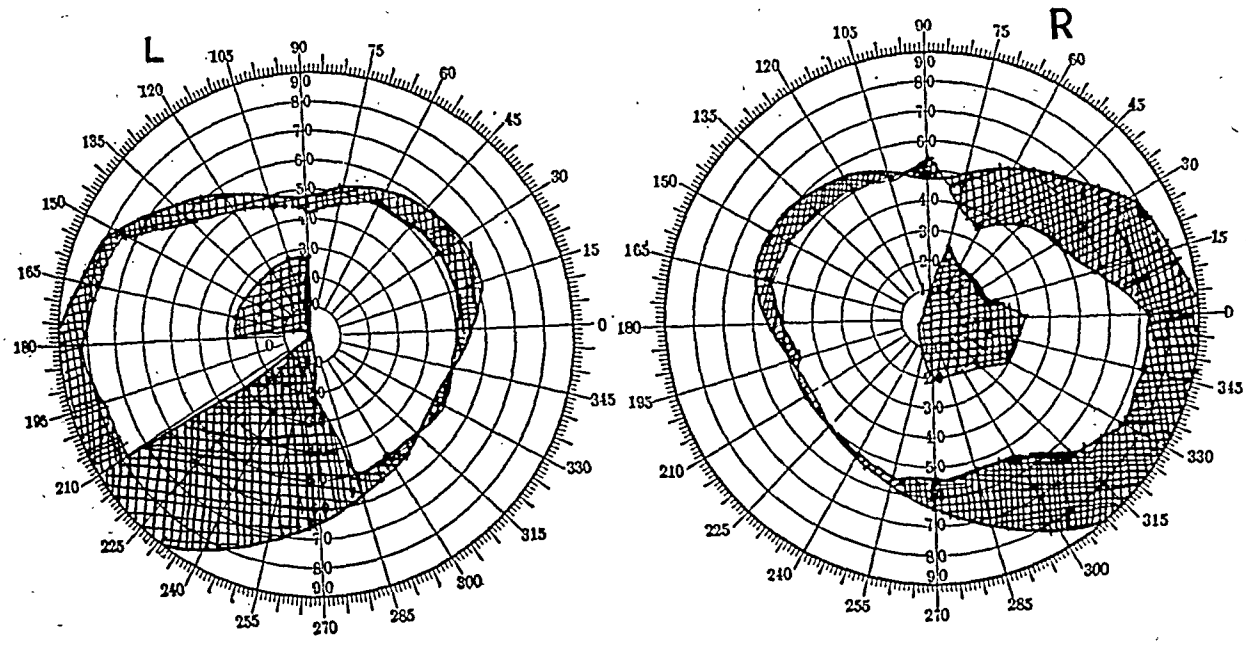


Fig. 6 (Kravitz). *Case 6.* Left: field for 5/250 mm. white. Visual acuity in the right eye is limited to hand movements.

skull showed an immense sella turcica with anterior and posterior clinoid processes eroded.

Ocular examination. There was advanced optic atrophy of the right disc with imperfect light perception. The left disc was of good color and there was a complete loss of the temporal field, with sparing of the macula. Vision was not taken because of very poor coöperation. At operation, a large cystic degenerated tumor of the pituitary gland was removed.

CASE 6

A. D., a woman, aged 29 years, gave a history of failing vision for four months and

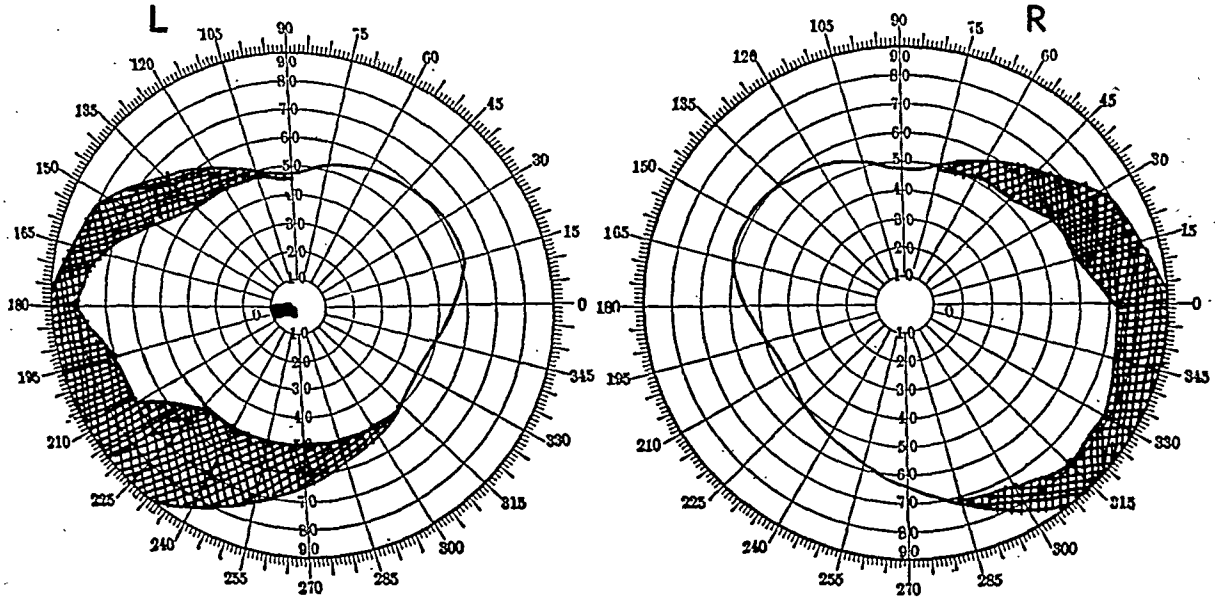


Fig. 7 (Kravitz). *Case 7.* Left and right: fields for 1/250 mm. white.

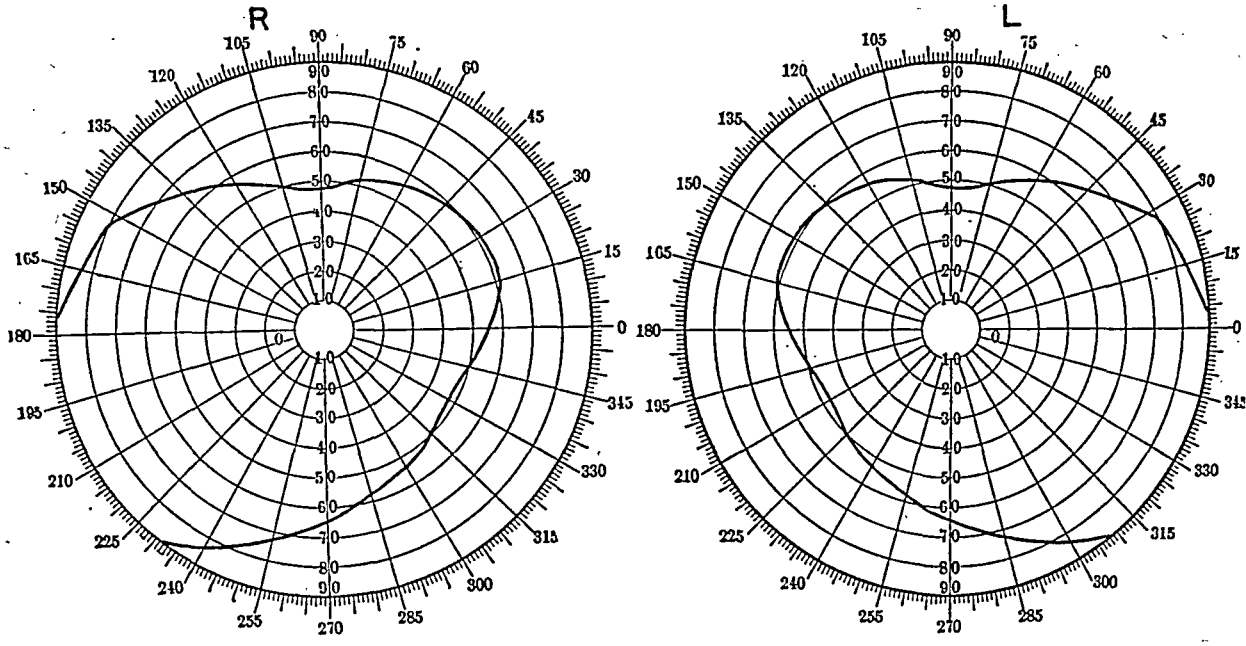


Fig. 8 (Kravitz). *Case 7.* Right and left: fields for 2/1000 mm. white.

severe periodic headaches for the past five months. The headaches came about once a month and lasted from 1 to 2 days, usually with vomiting. Her menstrual periods stopped completely about seven years before, but she had not lost or gained any weight since then. X-ray examination revealed a distended sella turcica with encroachment on the sphenoid sinuses.

Ocular examination. Vision was: O.U., 5/200, and there was moderate primary atrophy. Field examination revealed a temporal central defect in the right eye with a contraction of the temporal field. The left eye also had a loss of temporal central field with a central defect on the lower temporal area. The fields were evidence of pressure on the posterior chiasma with in-

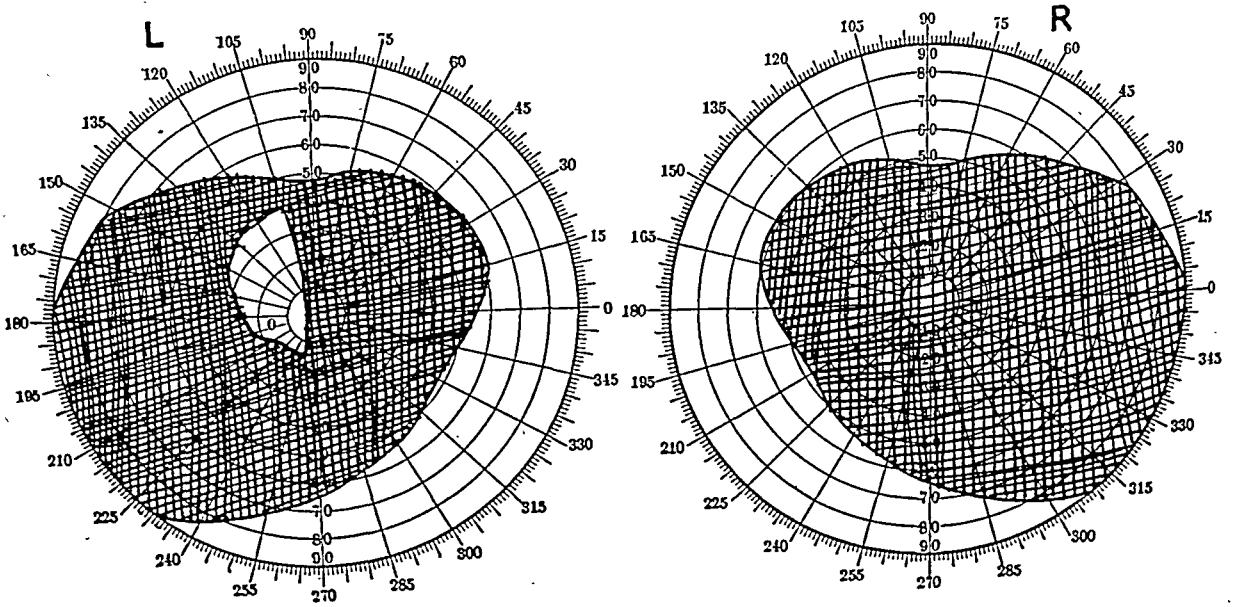


Fig. 9 (Kravitz). *Case 8.* Vision in the left eye is limited to hand movements. In the right eye, there is no light perception.

volvement of the crossed macula fibers. Operation revealed a suprasellar cyst which had encroached on the chiasm posteriorly and superiorly. A postoperative diagnosis of tumor of the pituitary gland with cystic degeneration was made.

CASE 7

M. W., a young woman, aged 17 years, gave a history that, about two years before, she had lost considerable weight. A year ago, she developed a persistent fever with headaches, nausea, and vomiting and soon thereafter she began to gain a good deal of weight and her menses became scanty and irregular. She also became dull and apathetic with symptoms of diabetes-insipidus.

Ocular examination. Vision was 20/20 in each eye and the disc borders were somewhat blurred, with slight pallor of the temporal portions. Field examination showed an enlargement of the blind spots with some loss of temporal fields, particularly of the right lower temporal. Examination two months later, showed a caecocentral scotoma of the left eye.

A diagnosis of a supra sella cyst was made.

Operation revealed an infiltrating lesion of the third ventricle with involvement of the visual fibers near the posterior border of the chiasm.

CASE 8

M. W., a woman, aged 29 years, came to the Post-Graduate Hospital because of menstrual disturbances for the past six years and failing vision for the past four years.

Previous to the onset of symptoms her menses came regularly every 28 days and lasted for four days. Now they came every two weeks and lasted one day. The visual disturbances began with blurring in one eye and then in the other, and vision had deteriorated steadily since the onset.

Neurologic examination revealed nothing abnormal, but ophthalmic examination showed pallor of both discs and left homonymous hemianopsia. Operation was performed for tumor of the pituitary gland but none was found, and the patient was discharged after recovery from the operation.

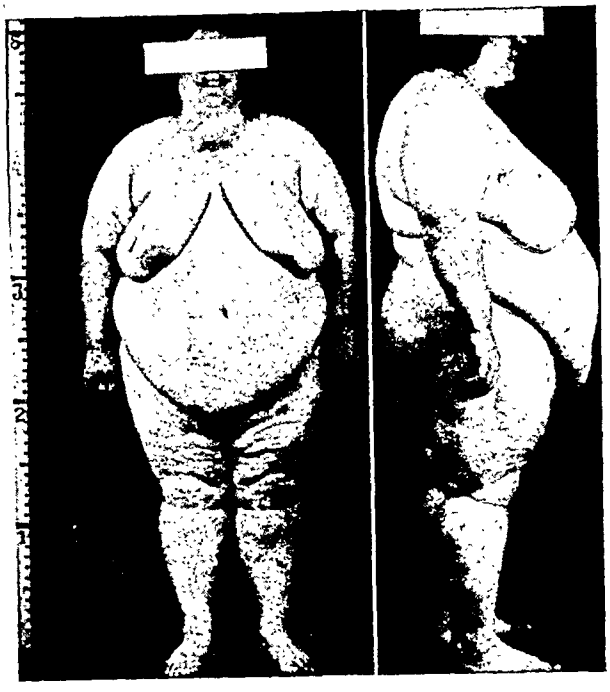


Fig. 10 (Kravitz). *Case 8.* An operation was performed on this patient for tumor of the pituitary gland, but none was found. After this she gained rapidly in weight. Several years later a second operation revealed extensive chiasmic arachnoiditis.

Unfortunately, all the original records were lost, so that more detailed information is not available.

She was readmitted with the history that, after operation, vision had failed more rapidly and she had gained considerably in weight, about 63 pounds (28.6 kg.). She had not had her menses since the operation. For the past five months she had had polyuria and polydipsia.

An encephalogram revealed a normal ventricular system and normal sella turcica, and she was again discharged for further care in the outpatient department. She was placed under mixed glandular therapy and at intervals X-ray studies of the skull were

taken. These always revealed no pathologic change.

The patient was readmitted to the Hospital three years later because her symptoms had become worse. Examination of the eyes showed a mixed type of primary and secondary atrophy of the optic nerve. The right eye was blind, and only an island of vision was retained in the temporal field of the left eye. A ventriculogram revealed dilatation of the left ventricle with cortical atrophy. The right ventricle was normal.

Operation revealed extensive chiasmic arachnoiditis, with a large cyst which had lifted the chiasm upward. The cyst was emptied and the adhesions were ruptured, but the patient's condition was not improved. When she was last seen, there was progressively increasing drowsiness and great impairment of memory.

The first operation was performed before the entity of chronic arachnoiditis was well known. If the adhesions had been separated then, the subsequent course of the patient's condition might well have been different.

Conclusion

Most of the cases herein reported, presented physical symptoms and showed loss of vision in one or both eyes before operation. If the ophthalmologist, who often sees these cases first, is to be of help, he must familiarize himself with the brain so that he will be better able to interpret the field changes as well as the patient's symptoms. To wait for typical field changes will frequently result in tragedy.

861 Park Place (16).

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Historical Miniature

Ibn Sina was the most brilliant star in the firmament of Arabian medicine, and a philosopher and statesman as well. He was born in 980 A.D. and is usually called Avicenna in mediaeval Latin. His *Canon of Medicine,* an extensive and complete discussion of all of medicine and surgery, is almost without equal in the entire world's literature.

Hirschberg in *Graefe-Saemisch Handbuch,* v. 13.

RELATIONSHIPS BETWEEN LATERAL HETEROPHORIA, PRISM VERGENCE, AND THE NEAR POINT OF CONVERGENCE*

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Numerous physiologic functions of the binocular neuromuscular mechanism have been measured for years with various kinds of testing equipment. Relatively few studies have been made to determine to what extent these various testing devices measure the same or different characteristics. This study was designed to investigate the relationships between lateral heterophoria, prism vergence, and the near point of convergence, as well as the relationship of these variables to age, sex, and refractive error.

Other partially similar studies have been made previously. Haessler[2] considered the relationship of heterophoria at 20 feet to refractive error and to the convergence angle. His sample consisted of 1,000 cases and was preselected to the extent that the following subjects were eliminated: (a) those with more than 0.5 prism diopters of hyperphoria; (b) those with more than 4.0 diopters of ametropia; and (c) those who had not worn correcting lenses for their ametropia for at least several months.

Haessler employed the Maddox-rod test for heterophoria and justified his use of it on the basis of a study by Weymouth,[7] who, with data from 12 subjects, concluded that the screen and parallax test, von Graefe's prism diplopia test, and the Maddox-rod test were essentially equivalent at a testing distance of 20 feet. Weymouth's interpretation has since been confirmed.[5] Haessler measured prism divergence at 20 feet but calculated convergence as the convergence angle using the PcB (the near point of convergence calculated from the convergence base line). After studying the distribution of heterophoria for each category of prism divergence—that is: 1, 2, 3, 4, 5, and so forth, prism diopters—as well as for each category of the convergence angle, he concluded that there was no correlation between heterophoria and vergence as expressed in the usual clinical measurements.

Abraham[1] studied heterophoria and vergence both at 20 feet and at 13 inches in 4,000 cases. He was primarily interested in the possibility of predicting the symptoms of a patient from the measurement of heterophoria or of vergence. He found that the prism divergence at 13 inches might serve this purpose and his work has been confirmed.[4]

SAMPLE AND TESTING METHODS

SOURCE OF SUBJECTS

Records were collected for this study upon 184 male and 217 female subjects. They were either emmetropic or had been rendered so by correcting glasses prior to the study. Roughly half of the subjects had no ocular complaints whatever and were either employees or patients from other clinics. The remainder were patients from the private practice of one of us (R. G. S.), although the chief complaint of many of them was not one of asthenopia, but rather "a red eye" or "something in the eye." An attempt to get as nearly a true random sample as possible was made and it is felt that this was for the most part successful.

* This study was made under a contract with the Office of Naval Research as Project N6onr-202, Task Order I.

† From the Department of Ophthalmology, Washington University School of Medicine, and the Oscar Johnson Institute.
‡ From the Department of Zoology, Ohio State University.

Data

For each subject, a record was made of:

1. Sex.
2. Age in years to last birthday.
3. Refractive error of the right eye, recorded as the spherical equivalent.
4. Refractive error of the left eye, recorded as the spherical equivalent.
5. Near point of convergence in millimeters.
6. Lateral heterophoria in prism diopters at a testing distance of 20 feet.
7. Prism convergence break point at 20 feet.
8. Prism convergence re-fuse point at 20 feet.
9. Prism divergence break point at 20 feet.
10. Prism divergence re-fuse point at 20 feet.
11. Lateral heterophoria in prism diopters at a testing distance of 13 inches.
12. Prism convergence break point at 13 inches.
13. Prism divergence break point at 13 inches.
14. Prism divergence re-fuse point at 13 inches.

Testing methods

All subjects used were refracted by one of us (R. G. S.). Those under 40 years of age had two examinations—one under homatropine cycloplegia and a second, postcycloplegic check. Subjects over 40 years of age received a manifest refraction. If correcting lenses were needed and desired, these were prescribed and a period of one month was allowed to elapse during which time the subject became adjusted to his correction.

The methods used in measuring the near point of convergence, prism vergence, and heterophoria have already been described in detail previously.[5] Only a brief description of each should be necessary.

The near point of convergence was determined in the usual manner with a millimeter rule, the target being a May-type ophthalmoscope with the head removed and the globe illuminated.

All heterophoria measurements were made with a white Maddox rod placed before the right eye. The rod was attached to a phorometer (American Optical Co.); the movement of its image was produced by means of a Risley rotary prism which was calibrated in units of one prism diopter and had a maximum strength of 30 prism diopters.

Tests of prism vergence were made using the Risley rotary prism on the phorometer, the prism being placed before the right eye. The order of testing was as follows: (a) prism convergence, break and re-fuse point at 20 feet; (b) prism convergence, break and re-fuse point at 13 inches; (c) prism divergence, break and re-fuse point at 20 feet; and (d) prism divergence, break and re-fuse point at 13 inches. All tests for heterophoria were completed before any tests of prism vergence were made. A muscle light rather than a printed target was used in the testing of prism vergence, since the correlation coefficient for measurements made using the different type targets is very close to 1.0.[4]

The spherical equivalent for the correcting lens for each eye was calculated by taking one half of the value of the cylinder and adding it algebraically to that of the sphere.

Age, sex, and refractive error

The chief objective of this study was to examine the relationship between heterophoria, prism vergence, and the near point of convergence, but this cannot be accomplished until the mutual dependence of these functions upon age, sex, and refractive error is known. If, for example, both the prism convergence break point at 20 feet and the lateral heterophoria at 20 feet were found to depend upon age, we should be interested in the correlation between these characteristics only after the effect of varying ages has been removed.

Age vs. heterophoria, near point of convergence, and prism vergence. In the sample of 184 males, with an average age of 33.5 years and an average of 0.8 prism diopters of esophoria at 20 feet, there is not a very marked change in the heterophoria with age. Still, the correlation ($r = +0.17$) is significant in the statistical sense, and implies that the subjects tend to change from slightly exophoric when younger to slightly esophoric when older. This correlation is definitely not enough to permit a satisfactory prediction of a subject's heterophoria from a knowledge of his age alone, since only 3 percent of the variance in heterophoria could be accounted for by so doing.

Among the 217 females, whose average age was 33.8 years and whose average heterophoria at 20 feet was 1.3 prism diopters of esophoria, the relationship appears to be the opposite of that among males. The correlation ($r = -0.20$) implies that younger females tend to be more esophoric and older females less esophoric. Again, the relationship is not sufficient for predicting heterophoria from age alone since only 4 percent of the variance in heterophoria would be accounted for by so doing.

The disagreement between males and females, positive correlation between age and heterophoria in males, negative in females, is difficult to explain. An inspection of the two-way frequency distributions in Figure 1 shows that a few males in the lower age groups were extremely exophoric; whereas, a few females of the same ages were extremely esophoric. No reason for this difference is known at present.

The near point of convergence was 49.0 mm. in males and 45.3 mm. in females, and these averages appear not to change significantly with age ($r = +0.13$ for males, $r = +0.06$ for females).

At a testing distance of 20 feet the prism convergence break point, averaging 18.7 diopters in males and 19.5 diopters in females, tends to decrease with increasing age; this tendency is statistically significant only in males ($r = -0.16$ for males, $r = -0.10$ for females). The prism divergence break point appears not to change significantly in either sex with increasing age ($r = -0.06$ for males, $r = +0.08$ for females).

The amount of manifest heterophoria at a testing distance of 13 inches, which averaged 4.0 prism diopters of exophoria for males and 2.3 for females, tends to increase toward more exophoria with increasing age, although this tendency is statistically significant only in females ($r = -0.12$ for males and $r = -0.19$ for females, where the correlation coefficients have negative signs because exophoria is represented on the negative side of orthophoria). In neither case is the correlation sufficiently intense to predict the amount of heterophoria from a knowledge of the age alone.

At a testing distance of 13 inches, the relationship of the break point of prism convergence to age (or to any other variable) is difficult to assess because of the nature of the frequency distribution of the prism convergence break point. For reasons which are not particularly pertinent at this point, we did not wish to introduce a Risley rotary prism before the subject's left eye when one was already before the right eye; because of this, the maximum convergence recorded was 30 prism diopters and this amount of prism convergence or more occurred in 132 of the 184 males and 164 of the 217 females. An examination of the two-way frequency distribution of the prism convergence break point and age (fig. 2) shows no obvious relationship to either sex.

Changes in age appear not to affect the prism divergence break point at a testing distance of 13 inches ($r = +0.14$ for males, $r = +0.13$ for females).

In general, the relationships of age to heterophoria and prism vergence, which are summarized in Table 1, are relatively slight if present at all. Nevertheless, it seems desirable to adjust for the possible mutual dependence upon age when examining the

relationship between heterophoria and prism vergences.

Sex vs. heterophoria, near point of convergence, and prism vergence. The males and females in this study, in addition to being comparable in age, also appear to be comparable with respect to the near point of convergence (averages: males, 49.0 mm.; females, 45.3 mm.), lateral heterophoria at 20 feet, prism convergence break at 20 feet, and prism divergence break at 13 inches. For prism divergence break at 20 feet, the difference of 0.82 prism diopters (=7.70 −6.88) is significant, having a standard error of ±0.30. Similarly the sexes are different in lateral heterophoria at 13 inches by 1.68 ± 0.54 prism diopters. Because of these differences, we have treated the sexes sepa-

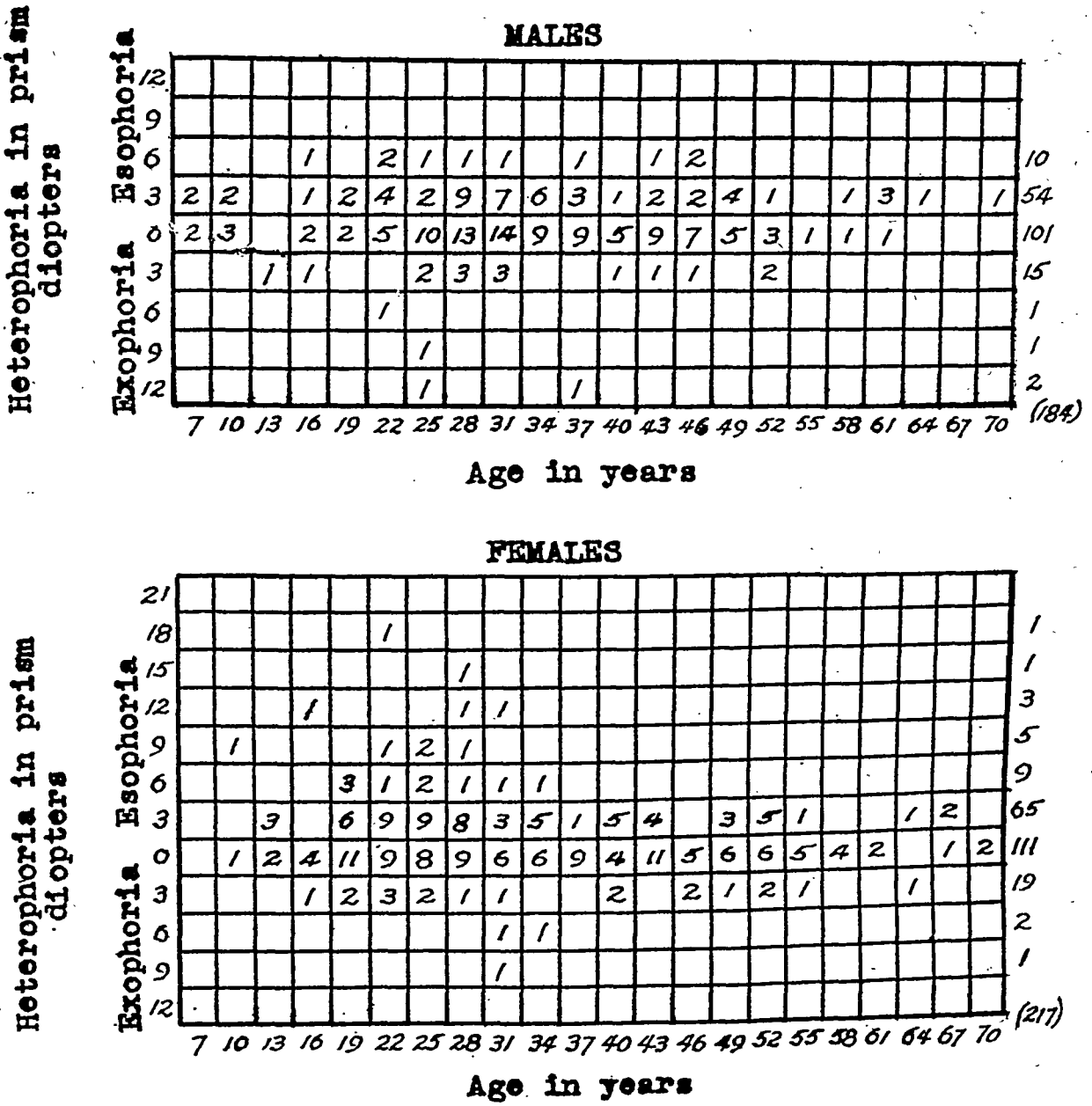


Fig. 1 (Scobee and Green). Frequency distributions of lateral heterophoria at 20 feet relative to age of subjects.

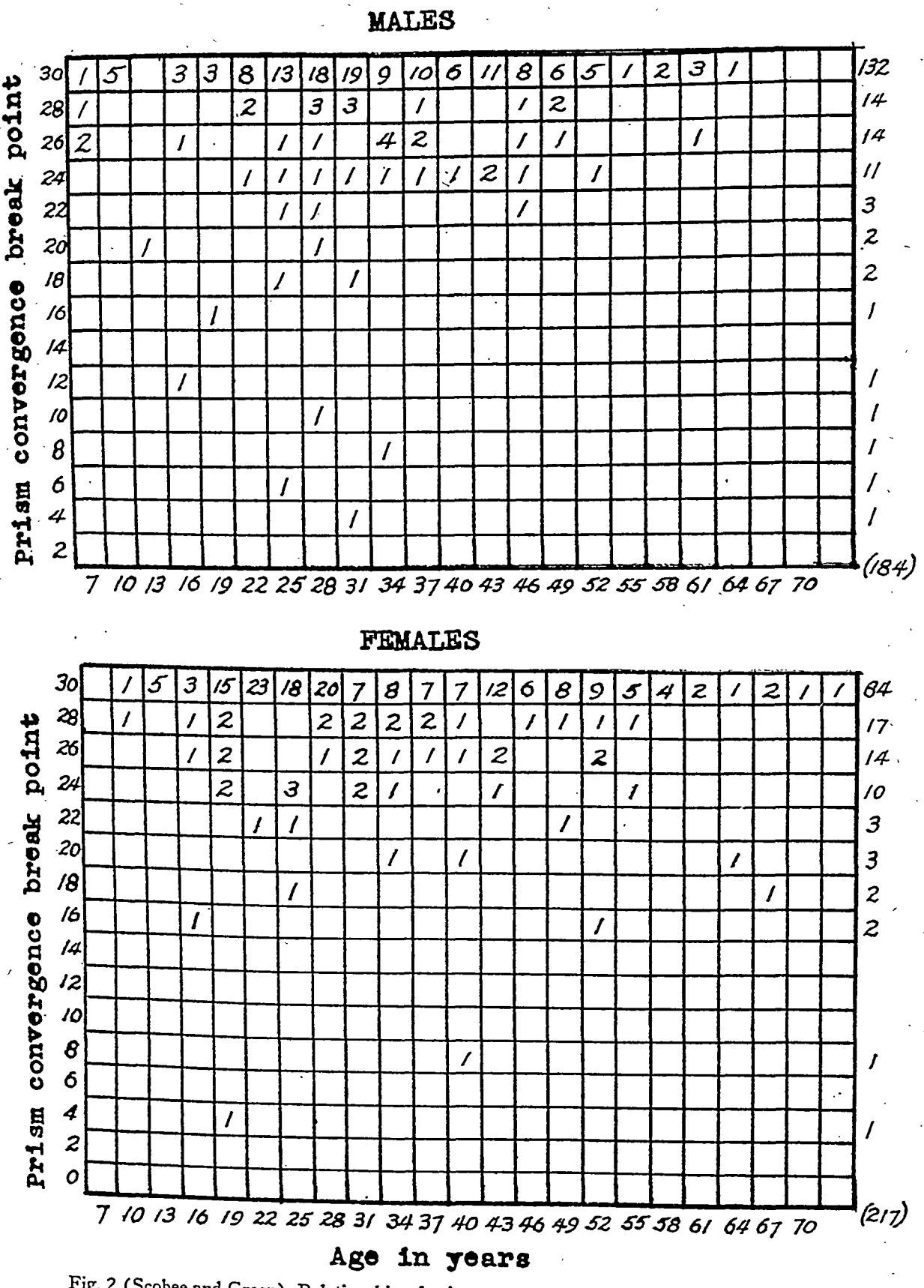


Fig. 2 (Scobee and Green). Relationship of prism convergence break point at 13 inches to age.

TABLE 1

THE RELATIONSHIPS BETWEEN AGE, REFRACTIVE ERROR, NEAR POINT OF CONVERGENCE, HETEROPHORIA, PRISM CONVERGENCE AND PRISM DIVERGENCE IN A SAMPLE OF 184 MALE AND 217 FEMALE SUBJECTS

	Sex	Avg.	S.D.*	Correlation† with: NPC	Hetero-phoria 20′	Conv. Brk. 20′	Div. Brk. 20′	Hetero-phoria 13″	Div. Brk. 13″
	(1)			(5)	(6)	(7)	(9)	(11)	(13)
(2) Age	M	33.5	12.1	+0.13	+0.17	−0.16	−0.06	−0.12	+0.14
	F	33.8	13.6	+0.06	−0.20	−0.10	+0.08	−0.19	+0.13
(3) Refractive error for O.D.‡	M	+0.13	1.51	+0.08	+0.08	−0.15	−0.01	0.00	−0.11
	F	+0.32	1.49	+0.01	−0.07	−0.11	−0.01	+0.01	−0.00
(4) Refractive error for O.S.‡	M	+0.05	1.56	+0.21	+0.08	−0.20	+0.07	−0.01	−0.06
	F	+0.27	1.62	0.00	−0.06	−0.08	−0.02	+0.12	−0.03
(5) Near point of convergence (mms.)	M	49.0	30.5		0.00	−0.23	−0.03	−0.15	−0.02
	F	45.3	26.3		−0.08	−0.22	+0.08	−0.25	+0.03
(6) Heterophoria, 20′ (prism diopters)	M	+0.8	2.6			+0.16	−0.14		−0.20
	F	+1.3	3.2			+0.09	−0.18		−0.32
(7) Prism convergence break point, 20′	M	18.7	6.8				+0.09		
	F	19.5	6.4				+0.01		
(8) Prism convergence re-fuse point, 20′	M	11.2	8.6			+0.54			
	F	11.1	7.8			+0.68			
(9) Prism divergence break point, 20′	M	6.9	2.9						
	F	7.7	3.1						
(10) Prism divergence re-fuse point, 20′	M	4.1	2.1				+0.67		
	F	4.7	2.8				+0.71		
(11) Heterophoria§ at 13″ (prism diopters)	M	−4.0	4.8						−0.19
	F	−2.3	5.9						−0.32
(12) Prism convergence break point, 13″	M	28.1	—						
	F	28.7	—						
(13) Prism divergence break point, 13″	M	20.8	4.3						
	F	20.7	4.3						
(14) Prism divergence re-fuse point, 13″	M	12.5	5.2						+0 52
	F	10.8	5.2						+0.52

* S.D. = Standard deviation.
† Product moment coefficients of correlation. To be judged significant with a 5% chance of being in error, it should exceed ±0.14; with a 1% chance, ±0.18.
‡ Spherical equivalent of the refractive correction.
§ + means esophoria, − means exophoria.

rately. The averages and the standard deviations of the distributions about the averages are given in Table 1.

Refractive error vs. heterophoria, near

Refractive error vs. heterophoria, near

neither the males nor the females is there any systematic association of the amount of refractive error with the amount of heterophoria, the near point of convergence, or with prism vergence at 20 feet or 13 inches.

HETEROPHORIA, PRISM VERGENCE, AND THE NEAR POINT OF CONVERGENCE

Heterophoria and prism vergence. The observed correlation coefficients between lateral heterophoria and the prism convergence break point at a distance of 20 feet

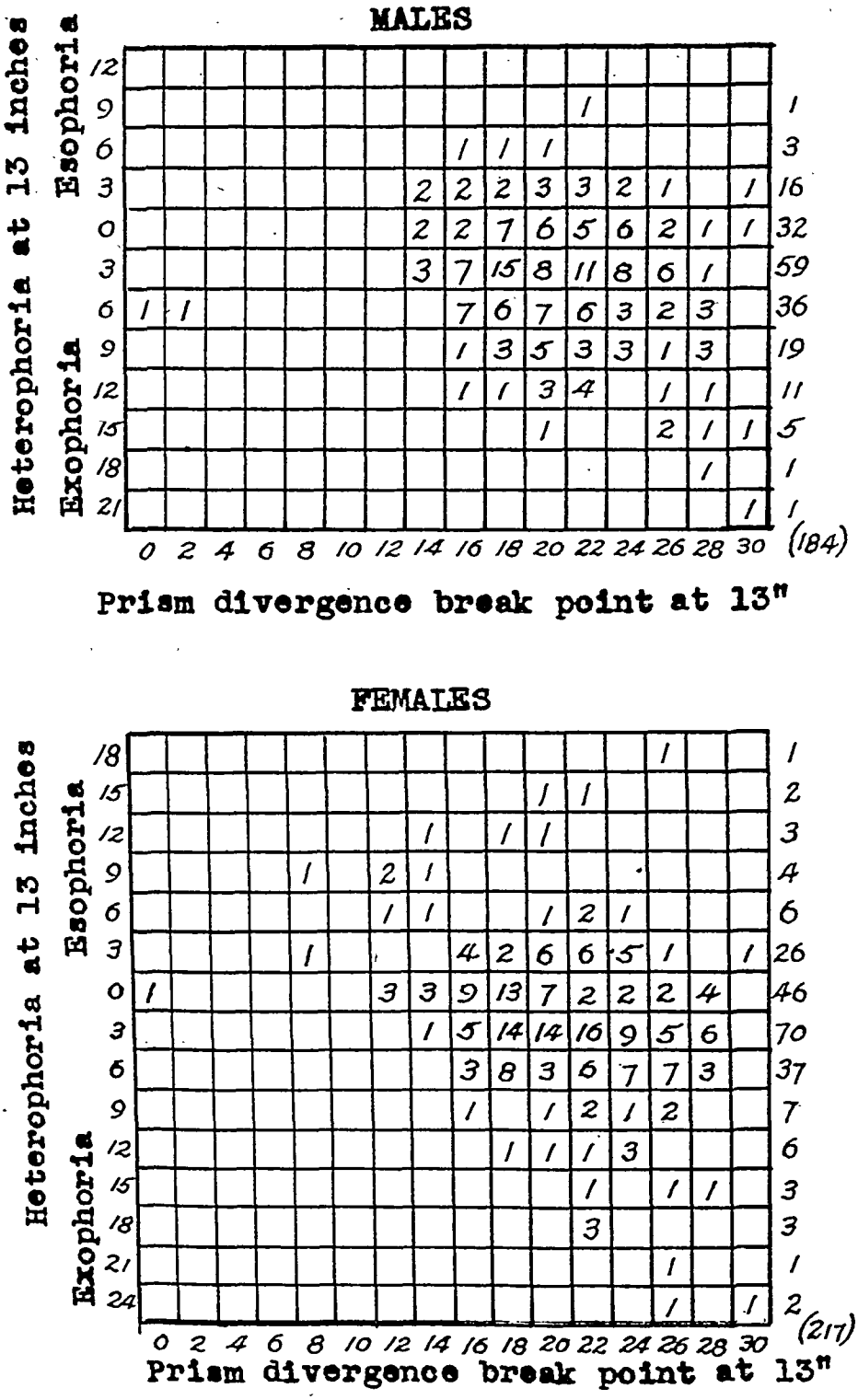


Fig. 3 (Scobee and Green). Relationship of heterophoria at 13 inches to prism divergence break point at 13 inches.

were +0.16 for males and +0.09 for females. When these coefficients are adjusted by removing the common effect of age, the partial correlation coefficients are +0.19 for males and +0.07 for females. The adjustments for age are in opposite directions because the relationships between heterophoria and age are different in the two sexes. The

partial coefficient is statistically significant for males but not for females. The adjusted coefficients for the relationship between heterophoria and the prism divergence break point at 20 feet are about on the border line of significance ($r_a = -0.13$ for males, $r_a = -0.17$ for females), suggesting that greater

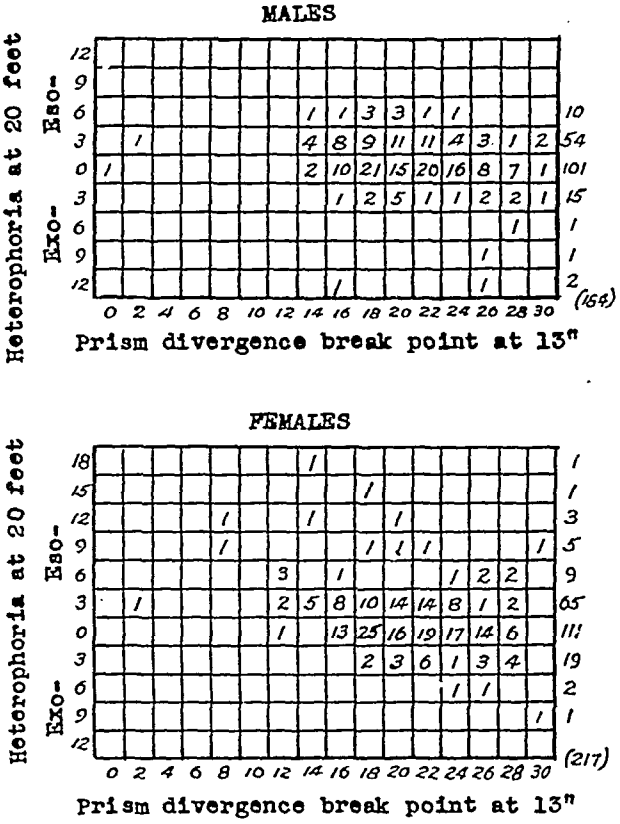


Fig. 4 (Scobee and Green). Relationship of heterophoria at 20 feet to prism divergence break point at 13 inches.

amounts of esophoria accompany lower amounts of prism divergence.

These correlations between lateral heterophoria and prism vergences at 20 feet are so weak as to prevent a satisfactory substitution of a heterophoria measurement for a prism vergence measurement. It appears that the two measurements, although correlated, are largely measures of different ocular functions.

On the other hand, the prism convergence break point does not correlate significantly with the point of prism divergence break at 20 feet ($r = +0.09$ for males, $r = +0.01$ for females).

At a testing distance of 13 inches, the amount of manifest lateral heterophoria is significantly correlated with the prism divergence break point even after removing the common effect of age on each function ($r = -0.18$ for males, and $r = -0.31$ for females). These coefficients imply that greater amounts of exophoria tend to accompany greater amounts of prism divergence and that greater amounts of esophoria tend to accompany lower amounts of prism divergence *at 13 inches*. This is shown in Figure 3.

A comparison of prism divergence at 13 inches with heterophoria at 20 feet shows that these two functions are related. The coefficients of correlation adjusted for age were -0.23 for males and -0.31 for females. The implication here is that greater amounts of exophoria at 20 feet tend to accompany greater amounts of prism divergence at 13 inches and that greater amounts of esophoria at 20 feet tend to accompany smaller amounts of prism divergence at 13 inches (fig. 4). This is another way of saying that if a patient is known to have a large amount of exophoria at 20 feet, one would expect a large amount of prism divergence at 13 inches; similarly, if a large amount of prism divergence at 13 inches is found, one expects to find a fairly marked exophoria at 20 feet.

Patients with much esophoria at 20 feet, on the other hand, usually have only small amounts of prism divergence at 13 inches; hence, a patient with poor prism divergence at 13 inches would, on the average, be expected to show fairly marked esophoria at 20 feet.

Patients with much esophoria at 20 feet, on the other hand, usually have only small amounts of prism divergence at 13 inches; hence, a patient with poor prism divergence at 13 inches would, on the average, be expected to show fairly marked esophoria at 20 feet.

The relationship is not strong enough to allow one measurement to be substituted

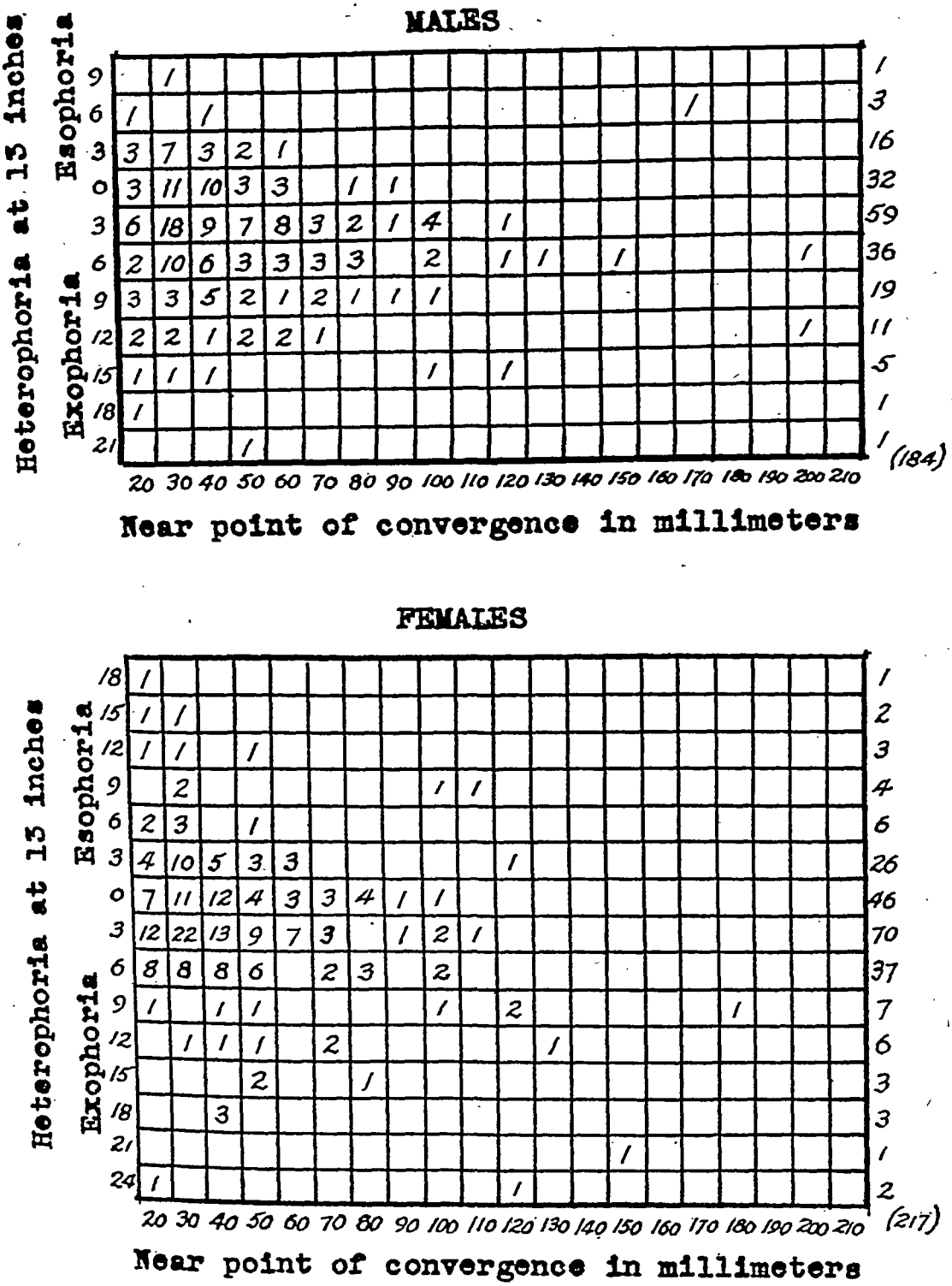


Fig. 5 (Scobee and Green). Relationship of near point of convergence to lateral heterophoria at 13 inches.

for the other, but is strong enough to enable the examiner who knows one measurement to make a guess at the other and not be too far wrong. It has been observed clinically that even large amounts of esophoria in patients with good prism divergence at 13 inches seem to be associated with no symptoms whatever; on the other hand, the patient with much esophoria and poor prism divergence at 13 inches will in all probability have many symptoms which will not be corrected by refraction alone. On clinical

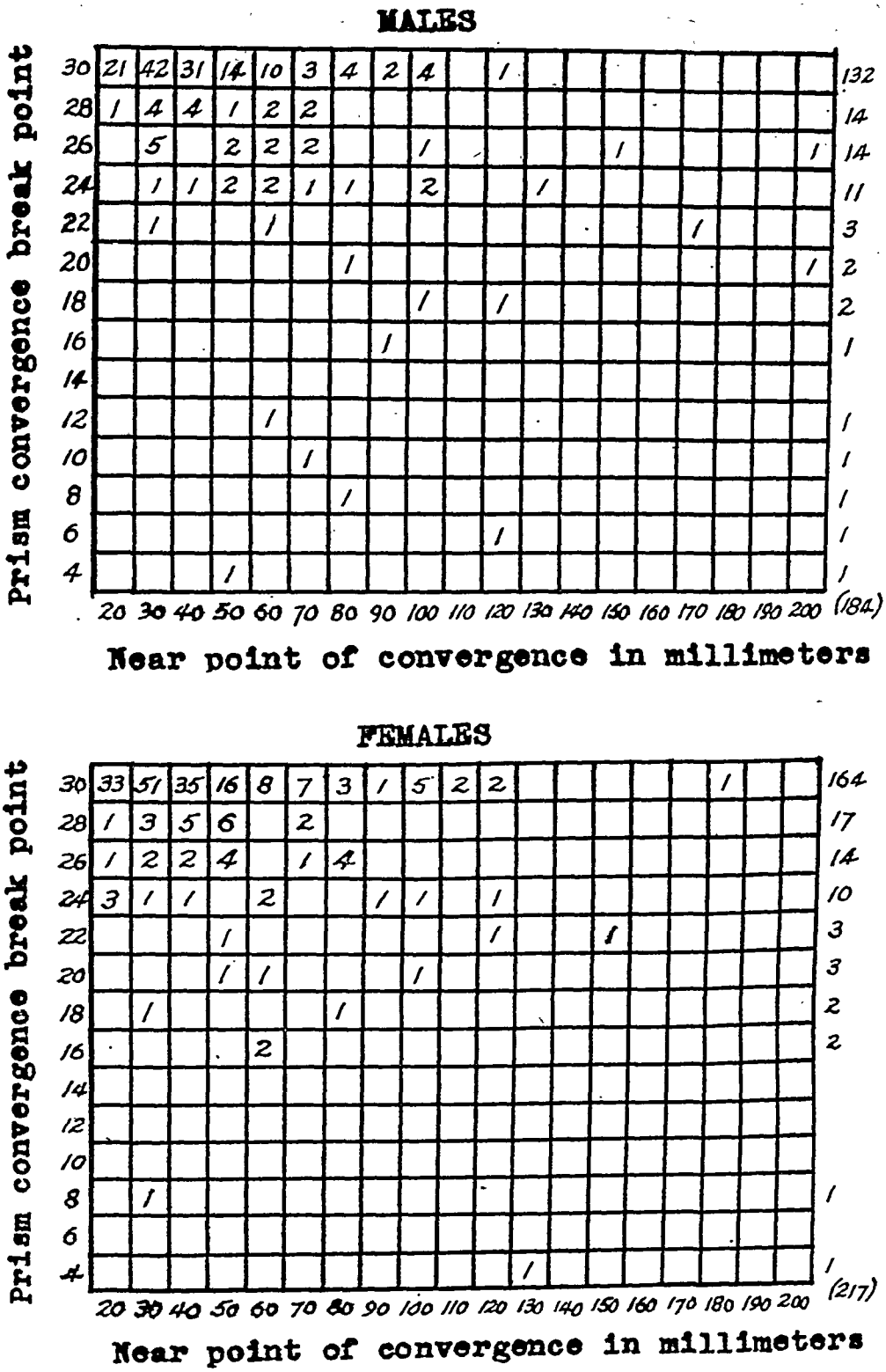


Fig. 6 (Scobee and Green). Relationship of near point of convergence with convergence break point at 13 inches.

grounds, it would seem that a knowledge of the prism divergence at 13 inches enables one to evaluate properly any esophoria which may be present.

Heterophoria and the near point of convergence. The near point of convergence is not correlated with the amount of manifest lateral heterophoria when the testing dis-

tance is 20 feet ($r = 0.00$ for males, $r = -0.08$ for females) but it is correlated with heterophoria tested at 13 inches with the effect of age removed ($r_a = -0.14$ for males, $r_a = -0.24$ for females). The relationship is such that greater amounts of exophoria tend to accompany greater measurements for the near point of convergence (fig. 5).

While it appears that a measurement of heterophoria at 13 inches and a measurement of the near point of convergence are to a slight extent measurements of the same ocular function, the similarity is not sufficient to justify an assertion that the two measurements are equivalent. It is quite obvious that the two measurements are measurements of largely different functions.

Prism vergences and the near point of convergence. As might be anticipated, the near point of convergence is correlated with the prism convergence break point (at least at the 20-foot testing distance and possibly also at the 13-inch distance, as shown in Figure 6), but it is not correlated with the prism divergence break point either at 20 feet or at 13 inches (table 1).

Discussion

The statement has been made that the data in this study show no significant relationship between age and heterophoria, prism vergence, and the near point of convergence. It is well known that some ocular functions, such as accommodation, change more or less systematically with age. It has been suspected that heterophoria also changes with age in the direction of exophoria. To discover whether or not such a change does occur, it would be desirable to study a group of subjects over a protracted period of time such as 20 or more years. No study of this sort has been made. For the time being, therefore, it is necessary to base a judgment about the effect of age on heterophoria on a sample of men and women of all ages. In our present sample, there is not sufficient relationship between age and heterophoria or vergence or the near point of convergence to enable one to predict the amount of change in the muscle balance of a patient from a knowledge of his age alone. Obviously a sample of this sort does not permit conclusions about changes in muscle balance in given individuals with changing age. Such a sample does allow the conclusion that there are no systematic changes with age affecting the population as a whole. If there are significant changes in muscle balance related to age, then these changes must be in different directions from individual to individual. This means, for example, that if the entire population had one prism diopter of esophoria at 20 feet at the age of 20, then at the age of 65, some might have 8 prism diopters of esophoria while others might have 7 prism diopters of exophoria; in other words, the change, if it occurs, is highly variable from one individual to the next. Certainly the *entire* population does not shift in the direction of exophoria with advancing years, as many have been led to suspect on the basis of observations on a few cases.

The near point of convergence is only slightly related to lateral heterophoria at 13 inches and to the prism convergence break point at 20 feet. The relationship is just barely of statistical significance and certainly is not strong enough to permit any clinical application.

There is a definite but not strong relationship between lateral heterophoria at 20 feet and the prism divergence break point at 13 inches. The relationship from the statistical standpoint is a weak although definite one. The addition of clinical observations, however, permits a clinical application of this relationship but only with certain limits. As was pointed out in the body of the paper, a knowledge of the prism divergence at 13 inches is a valuable adjunct to the proper evaluation of any esophoria present at either 20 feet or at 13 inches. Esophoria in the presence of good prism

divergence at 13 inches is not believed to be clinically important. Esophoria in a patient with poor prism divergence at 13 inches is often associated with severe symptoms which are not relieved, on the average, by correction of the refractive error, or even by orthoptics. It has been our clinical experience that patients with less than 12 diopters of prism divergence at 13 inches may be considered as having poor prism divergence and will usually have many asthenopic symptoms which are difficult or impossible to relieve by any known method of therapy at this time.

The question of the selection of an adequate battery of tests of muscle balance is and always has been a problem of particular interest to the armed forces. Tests which are highly correlated with each other are supposed to be measuring the same function and so may be substituted one for another. This means, for example, that if lateral heterophoria at 20 feet and prism convergence at 20 feet had a correlation coefficient of 1.0 or very close to it, both tests would, in all probability, be measuring the same function; that a knowledge of the results of one test would enable us to predict the results of the other; and that only one of the two tests need be included in any battery of tests for muscle balance.

On the other hand, tests that are not correlated at all are supposed to be measuring entirely different functions. If the correlation coefficient between two tests is 0.00, then we may reason that the tests are testing entirely different things and must be included in any battery of tests for muscle balance. This is the statistical approach to the comparison of various tests.

The primary difficulty in selecting a battery of tests for muscle balance is the fact that with the notable exception of the cover test, they are all almost entirely subjective. This means that they are all subject to different degrees of individual variation. A starting point would, therefore, be the comparison of various tests of heterophoria with the cover test and this has been done.[5] It is admittedly difficult to train inexperienced examiners in the proper performance and interpretation of the cover test. The armed forces have, therefore, selected the Maddox-rod test for heterophoria and it compares favorably with the cover test, at least at the 20-foot testing distance. At the 13-inch testing distance, either the Maddox-wing or the Thorington test are preferable from the standpoint of correlation with the cover test. So far, the armed forces have been content to omit any test of heterophoria at near and so the choice of a near test for heterophoria presents no problem at the present time.

The near point of convergence has been included in the battery of tests of muscle balance by the armed forces for a long time, although they appear to be about ready to drop it and apparently with good reason. It has a definite, although very slight, relationship to prism convergence at 20 feet and to lateral heterophoria at 13 inches. There are two convergence centers in the brain, one voluntary and the other involuntary. If involuntary convergence is lacking, voluntary convergence can be taught to the large majority of subjects in a very short time.[4] The near point of convergence is therefore a "trick" of crossing the eyes which can be learned in a short time; after it has been learned, the near point of convergence measurement is greatly improved although it seems obvious that there has been no improvement in the same individual's ability to perform close work over long periods of time. There are other and more reliable tests available which yield much of the desired information and hence the near point of convergence test can probably be eliminated from the test battery for muscle balance without impairing the efficacy of the battery significantly.

Like the near point of convergence, prism convergence can also be learned and is therefore so variable that there seems to be no

point in including it in the test battery at either 20 feet or 13 inches. It is not included at the present time.

Prism divergence, on the other hand, cannot be learned. No adequate demonstration of any divergence center has ever been made and prism divergence at the 13-inch distance to include prism divergence at 13 inches in any battery of tests of muscle balance. There seems to be no good reason to include prism divergence at 20 feet in such a battery.

Any decision about heterophoria tests at 13 inches is a difficult one in the light of our present knowledge. Certainly every ophthal-

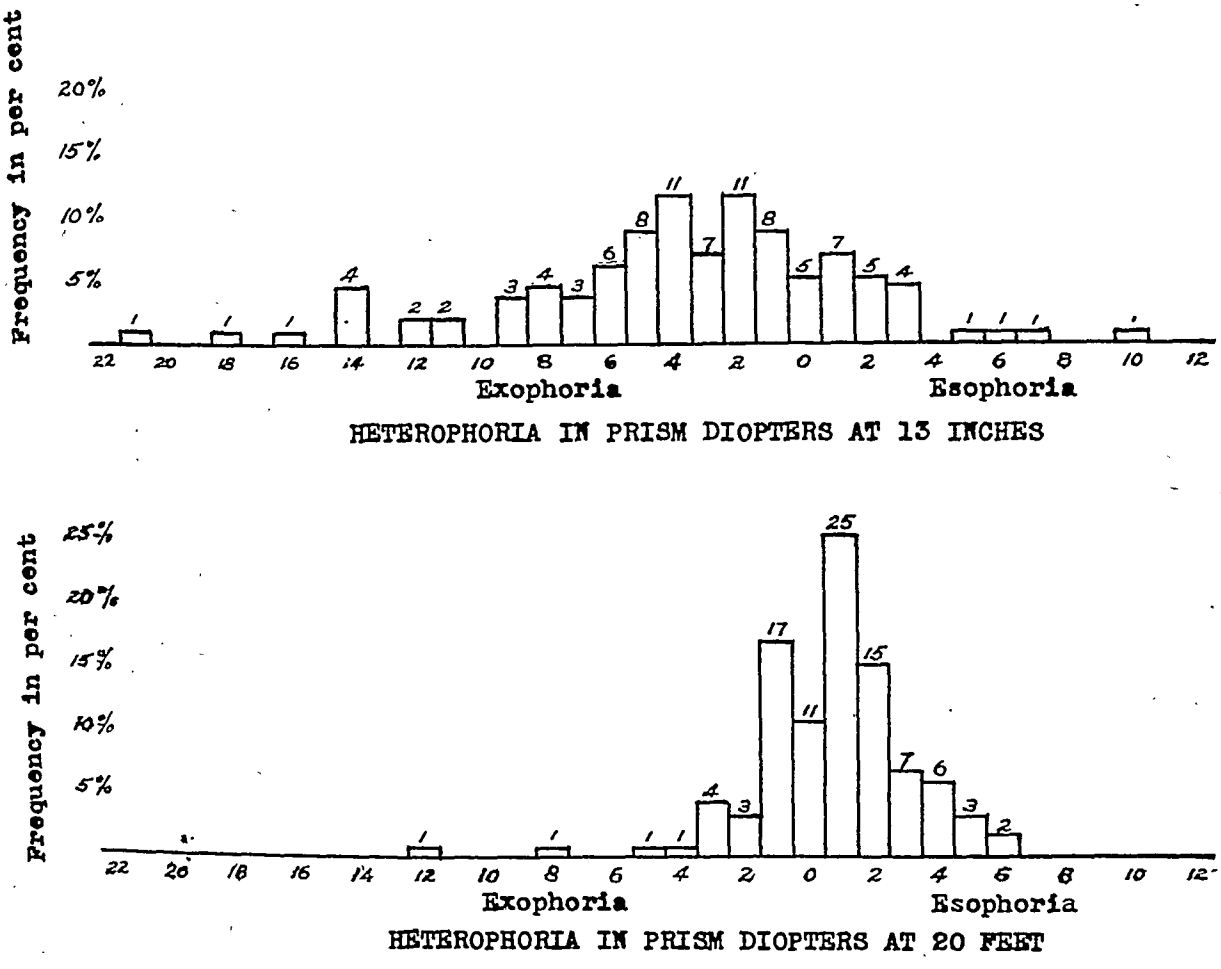


Fig. 7 (Scobee and Green). Distribution of lateral heterophoria for males 18 to 35 years of age inclusive.

appears to be a fairly reliable index of the ability of an individual to relax and give up convergence at the reading distance.[1, 5] It bears a definite, although slight relationship to heterophoria at both 20 feet and at 13 inches. Although the statistical evidence for its inclusion in any battery of tests for muscle balance is not impressive, the clinical evidence favoring its inclusion is much stronger. It would therefore seem advisable

mologist who tests muscle balance at all makes some determination of heterophoria at both 20 feet and at 13 inches. The mere fact of usage for a century or more is no evidence for inclusion in a test battery. Long usage would only indicate the weight of clinical experience seeming to favor the test. Imus[3] said that ". . . there is a small but definite relationship between the measures of near lateral phoria obtained by the

clinical method and the compensatory innervations measured at the same distance." This is substantially in agreement with our findings. Until more and better factual evidence is at hand, we are inclined to believe that a test of near heterophoria should be included in any battery of tests for muscle balance on the basis of clinical experience alone.

Selection of tests and test limits

The question arises as to what ocular functions shall be tested and what limits shall be established for "normal" ocular measurements. While such a question is of far more interest to the armed forces, since they desire to test large groups of individuals

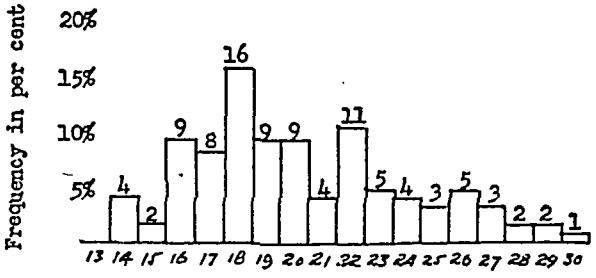


Fig. 8 (Scobee and Green). Distribution of prism divergence break point for males 18 to 35 years of age inclusive.

in certain age groups to be trained for specific tasks in time of war, than to the practicing ophthalmologist, nevertheless the question is of academic interest to all.

With the multitude of relatively unskilled examiners who must be called upon in time of war to test thousands of candidates, the armed forces are vitally interested in (a) the simplest examination which will yield reasonably reliable and significant results, and (b) a set of limits for the various tests employed which will adequately divide the "normals" from those who are likely to be unable to complete their training. Answers to these problems may be determined (1) by policy, or (2) by evidence.

Evidence would consist of data showing the various degrees of attainment in the performance of the task relative to the various readings for the test. Evidence of this sort is usually not available and can be obtained only by special studies. It is, therefore, frequently necessary to resort to a policy decision. When such a decision is made, it is desirable to know the proportion of individuals that will be classified as acceptable or not acceptable for various sets of limits.

For lateral heterophoria both at 20 feet and at 13 inches, Figure 7 shows the frequency distribution of an unselected sample of males in the age range of from 18 to 35 years inclusive. From this distribution it may be estimated that the acceptance limits of 4 prism diopters of exophoria to 4 prism diopters of esophoria at 20 feet will include about 92 percent of the population. If the limit for esophoria at 20 feet is increased to 5 prism diopters, then 95 percent of the population would be included.

With respect to lateral heterophoria at 13 inches, it may be seen that limits of 10 prism diopters of exophoria and 4 prism diopters of esophoria will include 85 percent of the population. In order to include 95 percent of the population, the limit on exophoria would have to be increased to 18 prism diopters, a figure which, by all clinical evidence, is known to be far too large for the comfortable binocular performance of sustained close work. On the basis of clinical evidence, 10 prism diopters of exophoria at 13 inches is a far more acceptable limit to be considered "normal."

Figure 8 shows the distribution for prism divergence at 13 inches of an unselected sample of males in the age range of from 18 to 35 years inclusive. From this distribution, it may be estimated that acceptance limits of not more than 27 prism diopters of divergence and not less than 14 prism diopters would include 95 percent of the population.

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DISCOLORATION OF THE EYELIDS FROM PROLONGED USE OF OINTMENTS CONTAINING MERCURY*

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Just a year ago, a 39-year-old woman came to my office with an unusual and rather striking discoloration of her eyelids. She had come for a routine examination but when questioned, she admitted that the discoloration was a source of considerable embarrassment to her; it had come on gradually over the last 10 years.

My first impression was that she had been using eye-shadow on her lower lids. There was a dirty gray color of the skin of both lower lids and of the lower 15 mm. of the upper lids; this latter was not apparent until she closed her eyes. The slitlamp showed a homogeneous gray cast to the skin; the pigmentation extended onto the lid margins as granules more brownish than gray. The bulbar conjunctivas, corneas, and lenses were normal. The color was very similar to that produced in argyrosis but the distribution was unusual, and there was no history of any silver preparations being used. Careful questioning finally brought out that because of granulated lids she had started rubbing yellow mercuric oxide on her lids every night and had continued it for about 23 years.

* Read at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947. From the Institute of Ophthalmology of the Presbyterian Hospital, New York.

REPORTS IN LITERATURE

A search of the literature gave nothing about such discoloration of the eyes from yellow oxide. In 1922, however, Goeckermann[1] described a woman whose eyelids, nasolabial folds, and chin were a brownish gray or slate color. It was attributed to a face cream containing bismuth and mercury. His second patient showing similar but less marked pigmentation, had used a cream containing only mild mercurous chloride. He pointed out that mercury in contact with alkaline secretions yields a blackish pigment of mercury oxide. This reaction was reversible by a dilute acid. Both of his patients improved on using a 2-percent acetic acid and did still better on a 1-percent aqueous solution of potassium cyanide, but both chemicals irritated the skin. Since mercury was freely used in creams, he concluded that the skins of his two patients were peculiar. He was able to demonstrate that the secretions of one were alkaline. The same author reported 13 more cases in 1925.[2] All were typical. A biopsy showed pigment granules in all layers of the skin and subcutis. He was not able to demonstrate mercury chemically but the granules were removed entirely by a compound solution of iodine.

The only other dermatologic report found was by Hollander and Baer, in 1929.[3] They

described a woman whose entire face was a dirty grayish black. She had used a face cream daily for 15 years. Mercury was demonstrated in the skin by an electromicroqualitative method. They rubbed the skin briskly with tincture of iodine to form soluble mercuric iodide, then alcohol to dissolve the new compound. Her skin improved but she did not complete the treatment.

I was unable to get a biopsy in my case, but the history was so definite that there seemed to be no doubt as to the relationship between the discoloration and the yellow oxide. As the treatments just described were considered too drastic for the eyelids, no treatment was attempted. The mercury was stopped and plain vaseline was suggested in its place. Six months later there was definite fading and the patient volunteered that people no longer commented about her lids. Eleven months after the mercury was discontinued, the patient is happy about her condition but the gray color, while fainter, is still fairly definite.

In the November, 1946, number of the *British Journal of Ophthalmology*, Abramowicz[4] gave the first report that I have been able to find of a case very similar to the one that I have described. The patient was a woman, aged 57 years, who had used white precipitate ointment of 6.66 percent nearly every night from the age of 16 years, that is, for 41 years, for blepharitis. The skin of her eyelids was bluish gray. Dark pigment granules were found in the bulbar conjunctiva, especially near the cornea, with preferential distribution around the perivascular lymph vessels. In the periphery of the cornea, in the region of Descemet's membrane, a discoloration varying from greenish gray to a bluish gray was seen. A yellowish-brown, lusterless opacity occupied the pupillary area of the lens.

I will return to the discussion of this case after describing very briefly four patients I have seen subsequently. This report by Abramowicz confirmed my belief that mercury had been responsible for the discoloration and increased my interest in the condition. I feel certain that without my first case, I would have missed the later ones, because the pigmentation, while definite, was subtle.

Reports of similar cases

My second patient was a druggist, aged about 55 years, who complained that his eyes were always irritated and tearing and that the lids were purple. He had used 1-percent yellow oxide for at least 10 years. There was a faint gray, slightly greasy appearance of his lids, most marked at the upper borders of the upper tarsi.

The third case was a woman, aged about 30 years. She had had many styes and had massaged her lids nightly with 2-percent yellow oxide for four years. There was faint but definite discoloration of her lower lids.

The fourth case was a woman, aged 40 years. She had used various ointments since she had trachoma 22 years previously. She was certain that yellow oxide had been one of them, but for the last four years she had been using 3-percent ammoniated mercury. There was a slight gray cast to the skin of the lower lids and the upper lid margins looked faintly blue.

None of these three persons had complained of the discoloration, nor were they actually aware of it. Yet, in each instance, it was definite enough for me to suspect mercury and to elicit the histories that have been given. While not a definite cosmetic blemish, the color was certainly unpleasant and might eventually have become embarrassingly conspicuous.

I am indebted to Dr. DeVoe for the fifth and last patient, a 67-year-old man. He is the only one who consulted an oculist because of the pigmentation of his lids. They had become red and inflamed so he had massaged them almost every night for 20 years with yellow oxide. The typical dirty gray

color involved both lower lids and the lower one centimeter of the upper lids.

Discussion

These five cases, although varying in degree of pigmentation, showed essentially the same picture. Only in the first and most marked instance was the pigmentation of the lid margins definite. None showed any pigmentation of the conjunctiva that could be attributed to mercury. There were no changes in the corneas or lenses. The much more extensive involvement in the case of Abramowicz should be easily explained because a much stronger percentage of mercury was used for a considerably longer period.

Many of the members of this society will remember the excellent report given by Atkinson[5] five years ago, in which he described for the first time a brownish reflex of the anterior lens capsule in people who had worked for long periods with mercury. This was thought to be produced by mercury vapor. That Abramowicz found the same change in the lens, from external application, is of particular interest. In four of Atkinson's cases with chronic mercurialism, the skin of the face presented a gray appearance.

Use of mercuric ointments

Yellow mercuric oxide first appeared in the English ophthalmic literature in 1866, when Pagenstecher[6] described its use for phlyctenular conjunctivitis and corneitis. It had been listed in the German pharmacopeia for 10 years previously and had gained "many ardent supporters" in that country. Since that first article, there has been scarcely any mention of it in periodicals, yet its use spread rapidly as shown by a review of textbooks. It soon became the most widely used ophthalmic ointment and has held this lead up to the present even though it is prescribed much less frequently by ophthalmologists today.[7] This decline in popularity with oculists is undoubtedly due to an appreciation of its relative ineffectiveness and the influx of new ointments such as the sulfonamides and penicillin.

Although no figures are available on the total annual consumption of yellow mercuric oxide in this country, the best evidence indicates that the amount is immense, possibly in the neighborhood of 100,000 ounces. This is largely due to the efforts of the druggists of the country, who prescribe and dispense the drug with great freedom for a wide variety of eye complaints.

Ammoniated mercury ointment apparently antedated yellow oxide in ophthalmic use. The earliest reference that I have been able to find was in the French *Annales d'oculistique*[8] for 1856, when it was called white precipitate. It has enjoyed continued popularity since that time but has never approached yellow oxide in the amount used. This is hard to understand because, for a long time, it has been generally known that the ammoniated mercury is equally or more effective therapeutically and much less irritating. In fact the great and lasting popularity of yellow oxide is a mystery that I have been unable to solve.

The wide use of mercury in ophthalmic ointments over the last 80 or 90 years has been discussed to emphasize how remarkable it is that this picture of discoloration of the eyelids has not been described before. I am convinced that we have all been seeing mild forms of it for many years. Evidence of this is the fact that, once I was aware of it, I found four more instances in 10 months.

Two other points present themselves for speculation. One is the question of individual susceptibility. This undoubtedly is a factor but it will be established with difficulty because of the very gradual onset and the lack of figures on the actual use of the drug. The other question is that of prescribing other mercury preparations, such as oxycyanide of mercury as eye drops. This experience has made me cautious about ordering them for indefinite use.

Conclusion

Five cases have been presented which show a characteristic dirty gray discoloration of the skin of the eyelids. These cases have one point in common; namely, daily use of an ophthalmic ointment containing mercury (yellow oxide or ammoniated) over a prolonged period, four years being the shortest. There appears to be a direct etiologic relationship between the mercury and the pigmentation. While no treatment is suggested, the color fades slowly on discontinuing the ointment.

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Historical Miniature

Hemianopsia. Although the Hippokratic writers neither knew nor measured the extent of the visual field as the later Greeks did, the phenomenon of half vision associated with cerebral disease did not escape their notice. In the *Second Book on Diseases,* it is noted that, in a patient with a disease of the head associated with somnolence and frequent urination, the headache ceased after 20 days. "And when he looked at something the vision escaped him and he was aware of seeing only one half of persons."

Hirschberg in *Graefe-Saemisch Handbuch,* v. 12.

THE USE OF BUCCAL MUCOSA IN THE RESTORATION OF THE ORBITAL SOCKET*

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INTRODUCTION

Restoration of the orbital socket to permit the wearing of a prosthesis is a necessary and important procedure in ophthalmic surgery. Although it is true that complete obliteration of the socket is relatively rare, partial obliteration is frequent, and only slight degrees of contraction may prevent the socket from accommodating a prosthesis. The lower cul-de-sac appears to be far more vulnerable to injury than the base of the socket or the upper cul-de-sac; therefore, it is most often deformities of this part that must be repaired. This unequal distribution of the effects of injury is emphasized by Maxwell,[1] whose ingenious operation was devised primarily to restore the lower cul-de-sac.

The recent war contributed to the problem. Many soldiers with contracted sockets could be counted among the 1,200 who were totally blinded and the thousands who lost one eye from battle wounds or training accidents. In addition to these, there was a fairly large group of inductees with only one eye, a number of whom had deformities which had prevented them from wearing a prosthesis.

The majority of these patients with contracted sockets received definitive treatment at the eye centers established throughout the United States by the Office of The Surgeon General. One of the largest of these was at Valley Forge General Hospital where I was stationed during a considerable period of the war. Here my associates and I had an unusual opportunity to apply the reconstructive procedures advocated for alleviation of contracted sockets. Even the totally blind soldiers were insistent that partially or completely obliterated sockets be restored in order that they might wear artificial eyes. They were not only willing but anxious to undergo any operative procedures that would result in giving them a normal outward appearance, even though their sight was gone. The technique which we found most satisfactory included the employment of grafts of buccal mucosa.

EARLY ATTEMPTS AT RESTORATION OF SOCKET

Earlier attempts at restoration of the orbital socket were by means of pedicle skin grafts or free skin grafts, and the surgeons who first advocated these methods made use of the full thickness of the skin. We are indebted to Reverdin,[2] Ollier,[3] Thiersch,[4] and Wolfe,[5] all more or less contemporaries, for demonstrating that pedunculated skin flaps are not essential to the vitality of the graft. Wolfe[6] conclusively demonstrated that ". . . the cause of non-success in transplantation was the areolar tissue underneath, and that, if we could transplant a skin flap free of that subjacent tissue, we should secure its adhesion and incorporation." Full thickness skin grafts were employed by Weeks,[7] Morax,[8] and others. Verhoeff[9] recommended the use of a Thiersch graft employed in a manner similar to that later advocated by Wheeler,[10] who utilized epidermic grafts. Wheeler objected to the use of the name Thiersch in connection with the epidermic graft, for the graft which Thiersch employed was dermo-epidermic. Wheeler, however, was not the first to use the epidermic graft; he had been preceded by Esser[11] who had employed it in the form of an "epithelial inlay" as a means of enlarging the orbital socket. Wheeler laid emphasis on the point that the ideal graft for

*Presented at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947; and the New England Ophthalmological Society, Boston, Massachusetts, December, 1947.

relining the socket was epidermis only, free from layers of true skin. While this technique was eminently successful in Wheeler's hands, one is impressed by the large number who failed to attain the desired results using the operative measures he advocated. In consequence, there are few ophthalmic surgeons who observe the technique outlined by Wheeler either in dissection of the socket or in cutting the graft.

Heterogeneous transplantations

In 1872, J. R. Wolfe of Glasgow first transplanted conjunctiva from the rabbit to the human eye for the successful cure of symblepharon. This operation was soon adopted by surgeons of various countries. In a subsequent report in 1883, Wolfe[6] stated that Noyes of New York had been the first American surgeon to apply this operation to reconstruct the sac so that the patient might wear an artificial eye, when the natural cavity had become contracted. Cohn of Breslau, however, had previously made use of the procedure to achieve a similiar result.

In connection with the Wolfe operation, the following statement appeared in the *British Medical Journal* of August 20, 1888: "In showing the patient, Doctor Wolfe commented on the fact that it was nearly 15 years since he introduced this operation, and in spite of the fact that the rabbit's conjunctiva gave perfect results, efforts to transplant mucous membrane from the human subject, from the mouth and even the vagina, were being made."

Early use of mucous membrane

Van Millingen[12] must be given credit for the first operative procedure which included transplanting a strip of mucous membrane from the inner surface of the lower lip to the margin and under surface of the upper lid for the cure of trichiasis. He first described his operation in an article, in 1880, reporting the result he had obtained during the preceding three years. After several experiments, including grafting with mucous membrane from the mouth of the rabbit to replace conjunctiva, he gave preference to mucous membrane from the patient's lip. Hugo Wolff[13] of Berlin reported, in 1905, that in his operation for symblepharon he was using mucous membrane from the patient's mouth for grafting in order to form a lasting conjunctival fold.

Denig[14] began to experiment with grafts of mucous membrane from the mouth in cases of trachomatous pannus, in 1910. The favorable results obtained induced him to use it as a curative measure following chemical burns of the cornea and limbus, and he later applied it to other corneal conditions. His report was based on the results of such grafts in 150 patients.

Influence of World War I

The influence of World War I is reflected in the publications on ophthalmic surgery during the following decade. Because of the great increase in deforming injuries to the orbital structures, interest in reconstructive surgery was stimulated, just as it has been during the recent war. In 1918, in discussing Henderson's[15] paper on suture operations for contracted socket, Story referred to the procedure that he himself employed. In the case of moderately contracted sockets, where operation was possible, he transplanted mucous membrane instead of skin, and found it to be fairly successful. The next year Greene, in his discussion of Cruise's[16] paper on an operation for contracted sockets, expressed the logical conclusion that since there was mucous membrane lining in the socket it was well to follow it up with more mucous membrane. He had obtained good results by taking a large flap of mucous membrane from the inside of the mouth to replace the lost conjunctiva and inserted a glass ball to maintain contact between the graft and the underlying tissues.

Further reports in literature

In 1920, Majewski[17] called attention to the

fact that either buccal or vaginal mucosa could be utilized in the repair of contracted sockets. In an article on the subject, written about the same time, Benoit[18] mentioned that Gallemarts used vaginal mucous membrane, while Ssapiejko preferred mucous membrane taken from the lips. He also called attention to the unsatisfactory results of heteroplastic grafts.

Karelus,[19] in 1924, distinguished three classes of surgical procedures for reconstruction of the orbit after total obliteration. The first of these included the different methods of covering the prepared orbit with mucous membrane. He stated that heteroplastic grafts, the rabbit's conjunctiva, for example, must be abandoned, and trial be made of transplanting human mucous membrane from the buccal or the vaginal mucosa. To the best of his knowledge Stellwag (1889) had been the first to describe this procedure.

Gillies and Kilner,[20] in discussing the treatment of symblepharon, in 1929, reported one case in which the cornea had not been damaged. Mucous membrane from the inner surface of the lower lip was employed, and the graft was applied in a manner precisely similar to the Thiersch grafts in earlier cases. They were of the opinion that this form of grafting had many advantages to recommend it, and that it would, in selected cases, entirely supersede the Thiersch graft. In a later discussion Kilner[21] stated that the difficulty in these cases was to insure proper pressure dressing of the grafts.

Clay and Baird[22] (1936) recommended mucous membrane from the prepuce and labia minora as an ideal substitute for conjunctival tissue. They found that not only was there enough tissue available for complete restoration of the socket, but also it had none of the objectionable features of ordinary skin grafts. They pointed out that skin grafts "are most unsatisfactory to the patient in that they are uncomfortable and unsightly, desquamation is always present, and there is most frequently a disagreeable odor."

Hughes[23] offered two objections to the use of mucous membrane from other parts of the body as a substitute for conjunctiva; the first being that the secretion was thick and copious, and the second, that it was difficult to obtain a sufficiently large area of mucous membrane.

Spaeth,[24] in discussing the use of mucous membrane in ophthalmic surgery, made the following statement: "There is but one defect for which these grafts may be used; namely, for the correction of a conjunctival defect, and that in the presence of an intact and healthy eyeball." He pointed out that one need allow for little if any shrinkage in the mucous membrane graft.

Whalman[25] advocated a wider usefulness for these grafts, stating, "Whenever it becomes necessary to supplement or supplant conjunctival tissue for any reason whatever, nothing serves better than a graft of mucous membrane from the mouth. . . . Skin exfoliates, becomes rough and irritating—mucous membrane remains smooth and soft."

DeVoe[26] described the technique he had developed to restore the lower cul-de-sac by means of buccal mucosa. He stated that sockets lined with these mucous membranes had been found to be most satisfactory; furthermore, they were free from objectionable odor and discharge. He considered it impossible to procure enough mucous membrane to line a socket completely, but recognized that a socket lined partially with mucous membrane and partially with skin was extremely annoying to the patient, because the discharge was profuse and ill smelling.

Marcks and Zugsmith[27] recommended the inside of the lower lip as an ideal donor area for mucous membrane for restoration of the lower cul-de-sac. They could see no contraindication to combining skin and mucous membrane.

Stallard,[28] on the other hand, concurred with the widely held opinion that combinations of mucosal and epidermal grafts in the same socket are unsatisfactory. He regarded mucosa from cheeks or lower lip as the best material for orbital grafts, but he stated that when areas larger than 1.5 cm. had to be covered epidermis was the only possible material.

Fox[29] stated that the ideal lining for a socket was mucous membrane and that the buccal membrane could be used if large grafts were needed. Mackenzie[30] also agreed that the ideal graft for lining the orbit was mucous membrane. According to him, the choice of donor sites varied depending on the sex of the patient. In the male he listed donor sites in the following order of preference: (1) Mucous membrane of the mouth; (2) mucous membrane of the prepuce; (3) Rectal mucosa; and (4) nasal mucosa.

He considered the order of preference for donor sites in the female to be: (1) Vaginal mucous membrane; (2) oral mucous membrane; (3) rectal mucosa; and (4) nasal mucosa.

Surgical treatment of contracted socket

Since sufficient mucous membrane, even for essentially complete restoration of a socket, is available from the mouth alone, to take mucous membrane from areas so much less accessible would seem to me to be unnecessary and might even subject the patient to possible untoward sequelae.

Like most ophthalmic surgeons, I had limited the use of grafts of mucous membrane to the cure of symblepharon, but had not explored its possibilities in more extensive procedures. Confronted by the great number of patients with contracted sockets at Valley Forge, I became aware that a dependable method of reducing this deformity was imperative. The disappointing consequences of skin transplants for partial restoration of the socket prompted me to utilize buccal mucosa, which most nearly resembles the lost conjunctiva, and which had been used with success by ophthalmic surgeons during World War I. The procedure found to be most effective in the surgical treatment of contracted socket was carried out in the following manner.

Preoperative procedure

Preliminary to operation it is necessary to eliminate all pus-producing areas in the region of the socket, allowing sufficient time to insure an operative field free from infection and well healed. It is equally important that the mouth from which the graft is taken be healthy; such conditions as pyorrhea affect the vitality of the transplanted tissue.

Operative procedure

The operation can be carried out under either local or general anesthesia. If there is a considerable loss of conjunctiva, intratracheal anesthesia is desirable. With the patient anesthetized, the entire face is prepared with soap and water, followed by tincture of zephiran. A packing of gauze, squeezed out of an aqueous (1:5,000) solution of zephiran, is placed in the mouth, where it remains while the dissection of the socket is carried out.

The technique as described by Wheeler[10] is closely adhered to in preparing the bed to receive the graft. The plane of dissection must be kept superficial so that the reconstructed lid will contain nothing but lid tissue. The dissection should be carried to a point beyond the orbital margin below and temporally. Nasally it should extend to the anterior crest of the lacrimal groove and to the orbital margin above it. The caruncle should always be preserved unless it already has been destroyed. Both temporally and nasally the dissection should extend beyond the limits of the palpebral fissure. If the levator is present every effort should be made not to injure it in dissecting the upper cul-de-sac. The dissection above should extend behind the orbital margin and need not

be carried all the way to the roof of the orbit, since it is not necessary that the upper cul-de-sac be deep. Bleeding points should be controlled by pressure if possible.

All cicatricial and granulation tissue must be excised in preparing the bed for the graft, for, as Wheeler[10] pointed out, contraction of the tissue beneath the graft results in reduction of the size of the socket. It is also imperative to remove any skin and scar tissue remaining from earlier attempts to reline the socket. External canthotomy should be performed if it will facilitate the dissection; but this is seldom necessary when only one cul-de-sac is to be restored.

After the bed for the graft is prepared, the upper and lower lips are retracted by means of towel clamps, and the malar buccal mucosa is put on the stretch. The submucosa is first infiltrated with 1-percent novocaine, if local anesthesia is used, and with physiologic solution of sodium chloride, if general anesthesia is used. Next, the extent of the graft is outlined with a sharp scalpel taking care to avoid inclusion of the opening of Stenson's duct. Caution must be exercised in dissecting the graft free, so that it will not be traumatized. After it is taken up, all submucous tissue is excised from its under surface with scissors. The wound in the buccal mucosa is closed with mattress sutures of heavy silk.

The graft is sutured into its new bed with interrupted fine silk. Three or four double-armed, 4-0 silk sutures are threaded through plates of rubber tubing and then through the graft in the depths of the new fornix. Below and temporally, these sutures are passed through the periosteum of the orbital margin in a manner similar to that described by Weeks.[7] In the upper cul-de-sac the sutures should be passed through the periosteum and brought out just beneath the brow. They are finally brought out onto the skin of the cheek or brow and tied over rubber plates. This gives assurance that the graft is anchored in the fornices and cannot retract. The socket is packed with one-quarter inch vaseline gauze, instead of employing the stent which has been in general use.

Postoperative procedure

We found that uniform pressure can be far more effectively obtained by packing than by the stent. Firm packing of the socket causes the graft to spread out more evenly and establishes more uniform contact between the raw surfaces. A pressure dressing is applied and left in position for a period of from 5 to 7 days. At that time the packing is removed, but the socket is repacked firmly, and a pressure dressing reapplied. The dressing is changed every three days until at the end of two weeks the graft is well healed, and if other surgical procedures are necessary, they may be undertaken. The wound in the mouth heals rapidly, and leaves no deformity.

When there is complete obliteration of the socket, the restoration has usually been carried out in two stages, one cul-de-sac being relined with buccal mucosa at each stage. A single graft of buccal mucosa cannot be obtained that is large enough to reline a socket completely; grafts from both cheeks are required. There should be no objection, however, to taking a graft from each side at one operation. The primary advantage of such a procedure would be the elimination of prolonged hospitalization.

When the socket is restored and healing has taken place, an acrylic conformer should be placed in the socket to maintain its shape.

Case reports

I shall present several illustrative cases in which I have performed buccal mucosal transplants for the correction of contracted sockets. Some of these patients were soldiers on my service at Valley Forge, others have been operated on since my return to civilian practice. All have been followed for periods of weeks, some for months, after operation. In no instance has there been a significant degree of contracture of the socket.

Case 1. A youth, 18 years of age, had been

born with no apparent eye in the left socket. At the age of four years, two unsuccessful attempts had been made to enlarge the socket by means of skin grafts in order that he might wear a prosthesis. When we first saw him, the left upper lid appeared shorter than the right. No eye could be seen in the left socket and there was very limited motility at the base. The upper cul-de-sac showed rather marked contraction toward the outer canthus where it was lined with skin. The only conjunctiva present was that lining the upper and lower tarsal surfaces. The external canthus was round with continuation of the graft from the floor of the socket onto the skin over the outer orbital margin. There was marked eversion of the lower lid.

In August, 1946, the skin graft in the base of the left socket was excised and dissection was carried to the lower orbital margin throughout its extent and to a point beyond the midline of the temporal orbital margin. A mucous membrane graft was taken from the inner surface of the left cheek and sutured into position in the denuded area. The socket was packed with vaseline gauze and a pressure dressing was applied. The mucosal wound was closed with mattress sutures of heavy silk. All sutures were removed at the end of 16 days. The graft was healthy and in good condition.

A month from the time of the original operation a second stage of reconstruction of the socket was carried out. The remainder of the skin from the base of the socket was excised and the dissection was carried well into the upper fornix. It was also carried temporally to a point beyond the upper temporal orbital margin. A mucosal graft was taken from the inside of the right cheek and sutured into position in the usual manner and the socket was packed with vaseline gauze and a pressure dressing was applied. Five weeks later an external canthoplasty was performed. A month following this, the patient could be fitted with a permanent prosthesis, which he has worn since that time with no difficulty.

Case 2. A 19-year-old soldier was admitted to Valley Forge General Hospital in February, 1944, with a diagnosis of contracture of the left socket. The left eye had been enucleated following an infection when he was six years of age, and because of a contracture of the socket he had been unable to wear a prosthesis. A few weeks following the enucleation, an unsuccessful attempt had been made to enlarge the left socket by a skin graft. In September, 1943, another attempt to restore the socket failed.

On examination of the left socket, externally, the lids appeared normal. Lining the inside of the lower lid, and extending almost to the margin, was an epithelial graft with some hair growing from it. There were adhesions between the base of the socket and the upper margin of the tarsus in the temporal half of the upper fornix. Nasal to this was an opening which was lined with skin extending toward the upper fornix for about 1 cm. The floor of the shallow socket and the tarsus of the upper lid on the nasal side were adherent.

At operation, performed in April, 1944, an incision was made on the inside of the lower lid throughout its entire length just anterior to the skin graft. Dissection was carried down to the inferior orbital margin throughout its extent. All scar tissue was removed along with the skin which lined the lower lid and the floor of the socket. A mucous membrane graft was taken from the buccal mucous membrane on the inside of the right cheek, and sutured in position with fine interrupted silk, so as to reline the newly formed lower cul-de-sac. Three mattress sutures were passed through the periosteum of the orbital margin, coming out on the skin of the cheek below this point. The socket was packed with vaseline gauze and a firm pressure dressing was applied.

In June, 1944, dissection of the upper cul-de-sac and the remainder of the floor of the socket was carried out, all skin and connective tissue having been excised. A mucous membrane graft was taken from the left

cheek and sutured in position, as in the lower fornix. The usual packings and pressure dressings were applied.

Three weeks later an acrylic conformer was substituted for the vaseline gauze. At the end of six weeks, an acrylic prosthesis was fitted to the socket, and the patient was returned to duty.

Case 3. The right eye of a soldier, 29 years of age, had been severely injured in action in Sicily in July, 1943. An enucleation was performed on the day of the injury. He had been unable to wear a prosthesis because of damage to the lower lid.

Examination revealed the left eye to be normal. The middle one third of the right lower lid was missing. There was a fibrous band extending from the lower orbital margin toward the base of the socket. The lower cul-de-sac appeared normal toward either canthus.

Following reconstruction of the right lower lid, the lower fornix was so constricted that a prosthesis could not be worn. The lower cul-de-sac was dissected to a point beyond the inferior orbital margin through its central two thirds. A buccal mucosal graft was taken from the right cheek and sutured into position as previously described. The socket was packed with vaseline gauze, and a pressure dressing was applied.

Six weeks following this operation the patient was given a permanent prosthesis.

Case 4. A soldier, 19 years of age, was admitted to Valley Forge General Hospital in June, 1944, with a diagnosis of contraction of the right orbital socket. When he was nine years of age, the right eye had been injured by scissors and enucleation was performed two weeks later. He had never been able to wear a prosthesis.

Examination revealed anophthalmus of the right eye, with contraction of the socket and a tendency for eversion of the lower lid. There were scars at the base of the socket, particularly toward the nasal side, where adhesions connected the caruncle with the conjunctiva, extending to both upper and lower fornices. As a result of these adhesions the upper tarsus had been thrown into folds. The base of the socket and the cul-de-sac toward the temporal side appeared to be adequate both above and below. All scar tissue in the socket was removed and the dissection was carried into both the upper and lower fornices of the caruncle. A buccal mucosal graft was taken from the left cheek and sutured into the denuded area in the usual manner. The socket was then packed with vaseline gauze, and a pressure dressing was applied.

This patient was later fitted with a permanent prosthesis and returned to duty.

Case 5. A soldier, 38 years of age, was admitted to Valley Forge General Hospital with a diagnosis of contracted left socket. The eye had been removed following an operation for cataract in infancy.

Examination revealed the socket to be small, the lower fornix very shallow with a band of scar tissue extending from the fornix to the lower lid margin. A web of scar tissue extending 1 cm. temporally from the inner canthus adhered to the palpebral conjunctiva, both upper and lower lids, and the conjunctiva of the base of the socket. No implant could be palpated in the socket.

In July, 1944, all the scar tissue and adhesions in the left socket were severed and excised, including the nasal one third of the floor of the socket and the lower cul-de-sac. A mucous membrane graft from the inside of the left cheek was placed over this denuded area, being sutured in position in the usual manner. The socket was then packed with vaseline gauze and pressure dressing applied.

This patient was later fitted with a prosthesis and discharged to duty.

Conclusion

It is now 70 years since buccal mucosa was first employed to replace conjunctiva. That so few ophthalmic surgeons have taken advantage of this relatively simple procedure

is surprising, in view of the excellent results obtained. I am sure that no one who has utilized both skin and buccal mucosa as substitutes for conjunctiva would insist that skin makes a more desirable lining for the orbital socket. The only objection raised by those who used buccal mucosa is that there is not a sufficient amount available for complete restoration of the socket. The mucosal lining of both cheeks and the lower lip furnish enough mucosa to reline an entire socket. There are many features that make buccal mucosa desirable as a substitute for conjunctiva. It is easily accessible, clean, and free from odor and its removal leaves no residual deformity at the donor site. It remains moist and smooth in its new location. There is little tendency for the graft to shrink, if preliminary dissection has been properly carried out. To be sure, the secretion is somewhat thicker than that from the conjunctiva, but it is not copious and produces a minimum of annoyance to the patient.

It is a well-known fact that skin remains skin regardless of its location, and buccal mucosa also retains its characteristics in its new location in the orbital socket. Nonetheless, there is no tissue which more closely resembles conjunctiva; the differences between the two are trifling and the fact remains that buccal mucosa is a far better substitute for conjunctiva than skin.

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ANGIOSARCOMA OF THE ORBIT*

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Angiosarcoma of the orbit is a very rare tumor. The term "angiosarcoma" was first employed by Kolaczek[1] to designate all tumors originating from blood and lymph vessels. This loosely applied term has led to various interpretations by individual investigators of histologic findings. According to Karsner[2] the term is applied to a sarcoma provided with numerous, wide, vascular spaces. Mallory[3] feels that the term is permissible only when the rate of growth is so rapid that cell differentiation does not take place and an exact diagnosis is impossible. McFarland[4] restricts the term to malignant tumors characterized by initial and continuous new formation of blood vessels associated with an excessive number of cells resembling those of sarcoma. Many pathologists use the terms "angioendothelioma" and "angiosarcoma" interchangeably; others employ "angiosarcoma" for neoplasms in which the blood vessel as a whole is the neoplastic unit and reserve "endothelioma" for tumors which are the result of neoplastic proliferation of the endothelium alone. Ewing[5] has described the histogenesis of angiosarcomas, although MacCallum[6] does not believe that there is sufficient descriptive explanation to warrant the use of a special name. Since the establishment of a general *Registry of Bone Sarcomas* by Codman,[7, 8] in 1920, one of the most significant papers in regard to pathology and histogenesis is that published by Kolodny[9] which describes the microscopic features of angiosarcoma and discusses its confusion with angioendothelioma and angioma. Recently Schmidt[10] has described the pathologic connecting link between hemangioma and angiosarcoma. There is, however, still a great lack of material regarding the etiology and histogenesis of this disease. It is evident from a study of the literature that there is much controversy about the histologic pathology of angiosarcoma. As Kolodny remarks, such discrepancy of views and opinions is only natural when one realizes that the tumor is exceedingly rare.

In citing Birch-Hirschfeld as an authority on diseases of the orbit, Meisenbach[11] discusses the clinical and anatomic findings of hemangioma of the orbit, but makes no mention of angiosarcoma.

A thorough review of available literature reveals that, in 1909, Parker[12] presented a case of angiosarcoma of the orbit in a little girl, aged 18 months. However, he did not describe the histopathology of this case.

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The same year Goldberg[13] presented a case which proved to be angiosarcoma of the orbit. The growth appeared in the orbit several months after an enucleation had been performed. There had been no microscopic examination of the enucleated eye, and the diagnosis was made when a small pedunculated growth, which had the appearance of a hematoma springing from the conjunctiva of the socket, was removed at the second operation.

Report of case

This patient, a white girl, aged 11 years, was first seen on September 15, 1945. Her



Fig. 1 (Carelli and Cangelosi). Appearance of the right eye preoperatively.

mother stated that her daughter was perfectly well until the last of July, 1945, when a slight swelling occurred over the right upper eyelid. There was a gradual increase in the swelling, but nothing peculiar about the eyeball was noted.

About two weeks after the onset, the patient was struck over the eye by a friend's elbow. About one week after this accident, the eyelid showed a black and blue discoloration. There was no pain and no disturbance of vision.

The patient's past history was negative except for the usual childhood diseases. The family history was negative.

Ocular examination on September 15, 1945, showed vision to be: R.E., 1.2—3 and J1 at 10 inches; L.E., 1.2 and J1 at 10 inches.

There was a swelling the size of an almond just below the right supraorbital rim involving the upper eyelid. The swelling had a doughylike feel with ecchymosis of the upper lid. Bruit and thrill were absent. There was a slight ptosis of the upper lid. The right globe, which appeared to be lower than the left, showed a limitation of movement when looking upward. Corneal findings were negative. The pupil was round and reacted to light and accommodation. The iris was a greenish blue. Fundus examination showed no unusual findings. Examination of the left eye was essentially negative.

Physical examination. The tissues in the nose were pale, a mucoid secretion was present, and the inferior turbinates were boggy. These findings suggested an allergic rhinitis. Examination of the oral cavity revealed enlarged, injected tonsils. The teeth were in good condition.

The remaining physical examination was negative.

Laboratory examination revealed the erythrocyte count to be 5,280,000; leukocytes, 14,050; hemoglobin, 102 percent; basophils, 2 percent; eosinophils, 3 percent; segmented, 75 percent; lymphocytes, 16 percent; monocytes, 4 percent. The blood Wassermann was negative.

X-ray examination of the skull was negative for bone injury or pathology. The sella turcica was of normal size and configuration. The optic foramen was normal. The sinuses showed "increased density in both frontals, ethmoid, and sphenoids due to hyperplastic changes probably associated with infection." The chest was negative.

Diagnosis was a hemorrhagic cyst of the right orbit.

Course. The patient was admitted to the hospital on October 28, 1945, and was operated the following day under general anesthesia.

An incision was made over the site of

the tumor which, on exposure appeared to be enclosed within a capsule. The mass was dissected out but was much larger than it appeared on the surface. The capsule ruptured during the dissection. The mass seemed to extend below the supraorbital rim and behind the eyeball. All visible tumor was removed. Upon palpation the superior rim of the orbit felt perfectly smooth. The wound was closed with interrupted dermal sutures.

Postoperatively, the child was given 10,000 units of penicillin intramuscularly every two hours and continuous ice compresses were placed over the right eye. The dermal sutures were removed on the sixth postoperative day, and the patient was discharged on November 10, 1945 after an uneventful recovery. Visual acuity upon discharge was the same as that obtained preoperatively.

Pathologic report. The hospital pathologic report was: "Specimen consists of pieces of soft, white tissue and soft gray hemorrhagic tissue. Microscopic examination shows a highly cellular malignant tumor; type, glioblastoma."

In view of this pathologic report, a slide of the specimen was sent to the Army Medical Museum for information concerning the diagnosis and advice as to whether irradiation or exenteration of the orbit should be performed.

The following report was received from Col. J. E. Ash: "The tumor, while highly anaplastic, presents in some areas a distinct cavernous vascular pattern and in other portions capillary structures can be made out. Diagnosis: Hemangiosarcoma. Believe irradiation is indicated."

Following this report irradiation therapy was started on December 14, 1945. The girl received 200R. of X-ray irradiation every day for nine days, using 140 kilovolts, 25 ma., with a filter of 1 mm. of aluminum at a distance of 50 cm. from the eye. The irradiation was particularly directed at the superior surface of the eyeball, a lead shield being used for the protection of the globe. There was a slight erythema reaction.

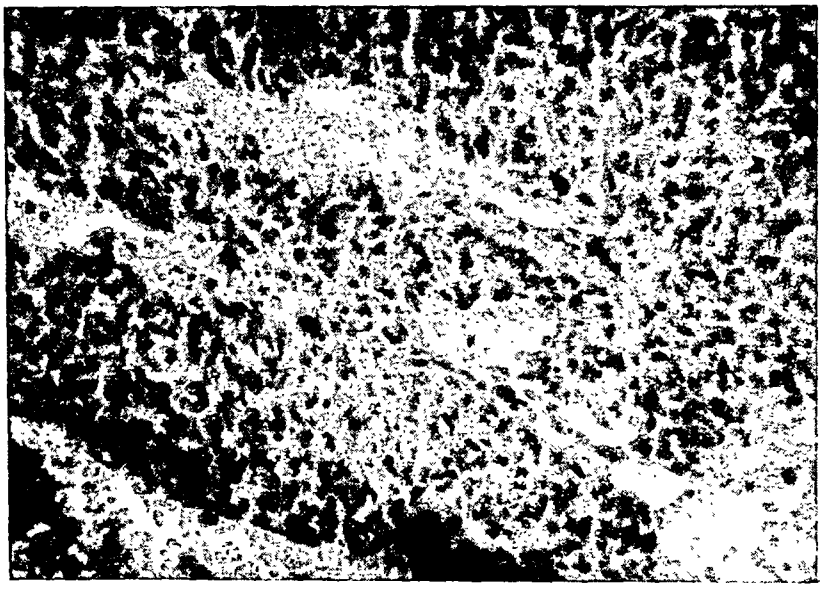


Fig. 2 (Carelli and Cangelosi). A photomicrograph reveals sheets of tumor cells that are composed of irregularly shaped nuclear cells which have vesicular nuclei. There is a moderate amount of light pink-staining collagen laid down around the cells. Many atypical mitotic figures are present throughout the cells. There are many dilated blood vessels throughout the tumor section, and in many places there is extravasation of blood cells between the tumor cells.

Follow-up. The follow-up examination on January 10, 1946, revealed a ptosis of the right upper lid with a healed curvilinear scar just below the orbital rim. Palpation was negative for any tumor masses.

Vision was: R.E., 1.2—4 and J1 at 13 inches; L.E., 1.2—2 and J1 at 13 inches. The ocular movements were within normal lim-



Fig. 3 (Carelli and Cangelosi). Appearance of the right eye 30 months postoperatively.

its; findings in the cornea and pupil were negative; the iris was greenish blue; and lens and fundus findings were essentially negative.

The girl was feeling perfectly well and was attending school regularly.

Comment

As the literature points out, angiosarcoma of the orbit is exceedingly rare; even the men with the most experience have seen only a few cases. The resulting confusion in histopathologic interpretations has been discussed and exemplified in this case.

Exophthalmus is the most frequently observed sign of the presence of any orbital tumor. Absence of pain, very slow growth, preserved motility of the eye, and elastic consistency and compressibility of the tumor are important signs in the diagnosis of orbital angiomas, but any malignant characteristics of the tumor become evident only upon microscopic examination.

This case is interesting not only because it presents a rare type of tumor, but also because the eyeball itself did not show any involvement, aside from the interference with motility. It is also noteworthy that the X-ray findings were negative.

This girl was operated 30 months ago, and there have been no visible signs of metastasis.

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A DISCUSSION OF DEFORMITIES OF THE SHAPE OF THE LENS

WITH A REPORT OF A CASE OF POSTERIOR LENTICONUS

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Both the rarity of lenticular deformities and the controversy concerning the factors causing these anomalies make the subject of deformities of the shape of the lens an interesting one.

These aberrations from normal lens shape can be differentiated from congenital or developmental cataracts, since an actual abnormal curvature in the shape of the lens is present. The defects are usually unilateral, but the case herein reported (lenticonus posterior) was bilateral. These lenticular deformities do not seem to be hereditary, as in cases of ectopia lentis where the factor of heredity has been definitely established.

CLASSIFICATION OF DEFORMITIES

For the purpose of this discussion, the subject has been divided into the following classifications.

True deformities. In this category are: (1) Lentiglobus, (2) lenticonus anterior, and (3) lenticonus posterior. Although infrequent in occurrence, posterior lenticonus is not so exceedingly rare as lentiglobus and lenticonus anterior.

False abortive forms. This classification includes: (1) Lenticonus internum or lenticonus perinuclearis posterior (Harrison Butler), (2) senile or acquired lenticonus, and (3) umbilication of the lens or monocular bilateral posterior lenticonus.

As far as terminology is concerned, the word "globus" describes the conditions more accurately because, with the exception of anterior lenticonus, the protrusions are more globular than conical in form. Before taking up the subject of posterior lenticonus in detail, it would be well to give a brief discussion of the various classifications.

DISCUSSION OF CLASSIFICATION

Lentiglobus. This condition is very rare and is differentiated from anterior lenticonus in that the projection is globular in shape instead of conical. The most probable cause is that, during intra-uterine life, the lens becomes permanently molded due to a rigid pupil.

Anterior lenticonus. This condition is extremely rare. The anterior surface of the lens is conical in form and the raised portion consists of clear cortex, while the nucleus remains normal. Since these cases often give the appearance of keratoconus, a careful examination is necessary to distinguish them.

Anterior lenticonus also develops during intra-uterine life and is thought to be due to an overstretching of the lens capsule; to a delayed separation of the lens vesicle; or to an adhesion of the cornea. Another plausible explanation is that of a weakened lens capsule. If there is a deficiency of the capsule, a type of anterior capsular cataract is produced. These two deformities are probably transitional stages of the same defect.

Lenticonus posterior. As Duke-Elder has pointed out, the projection is more globular than conical in shape so that the proper designation should be posterior lentiglobus. This condition is rare and is often confused with cases of false or abortive lenticonus. An uncomplicated case presents the characteristic oil-globule appearance of anterior lenticonus (Duke-Elder). (This description, however, cannot be applied with exactness to the case herein to be reported.)

In cases of posterior lenticonus, the central part of the lens is very myopic while the peripheral part may be emmetropic. Very

often the remains of the hyaloid artery are present. Dustlike opacities in the lens have been reported, as have occasional opacities in the infantile nucleus. Vogt described a bright-red reflex around the base of the globule. In my case, however, the edge of the globule appeared to be more like a glaucomatous cup.

In addition to a detailed slitlamp study of the posterior surface of the lens, a very valuable aid in differentiating this condition from pseudolenticonus was first demonstrated by Gullstrand.

While studying the movement of the Purkinje images on the posterior surface of the lens, Gullstrand noted the movement of the candle image on the posterior surface and could, thereby, determine the form and changes in the curvature of the surface. The posterior lenticular image is much smaller where the posterior surface of the lens is most strongly curved than in the surrounding area. If the image is caused to move about by moving the light, it elongates in passing from one zone to another and, in places, it disappears. These reflexes can demonstrate an essential change of form in the posterior segment of the lens. They can also show whether a portion of the lens near the posterior pole has protruded into the vitreous. The peculiar reflexes thus obtained can be compared to the images produced by a drop of oil on a lens.

Many theories have been advanced as to the etiologic factors in this condition, but the primary cause seems to be a congenital rent or weakness of the capsule. The idea that the globus is caused by traction from the hyaloid remnants does not seem plausible since hyaloid remnants are not found to exist in all cases and did not in mine.

The best assumption seems to be that the condition is an aberration of growth of the lens accompanied by a thinning of the capsule at the posterior pole. This probably occurs at the beginning, during, or after the fourth month (Ida Mann).

Lenticonus internum or lenticonus perinuclearis posterior (Harrison Butler). Harrison Butler reported this condition in a patient, aged 26 years, who had a typical case of lenticonus posterior in the other eye. The lenticonus internum consisted of an alteration in alignment of the zones of discontinuity in the posterior part of the lens without any alteration of the curve of the posterior surface. The adolescent nucleus appeared to be a sort of double bulge which, if it had been complete, would have formed a lenticonus (Ida Mann).

Senile or false lenticonus. This acquired anomaly of the nucleus, which is of normal form, occurs in elderly persons. The axial parts of the lens assume a high refractivity in advancing age or in cases of incipient cataract. This unusual picture has been observed in congenital cataractous changes in the fetal nucleus. Cases have been reported in which the lens has had a double focal point.

Umbilication of the lens. This condition could possibly be classified as an abortive form of monocular bilateral posterior lentiglobus that might be caused by the lens fibers not being long enough to meet at the suture involved.

Posterior lenticonus

Report of a case

History. This patient first consulted me when he was 47 years of age. He was born in this country and had had defective vision since birth. His father and mother were not related. He had four sisters and one brother. Because of poor vision, he left school at the third grade.

Ophthalmic examination. Vision in the right eye was reduced to 20/200. With a dilated pupil, it was improved to 20/200 plus. Vision in the left eye was 10/200. With dilatation, it was improved to 20/70.

Vision could not be improved with lenses nor with the stenopaic or pinhole disc. Examination of the right eye under homatropine disclosed spokelike lens opacities on the

nasal side in addition to the deformity of the posterior lens. In the left eye, besides the posterior lens deformity, there were spoke-like opacities below.

Treatment. In view of the fact that a dilated pupil improved the patient's vision and also because the definite signs of an incipient cataract already present suggested the possibility of a totally opaque lens, it was decided to perform an iridectomy. This procedure was carried out on each eye in such a position as to obtain the best vision. Figures 1 and 2 depict the condition following the iridectomies.

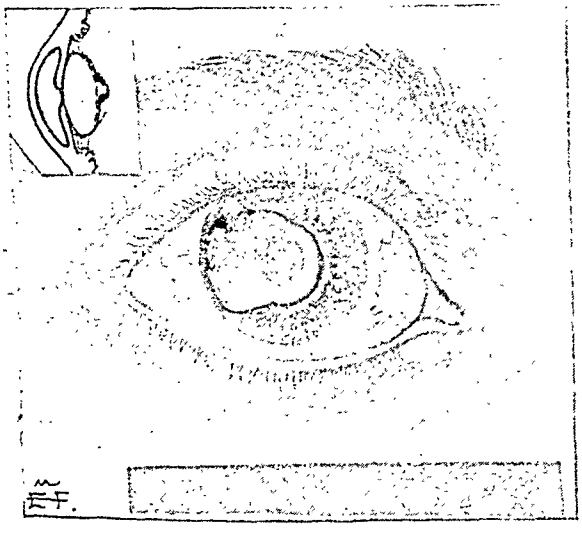


Fig. 1 (Doherty). This drawing made after the iridectomy of the right eye shows the condition of the posterior lens.

This operation provided an excellent opportunity to observe the pathologic conditions of the posteriors lens, but it brought very little improvement in vision. The presence of more dazzling probably accounted for the lack of improvement.

Slitlamp study of the posterior lens. In studying these two eyes with the slitlamp, the symmetry of the lesions in each eye was most noteworthy and certainly provides strong evidence that the condition was congenital in origin.

Throughout both lenses, more marked toward the periphery, were small linear flake-like opacities. The anterior Y was only partially seen and then only by careful manipulation of the slitlamp. The reflex from the conus caused this difficulty.

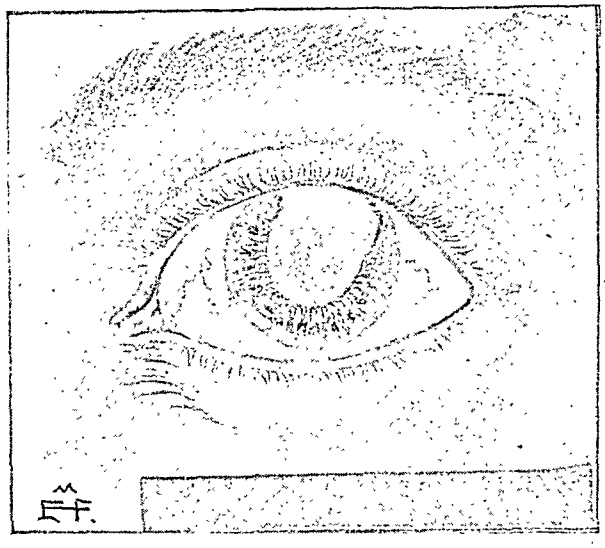


Fig. 2 (Doherty). Posterior lenticonus of the left eye. The drawing was made after an iridectomy.

The conus, itself, was cup-shaped. The ring reflex of Vogt, although present, was certainly not red. It was a brownish black. It was very distinct. When the slitlamp was moved, there seemed to be a second ring inside of the first. This was of a very light gray color with hazy borders and gave one the impression that it was a reflection or shadow rather than a real border. The general sheen of the conus was a light golden, and there were a number of opacities in the bottom of the conus when seen with the dot beam. These opacities looked something like crystals and, as the dot beam was moved from side to side, the general effect resembled slightly that of a kaleidoscope. Both eyes were essentially the same. There were no signs of the hyaloid artery, and the vitreous seemed to be normal.

Course. The lens opacities increased and, five years after the iridectomies, both lenses became entirely opaque and were removed. Vision at this time was: R.E., 20/30− with a +12.00D. sph.; L.E., 20/20−, with a +11.00D. sph. ⌒ +2.00D. cyl. ax. 45° (nasal).

Although every effort was made to remove the lenses with as little trauma as possible,

a laboratory examination after their removal showed no definite findings. About a week after the lenses were removed, there was severe hemorrhage in the left eye, and the anterior chamber was completely filled with blood. This gradually absorbed, but there was marked blood infiltration of the cornea which persisted for many months.

Conclusion

A discussion of deformities of the shape of the lens has been presented together with the report of an unusual case of posterior lenticonus. In conclusion, this question is proposed: "Would an intracapsular operation be considered in such a case?"

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NOTES, CASES, INSTRUMENTS

HYALINE MEMBRANE OF THE IRIS*

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REPORT OF TWO CASES

CASE 1

History. Sister M. B., aged 55 years, was born with congenital cataracts. In 1890, Dr. David Webster, Sr., performed bilateral optical iridectomies. In 1916, Dr. David Webster, the nephew, recorded 5/200 vision for the right eye and no light perception in the left eye which was due to absolute glaucoma. He enucleated the left eye at that time. In 1925, there was detachment of the retina in the right eye with complete loss of vision. In 1935, there was secondary glaucoma in this eye and on March 9, 1945, it was enucleated because of acute pain. At this time blood was noted in the anterior chamber and the eye was stony hard.

Pathologic findings. The globe is bulged temporally in the region of the optic nerve making it somewhat larger than normal; the ciliary body is barely visible. The retina is completely detached and there is blood in the anterior chamber and in the subretinal space.

Microscopic findings. The filtration angle is completely occluded by firm iris adhesions. The iris is necrotic and atrophied and has an occasional area of round-cell infiltration. The pigment epithelial layer of the iris is atrophic and cystic.

On the anterior surface of the iris lies a hyaline membrane that is continuous with Descemet's membrane. A layer of endothelial cells lies on the surface of the membrane which faces the aqueous, and these cells are similar in appearance to the endothelial cells of Descemet's membrane. The hyaline membrane is the same thickness as Descemet's except near the tip of the iris near the pupillary border where it becomes quite a bit thinner. There are many blood cells in the aqueous and an albuminous fluid.

The ciliary body is completely atrophic at the corona leaving only some hyalinized ciliary processes, the nonpigmented epithelium of which has proliferated moderately. The flat part of the ciliary body is only slightly atrophic. There is a thin remnant of cataractous lens matter but no lens fibers are seen.

The retina is completely detached and atrophic so that its constituent layers are not recognizable. The choroid is atrophic and has numerous excrescences of the lamina vitrea (drusen). The optic nerve is deeply cupped and atrophied. There is a formation of glial and fibrous tissue in front of the deep depression. Some blood lies between the retina and choroid.

CASE 2

History. G. L., a man, aged 46 years, always had had poor vision in the right eye. In 1915, the right eye was operated on by Dr. Thomas Curtin for cataract. There had been no vision in the eye since then. The left eye has always been myopic with corrected vision of 20/25 and has a zonular cataract. When seen by Dr. I. Hartshorne in November, 1945, the right eye was blind and the tension was 40 mm. Hg (Schiøtz). The globe was removed on November 24, 1945.

Pathologic findings. The globe is much larger than normal especially in the transverse diameter. There is thinning of the sclera and an increase in the size of the temporal portion of the globe. The optic nerve shows pronounced cupping. The ciliary body is barely visible.

Microscopic findings. The filtration angle is occluded by firm iris adhesions and a hyaline membrane continuous with Descemet's grows over the iris along its outer

*From the Laboratory of the Manhattan Eye, Ear and Throat Hospital.

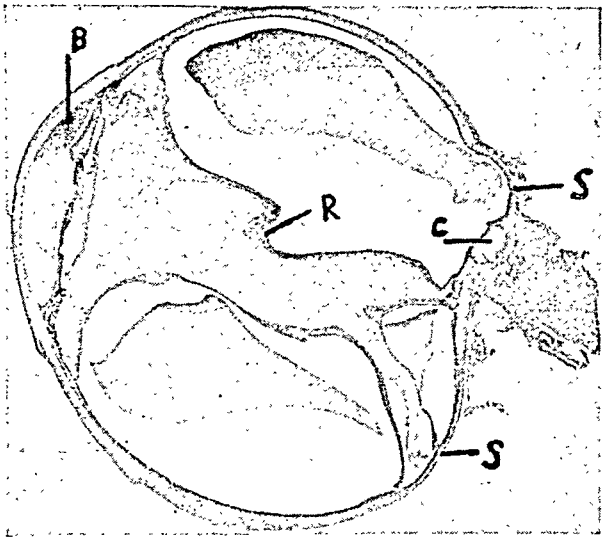


Fig. 1 (Laval). The sclera (S) is stretched and thinned posteriorly and there is moderate cupping (C). The retina (R) is completely detached. There is blood (B) in the anterior chamber.

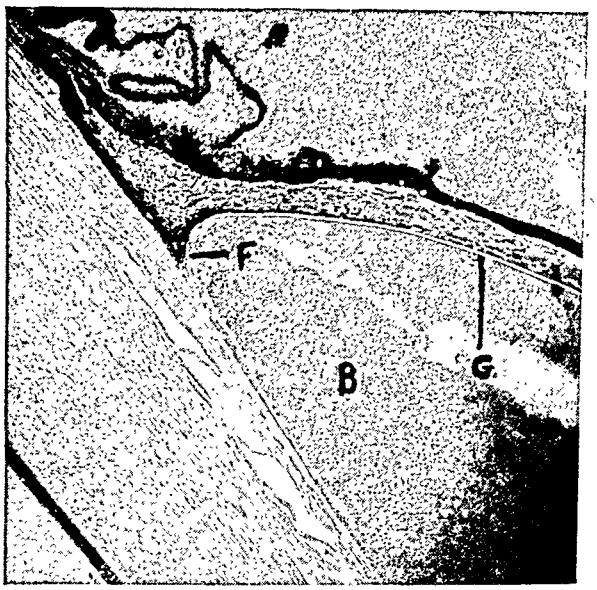


Fig. 2 (Laval). The glass membrane (G) lies on the anterior surface of the iris and is continuous around the filtration angle (F). The anterior chamber is filled with blood (B).

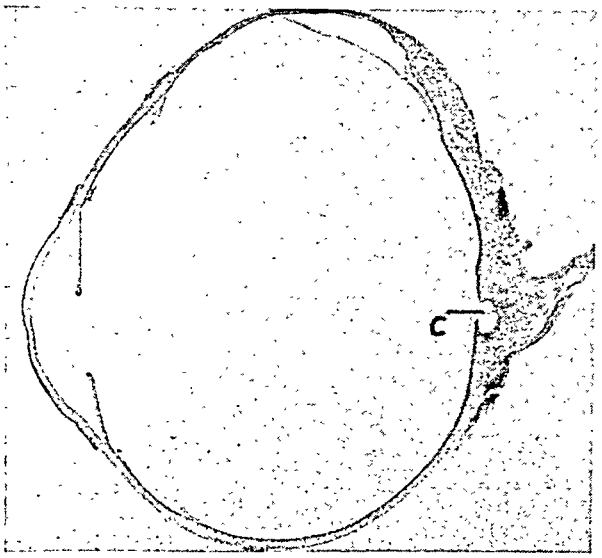


Fig. 3 (Laval). The globe is quite enlarged and there is pronounced cupping (C).

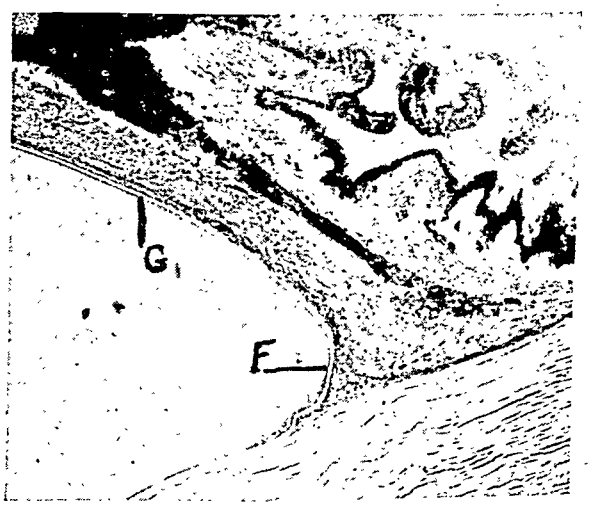


Fig. 4 (Laval). The glass membrane (G) lies on the anterior surface of the iris and is continuous around the filtration angle (F).

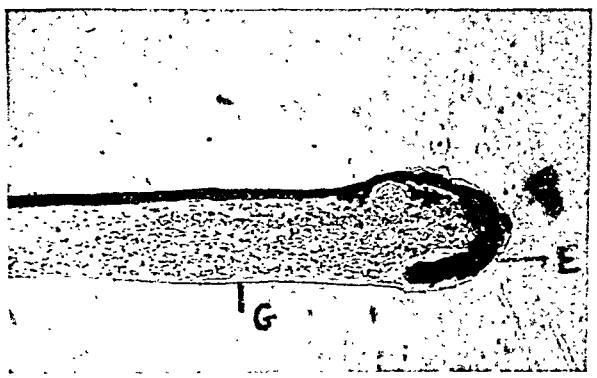


Fig. 5 (Laval). The glass membrane (G) becomes thicker near the pupillary area of the iris and ectropion (E) of the pigment epithelium of the iris is present.

surface. A layer of endothelial cells lies on this membrane facing the anterior chamber and is continuous with the endothelium of Descemet's.

The iris is markedly atrophic with ectropion of its pigment epithelium. The ciliary body is practically absent and is represented by a thin layer of fibrous tissue. A few atrophic processes remain and there is some proliferation of the nonpigmented epithelium.

The retina and choroid are intimately adherent with marked atrophy of the cellular layers of the retina. There is pronounced cupping of the optic nerve with some proliferation of connective tissue at the margins of the depression. The optic nerve is atrophic.

Comment

Collins and Mayou state, "a new formation of a hyaline membrane on the anterior surface of the iris may be produced beneath its layer of endothelial cells." It seems to be produced by the mesoblastic endothelial cells. In cases of infantile glaucoma, it may be the cause of the glaucoma by being continuous with Descemet's membrane around the angle. In the two cases reported here, both in adults, there was glaucoma. This may have been caused by the glass membrane growing over and around the filtration angle.

136 East 64th Street (21).

BILATERAL CHALCOSIS LENTIS WITH ENDOPHTHALMITIS OF THE RIGHT EYE

Abraham Schultz, M.D.
Chicago, Illinois

Report of a case

The destructive effect of penetrating copper particles upon the eye has been well recognized during the past 50 years. The intraocular reactions produced by this metal were first strikingly demonstrated by Leber,[1] in 1892. His classic work showed that the reaction of copper was influenced by the ocular tissues in which it became imbedded. When in contact with vascular tissue, such as iris, chemical suppuration rapidly occurred. Avascular tissue, however, such as lens or vitreous, usually tolerated the metal by enveloping it with a protective coating of albumin.

Because of the frequent inclusion of copper as an alloy of explosive missiles, the penetrating eye injuries incurred in World War II by these fragments were apt to produce grave ocular sequelae. The fate of an eye so injured depended primarily on the size, location, and percentage of copper contained in the intraocular foreign body. Such particles, although usually sterile because of the heat generated by their high velocity, often produced a chemical inflammation with rapid aseptic suppuration and final destruction of the globe.

Occasionally, however, these copper fragments may be tolerated in the eye for long periods, with preservation of good vision. The literature is replete with instances of this nature as reported by Würdemann,[2] Schwartz,[3] and others.[4]

When retained, these copper particles produce a constant chemical reaction with gradual development of ocular chalcosis.[5] Under these circumstances, the cornea may become impregnated with copper at the level of Descemet's membrane, especially about the limbus. Occasionally the vitreous becomes involved, and chronic irritation of the retina supervenes. More commonly, however, chalcosis lentis or copper cataract is the result of this chemical process. This was first recognized by Purtscher,[6] in 1918, during World War I, as diagnostic of retained intraocular copper particles which are slowly oxidized. It is a shallow, polychromatic opacity which is situated just beneath the anterior capsule of the lens in the form of a sunflower. Vogt[7] believed that this forma-

tion was facilitated by the posterior ridges of the iris as they rubbed against the anterior capsule of the lens, the center of which corresponds to the iris pupil.

The following case of bilateral chalcosis lentis is reported because of the remarkable ocular sequelae observed four years after the original injury.

Case report

History. A soldier, aged 21 years, with 16 months' service, was admitted to the ophthalmic service of an army general hospital April 4, 1942, complaining of pain, photophobia, and marked loss of vision in the right eye. These symptoms had suddenly appeared a month previously following a mild contusion of this eye which was accidentally incurred while working on a truck. Despite prompt treatment at the local station hospital, no improvement was noted, and he was transferred here for further observation and treatment.

Additional history revealed that four years previously, while still a civilian, he had sustained a perforating injury of his left eye as the result of a dynamite cap explosion. His left hand was also wounded at that time, requiring partial amputation of the thumb and forefinger. The injured eye gradually improved under conservative treatment, and he was released from the hospital three months later with complete restoration of vision. No ocular symptoms were noted since then until the present episode.

Ocular examination. Vision upon admission was light perception with poor projection in the right eye, and 20/20 in the left eye. A diffuse circumcorneal injection was present in the right eye, with tenderness over the ciliary region. No external signs of previous ocular trauma were evident. A definite aqueous flare was visible in the right anterior chamber, associated with a moderate increase of cells. The pupil was dilated and fixed as the result of previous atropinization. A serrated, gray, superficial opacity of the lens was grossly visible in the center of the pupillary area measuring 6 mm. in diameter.

Biomicroscopy under direct illumination revealed this opacity to consist of fine particles which were situated beneath the anterior capsule of the lens, producing a gray-green metallic sheen. These deposits were condensed into the shape of a sunflower, with a relatively clear center 2 mm. in diameter, from which about 40 slender petals of various lengths radiated peripherally. The remaining portion of the lens was not affected.

The vitreous appeared very turbid and was filled with much cellular and fibrinous exudate. The fundus, although partially obscured, revealed a severe bulbous detachment of the temporal half of the retina which overlaid the optic disc and extended diagonally from the 11- to the 5-o'clock positions.

The left eye showed no evidence of external injection. A small healed pigmented perforation was present in the nasal portion of the sclera 8 mm. from the limbus and 1 mm. above the lower lid margin. The aqueous fluid and vitreous appeared clear. A gray-green, superficial sunflower opacity, identical with that of the right lens, was situated beneath the anterior capsule of the left lens. The fundus revealed an old healed horizontal streak of atrophic chorioretinopathy in the extreme nasal periphery through which the sclera was visible. This was the site of the original intraocular path of the foreign body. A pale-green elliptical cyst which projected about 12 diopters into the vitreous was seen 3 disc diameters nasal to the optic nerve (fig. 1). The "tail" of this cyst was firmly imbedded in the retina, while its free anterior end contained a triangular metallic particle having a distinct copper luster.

Roentgenographic observations. Roentgen examination of both orbits revealed a minute metallic fragment in the left globe

corresponding to the position observed by ophthalmoscopy. Several fine metallic particles were also visible above the left frontal sinus. No metallic densities were observed in the right orbit.

Course in the hospital. The patient was placed on intensive foreign-protein therapy, with five increasing doses of triple typhoid vaccine which were injected intravenously at 2-day intervals. Chemotherapy in the form of sulfadiazine was administered for 10 days, attaining a level of 10.6 mgm. per 100 cc. of blood. This was followed by large doses of sodium salicylate for two weeks. Local atropinization of the right eye in conjunction with moist heat was continued throughout his hospitalization. All foci of infection including teeth, tonsils, and the genito-urinary tract were ruled out. The Mantoux reaction was negative with 0.01 mg. of old tuberculin. Laboratory studies which included the sedimentation rate and differential white count were within normal limits.

Despite all systemic and local measures the acute endophthalmitis of the right eye remained essentially unchanged. Because of the persistent suppuration in a hopelessly blind eye, enucleation was recommended. This procedure, however, was refused by the patient. After maximum hospitalization of six months was attained, he was transferred to a veterans facility for further observation and treatment. An opportunity to examine him 10 months later revealed a persistent endophthalmitis of the right eye with almost complete absorption of the lens. The left eye, containing the intraocular particle, remained quiescent, and the chalcosis lentis was unaltered.

Comment. Despite the absence of roentgenographic evidence of any metal in the right globe, the acute endophthalmitis in conjunction with the presence of chalcosis lentis in this eye, identical with the lens changes of the left eye containing the copper particle, must be due to a similar metal

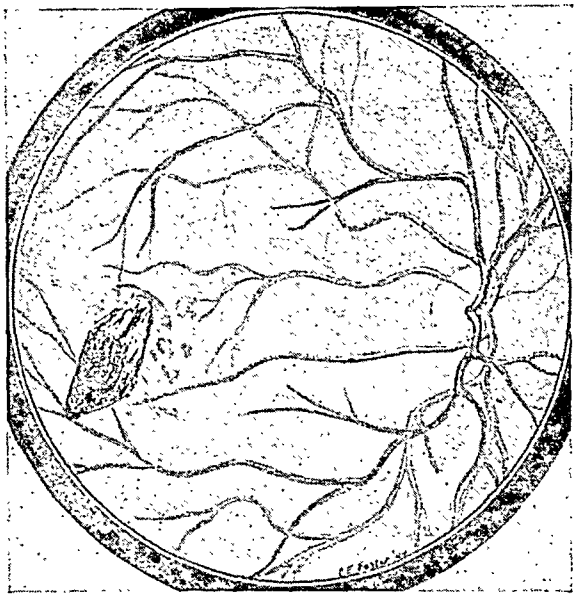


Fig. 1 (Schultz). Cyst containing copper particle imbedded in retina of right eye.

which had become absorbed. The presence of sympathetic ophthalmia in the right eye may be ruled out because of the quiescent left globe and characteristic copper changes in both lenses. The suppurative process in the right eye must, therefore, be caused by a perforating copper fragment which occurred at the time of the original injury four years previously but was not noted at the time because of the apparently more serious wound of the left eye. Both copper fragments then lay dormant four years, gradually producing a bilateral chalcosis lentis, with sudden onset of an aseptic suppuration of the right eye at the end of that time.

Summary and Conclusions

A case of bilateral chalcosis lentis is described with continued toleration of a copper particle in the left eye and subsequent severe endophthalmitis of the right eye four years after the original injury.

Intraocular copper fragments, even when apparently innocuous, usually produce a constant chemical change which may affect the cornea, lens, or vitreous. Chalcosis lentis, characterized by a sunflower metallic opacity beneath the anterior capsule of the lens, is

the most common sequela of these chemical changes. A severe aseptic suppuration of the eye, however, may suddenly occur years after the penetrating injury.

This case serves to emphasize the guarded prognosis that must be attached to all penetrating eye injuries, which, though quiescent, still retain intraocular metallic fragments. It also stresses the importance of examining both eyes carefully at time of injury, even though only one eye is apparently affected. Roentgen examination of both eyes is indicated in all questionable cases of bilateral involvement.

30 North Michigan Avenue (2).

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A TRIPLE-ARMED SUTURE FOR RESECTIONS

Jack V. Lisman, M.D.
New York

This suture is thought to be an improvement, as well as a simplication, of the two double-armed sutures generally used for the resection operation on the external ocular muscles. It has been used routinely for the past 18 months on the service of Dr. Wendell L. Hughes at the New York Eye and Ear Infirmary with satisfactory results.

The usual double-armed suture may be converted to a triple-armed suture by fixing a No.-3, French, open-eye needle to its center (fig. 1). The two end needles are passed through the marginal muscle fibers close to the upper and lower muscles edges. The central needle is passed through the muscle at its center from the outside in. The three needles are then passed through the muscle stump (fig. 2) and the central needle is cut free, leaving two complete sutures. There is no possibility of leaving any muscle tissue centrally that is not included in the suture, as might be the case when two separate double-armed sutures are used. The result is better than using two double-armed sutures.

The advantages are: (1) its simplicity, (2) the easier alignment of sutures in the muscle belly, (3) saving of suture material, (4) greater accuracy in placing the suture, (5) saving of time, especially important under general anesthesia, (6) less tissue trauma since there are only three muscle, tendon, and scleral punctures rather than the four made by the use of two separate sutures.

654 Madison Avenue (19).

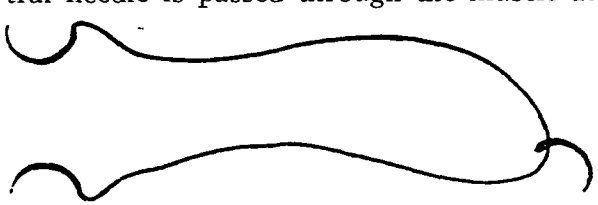


Fig. 1 (Lisman). A French-eye needle is fixed to the middle of a double-armed suture.

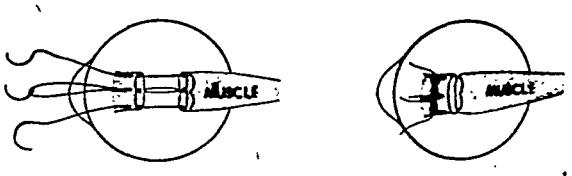


Fig. 2 (Lisman). The three needles are passed through muscle and stump. The needles are cut loose, leaving four ends which are tied.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

April 16, 1947

DR. HOWARD F. HILL, *presiding*

INTEGRATED IMPLANTS AND ARTIFICIAL EYES

DR. WENDELL L. HUGHES of Hempstead, Long Island, New York, presented a paper on this subject which was published in the Journal, 31: 303-310 (Mar.) 1948. A brief abstract follows.

The decision to use Vitallium was based on the following considerations. Plastics were rejected because of (1) insufficient strength for design contemplated, (2) possibility of wear and scratching in time, (3) occasional allergy, (4) effect of age, (5) unsatisfactory union of metal and plastics. Gold was rejected because of prohibitive cost, while tantulum was objectionable because of tissue reaction and because it was difficult to fabricate. Vitallium was decided upon because of its moderate cost, its strength, ability to be cast in any shape, and because its prolonged use in other regions of the body showed minimal tissue reaction.

The implants and surgery were described in detail. The implants to be used after enucleation are of two sizes, the smaller one being used to replace previously buried implants when the usual implant would be too large. The larger implant consists of a polished, smooth, posterior spherical portion 18 mm. in diameter, with an anterior portion approximating a truncated cone, ending in a flat face 10 mm. in diameter. On the anterior surface of the flattened portion is the depression which receives the peg extending from the rear surface of the prosthesis. Surrounding the neck of the implant is a ring attached to it by eight small bars. The recti muscles with a tab of sclera attached are fastened to the ring of the implant. Tenon's capsule is then pulled through the ring between the recti and sutured. The conjunctiva is then sewed around the flat anterior surface, anchoring it to the tissues passing over the ring.

In conclusion, Dr. Hughes summed up the advantages of this type of implant over the buried type as follows:

1. The motility of the implant is transmitted to the artificial eye because of the integration of the eye with the implant. The slippage between the buried type of implant and the eye is eliminated.

2. The position of the eye may be changed simply by altering the position of the peg on the back of the eye.

3. A stock plastic eye can frequently be used simply by placing a peg on the posterior surface to integrate it with the implant.

4. The motility is excellent in all directions as noted by measurements. In several of the cases reported, convergence was noted.

5. The normal fold of the upper lid is retained and the sinking in, so common with the ordinary artificial eye with a buried implant, is eliminated. This is due to the eye being supported by the implant through the medium of the peg on the back of the eye integrating it with the implant. The eye is held backwards so that the peg is held into the depression on the front of the implant by the normal tonicity and muscles of the lids. The lower lid no longer needs to support the entire weight of the eye plus the pressure exerted by the upper lid.

6. One piece metallic hollow construction of metal .002-inches thick is an advantage over any combination of two substances; metal, plastic or otherwise.

Discussion. Dr. H. B. C. Riemer asked

about the formation of granulation tissue at the conjunctival edge. Dr. Hughes said it had occurred once, at which time he simply cut it off. He did not know what happened to the edge of the epithelium around the implant, but as pure conjecture thought a connective-tissue layer is formed as a result of foreign body reaction at the junction with the implant.

Dr. Howard F. Hill inquired about the length of time the implants had remained in. Dr. Hughes replied that in all his completed cases the implants have been in longer than three months.

Dr. Riemer then asked in what type of case Dr. Hughes felt evisceration was safe, since Dr. Riemer thought the majority of Boston surgeons did not regard it as a safe operation.

Dr. Herman Grossman also asked about the relation of sympathetic ophthalmia to advisability of evisceration. Dr. Hughes replied that any suggestion of the presence of an intraocular tumor or injury through the ciliary body contraindicated doing an evisceration.

Dr. Grossman inquired about the removing of a buried implant and replacing it with Dr. Hughes' implant. Dr. Hughes said that there would not be room for a full-sized implant, but that he was going to try it with a smaller one. The only cases that are suitable are ones in which there is good fascial and conjunctival covering of the implant so that one can get strips connected with the recti and also strips of fascia to go between the recti around the ring. He felt it would be impossible to put an implant in a socket in which no implant was buried.

Development of Monoplex eye

Mr. Jardin of the American Optical Company (by invitation) spoke of the development of the Monoplex eye, which is an attempt to put the artificial eye on a standardized basis of colors, shapes, and sizes. This prosthesis is made of plastic and is subject to further adjustments in fit by a qualified technician.

Mahlon T. Easton,
Reporter.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

April 24, 1947

Dr. Burton Chance, *chairman*

Rubeosis iridis diabetica

Dr. Joseph Waldman and Dr. David Naidoff (by invitation) presented the subject. Rubeosis iridis is a comparatively rare condition in which a noninflammatory proliferation of new blood vessels occurs on the anterior surface of the iris. It is usually associated with glaucoma. Salus first described the condition in 1928, and used the term rubeosis iridis diabetica when he observed it bilaterally in three diabetic patients, all of whom eventually developed glaucoma.

The appearance of the iris is characteristic; the anterior surface is covered by radially arranged new vessels, especially near the sphincter region where the individual vessels anastomose to give the appearance of a ring about the pupil. The vessels end at the pigment margin without extending over it. Beginning at this capillary net some larger vessels spread over the iris, and disappear in the angle of the anterior chamber.

Kurz, in 1937, first described the gonioscopic and pathologic findings. On gonioscopy he found large vessels to run peripherally into the angle where they divided into innumerable branches to connect directly with Schlemm's canal, and to form extensive peripheral synechias. With the development of atrophy of the iris, the vascular net in the rubeotic eye tended to disappear. Pathologic study revealed that the new vessels were unassociated with inflammation or with newly formed tissue, but lay in and

upon the iris itself. Hemorrhagic retinopathy and a tendency to vascular proliferations in and on the retina and optic nerve were frequent concomitant findings.

Hyphemia is common, and in all reported cases a recalcitrant glaucoma results which yields only temporarily or not at all to treatment, medical or surgical. In 1945, Fralick reviewed 32 reported cases of rubeosis iridis associated with diabetes and added three cases which he had observed; of the 35 cases only one failed to develop glaucoma and in this case, reported by Wegner in 1939, treatment was considered successful when an intracapsular cataract extraction was performed. Since then, Meyer and Steinberg, Scobee, Grury, and de Roetth have reported the use of cyclodiathermy in controlling the glaucoma in rubeosis iridis diabetica although this treatment resulted in atrophic eyes.

An interesting observation is the relationship between arterial hypertension and rubeosis; this was first mentioned by Kurz. Fralick, in his review, found that 16 of the 35 cases suffered from hypertension. It seems that diabetes and hypertension together in the same patient manifest a much higher percentage of vascular pathologic change than when either is present alone.

The following case is from the Number 2 eye service of the Jefferson Medical College Hospital.

CASE REPORT

M. G., a woman, aged 58 years, first learned that she suffered from diabetes in 1943. Treatment since then had been dietary and haphazard. Insulin had not been used. For the last six months she had also been treated for hypertension. In December, 1946, the patient had suffered sudden loss of vision in her left eye, and was told then that it was due to a severe vitreous hemorrhage. On February 24, 1947, one week before admission to the Hospital, the patient became aware of what she termed "pink vision" in her right eye, the good eye; everything at which she looked had a reddish hue. That night she suffered severe pain in the right eye, and the next morning vision was limited to light perception. She was seen by one of the members of the staff that day and a diagnosis of acute glaucoma was made. At this time hyphemia was present. Treatment consisted of eserine drops and hot compresses, but the elevated intraocular pressure, pain, and loss of vision persisted until her admission to the Hospital on March 1, 1947.

Eye examination. On admission the eye examination revealed vision to be O.D., light perception; and O.S., 4/60. The intraocular pressure was O.D., 65 mm. Hg. (Schiøtz); O.S., 16 mm. The right eye was severely congested throughout. Biomicroscopic examination showed the cornea to be edematous; many small gray keratic precipitates were present. The aqueous was slightly turbid. The iris stroma was atrophied, and a narrow ectropion uvea extended around the entire inner pupillary border. Just outside this pigmented margin of the pupil was a fine network of newly formed blood vessels, which covered the sphincter zone in a wreathlike fashion and gave a reddish hue to this portion of the iris. From this vascular zone on the surface of the iris several more or less straight and larger vessels coursed toward the base of the iris; some terminated in tufts of small capillary networks situated about the base of the iris; others disappeared behind the limbus. Uveal pigment and grayish debris were noted on the anterior surface of the lens which had suffered a general loss of transparency with other cataractous changes. Fundus examination was impossible because of the changes in the media as noted.

The left eye presented a normal external appearance. The vitreous was loaded with fine and coarse opacities. Many infiltrates typical of diabetes were noted in and about the macular area, and numerous retinal

hemorrhages, both punctate and flameshaped, were present throughout. The retinal arterioles showed marked sclerosis. Biomicroscopic examination revealed numerous fine gray and brown keratic precipitates. The anterior chamber was clear. Atrophy of the iris stroma and absorption of iris pigment were evident. On the iris, near the pupillary border, at about the 9-o'clock position, a tiny network of new vessels was noted. The lens changes were similar to those seen in the right eye.

General physical examination showed a blood pressure of 210/120 mm. Hg; generalized arteriosclerosis; and slight cardiac enlargement.

Significant laboratory findings were: Blood Kahn, negative; blood sugar, 235 mgm. percent; blood urea, nitrogen 25 mgm. percent; serum cholesterol, 222 mgm.; urea clearance, 35 percent; coagulation time, 3½ minutes; bleeding time, 1¼ minutes; capillary fragility (tourniquet test) normal. Urine showed 4+ albumen, trace of sugar, many red blood cells, and many epithelial casts. An electrocardiogram showed slight left axis deviation. There were no other findings indicative of myocardial change.

Diagnoses. O.D., rubeosis iridis diabetica and secondary glaucoma; O.S., diabetic retinopathy and retinal arteriolarsclerosis. Diabetes mellitus. Arteriosclerotic and hypertensive renal disease. Generalized arteriosclerosis.

Course. Miotics—eserine, prostigmin, mecholyl and D.F.P.—were all employed, without any decrease in the intraocular pressure; on the contrary, these drugs increased the pain and caused incessant vomiting which prevented proper control of the diabetes. Pilocarpine (8 percent) was then used, but the results were the same, even when the strength was reduced to one percent. After three weeks, since no beneficial results were obtained, all miotics were discontinued, and the patient became fairly comfortable, although vision was completely lost. From the time of admission the patient had received 20 mgm. of rutin four times daily. On April 4, 1947, the patient again suddenly experienced excruciating pain in the right eye. Examination then revealed a severe hyphemia with an intraocular pressure of 68 mm. Hg (Schiøtz). The pain has now diminished, but the anterior-chamber hemorrhage is still present. The patient's family was informed that operative procedures were usually unsatisfactory in these cases, and that enucleation was to be considered for the relief of intractable pain.

Discussion. Dr. Burton Chance: I recall a case of rubeosis in the service of the late Dr. Schwenk, 20 or more years ago, in a diabetic woman, who failed to return for further study because, so we were informed, she died from the severity of her general disease. I have not seen another case since.

Contaminated ophthalmic ointments

Dr. Louis Lehrfeld and Dr. Edward J. Donnelly discussed this subject. Ophthalmic ointments have been and are prescribed and used by eye surgeons throughout the civilized world. By far, the ointment most commonly used by the family physician is yellow oxide of mercury. The American lay public has used this ointment as a household remedy for external eye diseases. It is now to be replaced by sulfathiazole ointment. In the experience of one of us (Dr. Lehrfeld), such ointments as bichloride of mercury, boric acid, and ammoniated mercury have been used in collapsible tubes on numerous patients in office practice with a thought to economy until the last drip is expressed. At the Wills Hospital, it was our experience for years to use bichloride of mercury ointment (1:3,000) following all cataract operations merely because we had seen our predecessors do the same. Not more than seven years ago, we witnessed a corneal transplant performed by a well-known New York surgeon, in which the surgeon squeezed a goodly portion of an ointment from a collapsible tube into the patient's eye for antisepsis and lubrication. On another occasion, we saw motion pictures of a transplant by the same surgeon in which he advocated

the use of sulfathiazole (5 percent) immediately after the operation and then, at a later period, penicillin ointment.

Most ophthalmic surgeons and students of ophthalmology are inclined to play "follow the leader." It is not good form to question the masters who have obtained good results.

Personal experience of a continuous chain of infections following operations makes the surgeon stop to recount his steps with an effort to find out the missing link in asepsis and antisepsis.

When our attention was directed to the use of ointments in general, we dismissed at once the old ointment jar and directed our study toward the sterility and the maintenance of sterility of ointments commonly used in collapsible tubes.

It has been our experience that the ointment in fresh tubes, regardless of the name of the ointment, is different in color and consistency in the first sample expressed, compared with the second. It was also found that the nozzle of the tube was never free of ointment substance after a quantity was expressed. Pressure by the fingers left an extra quantity at the tip of the tube over which the cap was replaced. This overflow of ointment substance remained in the cap and on the nozzle of the tube until the next use. It is not always customary to express some of the ointment onto a towel or a pledget of cotton before using. In other words, the ophthalmologist has a false sense of security when he relies on the ointment in every collapsible tube being sterile until the last squeeze. It has been believed that the contents of the ophthalmic tube were sterile in the beginning and in the end. I feel certain that most ophthalmologists used ophthalmic ointsments in the treatment of corneal ulcers with the belief that the germicidal value of its contents was sufficient to destroy the bacteria present.

Strangely enough, you and I have never seen an ophthalmic ointment in a collapsible tube marked "sterile," and yet for years you and I have ordered ophthalmic ointments in the treatment of hordeola, blepharitis marginalis, ulcerative keratitis, and injuries to the eye with a smugness founded upon custom rather than scientific knowledge. We felt that the healing qualities of ointments were guaranteed by every textbook on ophthalmology. Fisher, Accousti, and Thompson (Bacterial contaminations in sulfonamide ointments, J.A.M.A., 122:855-858 (July) 1943) reported from the Warner Institute for Therapeutic Research that 5-percent sulfanilamide, sulfathiazole, or sulfadiazine ointments in a water-dispersible base may become contaminated with disease-producing organisms which these sulfonamides are not capable of killing.

Experiment on ophthalmic ointments

The authors wish to present evidence that most ophthalmic ointments in new and unused tubes are sterile. We wish to prove that once a fresh tube is opened the remaining contents are very frequently contaminated.

Data regarding culture media. The culture media used in this experiment was brain-heart infusion agar with sterile human blood. Approximately one inch of sample was expressed from each collapsible tube onto the culture media. The period of incubation varied from one week to 10 days. The first culture appeared, varying from 48 to 72 hours. The incubation temperature was 37°C.

The ophthalmic ointments used in this series of experiments were from six different manufacturers.

Cultures made. Cultures were made of the contents of 50 used tubes and 24 unused tubes of commonly known ophthalmic ointments as found on the open market. Three control Petri dishes were also observed, having been exposed the same time as cultured media.

Of the 50 tubes, which had been used more than once, a goodly proportion showed contamination by bacteria such as Staph. albus hemolyticus, Staph. aureus hemolyticus, fungi (species not determined), and other organisms, which were not identifiable by

microscopic examination alone. Eight of 15 tubes of 5-percent sulfathiazole ointment, which had already been used at least once, showed growth. Four of 11 tubes of bichloride of mercury (1:3,000) were found to be contaminated. Two of five tubes of penicillin ointment (500 units per gram) revealed growth. Two of seven tubes containing epinephrine bitartrate, which had been opened once or more, were positive. There was one positive out of six tubes of atropine ointment which had been used. Three pontocaine ointment tubes were found to be negative. A tube of eserine ointment (1 percent) which had been used on postoperative cases, showed many fungi. One borofax tube was negative.

Cultures of unused tubes. Twenty-four new tubes of ointment were selected from a stockpile of boxes containing 5-percent sulfathiazole ointment. One tube was selected from each supply box as a spot check (each original having 50 small boxes of ⅛ oz. each).

In 12 new unused tubes the first portion of ointment was cultured; all samples were negative. In another group of 12 new tubes, the entire contents of each tube were cultured. One was positive. Three controls consisting of blood agar were exposed for the same length of time as was required to smear the ointment from the tube. The three controls were negative, indicating there was no contamination from the outside atmosphere during the period of culturing.

There was sufficient information in all the experiments to indicate that the unused tube of ointment was, in most instances, sterile, while the used tubes were frequently contaminated.

The findings in this study call for a revaluation of the use of ophthalmic ointments in the eye postoperatively. Further, they call for the revaluation as to the use of ointments for ophthalmic conditions in general.

The authors appreciate the difficulty of sterilizing ophthalmic ointments. The composition of the tubes and of the ointments enters into the difficulty of marketing or preparing sterile ointments in collapsible tubes.

Conclusions. The authors do not have any evidence to prove that infections actually occur from the use of contaminated ointments. Surgeons of experience, however, do not wish to publicize overwhelming proof in the form of blind eyes. The authors do not have proof that the organisms found in the contamination were pathogenic bacteria. The mere fact that the ointments do contain organisms is sufficient proof that pathogenic bacteria may also be present. One may question why more infections do not occur following the use of ointment in used tubes. The answer can only be a conjecture. Either the lysozymes of the tears have their effect upon certain bacteria or the eye itself possesses a factor "X," which saves most patients from infection following intraocular surgery. Scientists do not willingly or knowingly place contaminated ointments into open wounds or even into a healthy eye.

Our experiments have convinced us that it would be well to discontinue the use of ointments postoperatively. We get along very well without them. Perhaps we, too, were formerly the subjects of habit and custom.

We are greatly surprised to learn that sulfathiazole ointment and penicillin ointment may become contaminated before the contents of the tube are exhausted. We have lost faith in the use of ointments. Our confidence can only be restored if an ointment could be produced sterile in containers for one application only. It is hoped that the experiments here reported may stimulate renewed interest in ophthalmic therapeutics.

Discussion. Dr. Louis Gershenfeld: I think we are indebted to Dr. Lehrfeld and Dr. Donnelly for the presentation of this paper on the sterility of ointments. Generally speaking, information like that comes from laboratory workers and, therefore, does not strike the ophthalmologist with the same force and meaning as it does when coming from an ophthalmic surgeon.

Some 25 years ago when I was very much concerned about the sterility of ampules used

for internal medication, I was at a meeting with the Commissioner of Food and Drugs. As you know, the Food and Drug Administration is interested primarily in the interstate-commerce traffic of food and drugs. During the discussion, I asked Mr. Campbell, the commissioner, whether or not his department had examined or investigated ampules on the open market. Mr. Campbell did not recall, but turned to two of his assistants and asked them. Their reply was they didn't think so. I then said to Mr. Campbell, "Don't you think it would be of more interest, perhaps, and certainly of greater value, if we concerned ourselves with the examination of ampules on the market and especially with the sterility of parenteral solutions than with such routine examinations as noting whether the strychnine content of Nux Vomica was 1.15 percent or 1.05 percent?"

Routine examinations are important, but it is of greater importance to make certain that solutions for direct injection, which may sooner or later reach the bloodstream, are sterile. I was surprised to learn nothing was being done as far as examining for sterility was concerned. My attention had been directed to this because a prominent internist had asked me to examine three identical ampules which he had. Upon examination, I found in each ampule a hemolytic Staph. aureus, which produced suppuration in rabbits. The internist had thought that something was wrong, since, of the nine other ampules of this lot which he had injected into his patients, abscesses had resulted in four of the cases. The other patients had never come back, and he was wondering what was the matter.

I immediately wrote an editorial for one of the journals, and it was at that time that the Food and Drug Administration proceeded to spend over $25,000 to look into the sterility of parenteral solutions throughout the country.

These points are mentioned primarily because I, too, then began to examine the ampules on the market. Very few of them stated that they were sterile. There was a statement as to contents—a solution of iron citrate, or a solution of morphine sulfate, or whatever the drug may have been. More recently the Sterile Advisory Board of the United States Pharmacopeia, of which I am a member, has become concerned with many of these sterile products.

Now we definitely define what parenteral means and, therefore, ampules and parenteral solutions must be sterile, whether labeled so or not. The Food and Drug Administration and the manufacturers accept this as such. The result is that this class of marketable products is sterile, and we have had practically no trouble on that score.

On the other hand, ointments are not sterile unless they are labeled sterile. I dare say there are very few ointment preparations on the market, whether used for ophthalmic work or for other surgical work, that are sterile. I have examined ointments in tubes and in jars and have found them to reveal the presence of bacteria.

The whole question of sterility is most intricate and complex. We must remember, of course, that the economic question affects the picture, although the question of price should not enter into the consideration if we want a finished preparation in which we have assurance that it is definitely sterile. When surgical catgut became official in the Pharmacopeia, members of our committee went on record to the effect that individual strands should be kept in individual hermetically sealed glass tubes. This form of marketing was first official in U.S.P. XII, and it is official in U.S.P. XIII, which recently made its appearance. At one time many strands of surgical catgut were in one container. This was objectionable and for many of the reasons which Dr. Lehrfeld presented here this evening.

In ointments we must remember many specific things. Dr. Lehrfeld has mentioned various ointments which, for the moment, one may think are bactericidal. However, we must remember that this is not always the case. The sulfonamides, for instance, are

only bacteriostatic. They are not bactericidal. They do not kill bacteria even if used internally, let alone in ointments.

One thing that we may forget is the fact that when we speak of bactericidal effect we seem to think that it means that every species of microörganism is killed. This is not so, although it may occur occasionally. The sulfonamides are only effective against certain particular groups of organisms. The same thing holds true for penicillin.

Even when a bactericidal agent is effective in suitable liquids, it may not be in ointments unless the proper base is used. In a petrolatum-phenol ointment, there will be very little antibacterial effect, but if a water miscible base is used, there will be an entirely different effect. These are some of the things which, of course, may play an important role.

With regard to the containers for ointments, I heartily endorse Dr. Lehrfeld's recommendation that, after surgery especially, a tube or container should be used only once in medicating an open wound. If an ointment is used in ophthalmic surgery, it certainly should be sterile. It is not a simple procedure, however, to market sterile ointments in small tubes or other individual containers if the expense has to be considered, because the process is an intricate, tedious, and long drawn-out one. The ointment tube itself, even those for ophthalmic use, are generally primarily tin. Some of them contain about three-fourths of one percent copper, added for hardening purposes. The larger tubes—½ oz., 1 oz., 4 oz., and larger —usually not used for ophthalmic products, are made of lead, lined with tin, about 7-percent tin; for toothpaste, 3-percent tin. Some of them may even have a plastic lining, but not the tubes for ophthalmic use.

It must be remembered that all tubes have to be sterilized. The ophthalmic tubes of pure tin with a small amount of copper can withstand heat up to 400°F. We use dry heat at 160°C. (320°F.) for sterilization. The closures are generally of Bakelite, which may hold up at this temperature. The individual sterile tubes then have to be filled under aseptic conditions with the sterile ointment. In many instances it may not be practical to sterilize the tube and contents or final containers. Individual sterile gelatine containers can also be used. The additional expense involved in the manufacture of sterile ointments must be kept in mind. Although the manufacturers will be delighted to cooperate in producing such preparations, you must remember what it will cost them.

The question has been raised as to whether or not a bacteriostatic agent can be incorporated in an ointment to produce a preparation that is self-sterilizing. Zinc peroxide has been mentioned. Zinc peroxide may be satisfactory, but in some instances you will find it possesses irritating effects, especially in the eye. Urea peroxide has been recommended for sulfonamide ointments, but frequently, upon standing, oxidation of the sulfonamide compounds occurs. The self-sterilizing agent must not only kill the bacteria present, but must also be nonirritating. A series of tests to prove that particular point will have to be conducted. Furthermore, one cannot just say that, because zinc peroxide, or urea peroxide, or whatever the agent may be is effective in combination with sulfonamide, it will be effective with other drugs. The question of effectiveness, stability, harmlessness, and so forth, are factors which must be taken into consideration.

It is possible to have individual containers for dispensing ophthalmic ointments and I, for one, definitely recommend and heartily endorse them. Certainly sterile preparations should be used for surgical purposes. However, unless requests are made specifically for sterile ointments, unless there is a demand for them, and unless individuals are willing to meet the additional expense involved, manufacturers will not market sterile ointments for use in ophthalmic surgery.

Dr. George J. Dublin. What I have to say is not relative to contaminated ophthalmic ointments, but rather to the effects of ordinary ophthalmic ointments, on the eye. I have noted for many years untoward re-

actions following the use of ophthalmic ointments.

These reactions were noted particularly in patients from whose corneas foreign bodies had been curetted. As usual, pontocaine or butyn ointment had been ordered. The corneal abrasion healed without much trouble, but I noticed that there were a considerable number of punctate staining areas over the cornea. These remained present for several days following the healing of the original corneal ulcer or corneal abrasion.

At first I thought that these abraided areas were due to some form of allergy. Later, the thought came to me that the punctate staining areas might be due to some form of mechanical irritation. We know that there is no ointment in which a drug is completely dissolved. Some of the drug always remains in crystal form. The small crystals within the ointment, by their mechanical action, cause corneal abrasions. I wondered at first why these patients complained of vague symptoms such as scratching, sensation of a foreign body, and tearing in the presence of a quiet eye, until I routinely stained each patient with fluoroscein. To my surprise, I found a great number of staining areas. To eliminate the possibility of these reactions being allergic in character, I used these ointments in the opposite eye, and noted the same reaction. I tried other types of ointments, and I found that, regardless of the type used, even boric-acid ointment, the same reaction was present in a majority of cases. I felt that an abraided cornea, the result of ophthalmic ointment, was an excellent medium for infection to develop. I reasoned that, instead of preventing an infection, I might be responsible for the development of a corneal ulcer. I have noted these reactions for several years, and consequently, I have not used ophthalmic ointments when I could possibly avoid them. In my opinion, liquid medication is equally efficacious, and probably it is considerably better to use it rather than ointments.

Dr. Louis Lehrfeld. I am very grateful to Dr. Gershenfeld and Dr. Dublin for their discussion. I should like to read part of a letter that was received by the pharmacist at the Wills Hospital following a question he asked as to whether ointment tubes were sterilized before ointment was inserted. The letter reads in part:

"We do not sterilize empty tubes except in the case of penicillin ophthalmic ointment where we use dry heat to sterilize empty tubes." Signed by Lanwermeyer, representing Abbott Laboratories.

Dr. Louis Gershenfeld (in closing). And this, in the case of penicillin, is the result of action by the Food and Drug Administration.

Vitreous infections and streptomycin

Dr. Irving H. Leopold, Dr. Richard Dennis, and Miss Marjorie Wiley, B.A. (by invitation), presented a paper on this subject which was published in the Journal, 30:1345-1352 (Nov.) 1947. A brief abstract follows:

Streptomycin penetrates poorly from the blood stream into the vitreous humor of normal rabbit eyes. Local methods of administrating streptomycin were studied and compared for their abilities to produce adequate vitreous-humor concentrations of streptomycin. Subconjunctival, anterior-chamber, and retrobulbar injection of streptomycin plus anterior-segment iontophoresis produced higher levels than that obtained by systemic administration. These methods were tried against the standard vitreous infections produced by bacteria coli.

Direct intravitreal injection of streptomycin, retrobulbar injection plus iontophoresis, and anterior-chamber injections reduced the severity of experimental vitreous infections due to bacteria coli. They were effective in the order listed.

Direct intravitreal injections of streptomycin produced retinochoroidal exudation and subsequent degeneration. In concentrations below 800 micrograms per injection, the damage was minimal and limited to the site of injection.

Discussion. Dr. Richard Dennis. I would

like to emphasize a couple of points and also add another. From the work that we have done, it seems that direct intravitreal injection is the most efficacious of the local methods of administering streptomycin. It also appears that the injection of reasonable quantities of streptomycin, at least up to 800 micrograms, can be done with no more damage than would follow a similar direct injection of saline solution. With improved methods in the refinement of production of the drug this will probably be more obvious. In a severely infected eye where other remedies have proved to be of no avail, the ophthalmologist would seem justified to try this method. For intravitreal injections, the solution should be as near isotonic as possible. In the lower concentrations this is best obtained by diluting the drug in physiologic saline. In higher concentrations, considerable osmotic effect occurs, and here it is best to dilute with distilled water.

Dr. Irving H. Leopold. For those who might try retrobulbar injections of streptomycin, it is necessary to point out that such injections may be painful. Intramuscular injections of streptomycin are painful to some individuals. Procaine does not interfere with the action of streptomycin, and could be used with or prior to retrobulbar streptomycin injections.

Role of the vertically acting muscles in concomitant strabismus

Dr. Edmund B. Spaeth presented a series of cases to illustrate the role which the vertically acting muscles must play in the causation of convergent as well as divergent strabismus. This is one basis on which to consider the etiology of strabismus. The cases illustrated a relationship between the conjugate muscles, with muscle overaction in one eye and with muscle underaction in the opposite eye. A degree of vertical deviation was always present but changed in each possible position of the lateral rotations. Further, muscle overactions were found to be quite common in the homolateral antagonistic muscles with and without contralateral conjugate muscle disturbances. The various possible combinations were all presented.

Disturbances in the vertically acting muscles modify to a marked degree the corrective surgery necessary. Certain rules for this were presented as to the sequence of the necessary operations (lateral and/or vertical) in the various situations seen.

Discussion. Dr. Glen G. Gibson. Once again we are deeply indebted to Dr. Spaeth for calling our attention to an extremely important and frequently neglected phase of ophthalmology.

The time has come when we can no longer neglect this subject of the vertical deviation in horizontal strabismus. I feel that this is an important paper for two reasons.

It is important, first, because it brings us intimately in contact with the author's extensive surgical experience in these very interesting cases.

It is also an important paper, because the literature in the past has been inadequate in guiding us in the handling of these cases. It illustrates the fact that we, as clinicians, are in need of precise definitions by which we can understand each other more thoroughly when we speak of such terms as spasm, overaction, vertical component, and vertical element.

This paper is too inclusive and extensive to permit a discussion of all the aspects of it, and I feel that I may best serve our purpose at the moment by summarizing briefly what Dr. Spaeth has really said.

He has pointed out that there are cases of pure horizontal deviation without any vertical element. He has also pointed out that if we study these cases carefully we can determine that many of them have a very slight degree of vertical imbalance, either hypertropia or hyperphoria. The careful study of these cases is rewarded by much better surgical result. There are two main groups in which we encounter combined vertical and horizontal tropias. The first group is primarily a concomitant strabismus

in which there is a secondary vertical deviation. The most common of these is the type in which there is bilateral inferior oblique overaction. The inferior oblique overaction is merely the secondary participation of these muscles in the esotropia. The second type of these cases are usually paralytic cases. These are primarily vertical deviations in which the horizontal deviation is merely the secondary device that the patient uses to get away from the disturbing diplopia that results in these vertical cases.

Now the differential diagnosis of these two types is relatively easy when we consider that the one in which the horizontal deviation is primary is the one in which the inferior oblique excess is bilateral. It is equal, and it is symmetrical. In other words both inferior obliques participate equally in these cases. In the cases which are primarily paralytic in origin, the deviation is always different in each eye. They are not symmetrical.

Now there is a third type of mixed deviation that one encounters in which the deviation has become so concomitant that it is impossible to tell just precisely which muscle was primarily involved. Some people will not admit that cases which were originally paralytic become progressively more and more concomitant as time passes, so that it is impossible to identify which is the originally offending muscle. I feel, however, these cases do occur and quite frequently. It is embarrassing to deal with these cases when it is impossible to say which of the muscles is primarily at fault. This is due to the fact that these paralytic bases become progressively more and more concomitant as time goes by.

Dr. Spaeth has called attention to the fact that the sensory correspondence is vitally important in these cases. I would like to cite two cases which illustrate this all important point. Two young men, aged 22 years, each had 10 prism diopters of left hyperphoria when measured in the primary position.

In the first case, the onset of the deviation was at the age of 22 years, in an individual who presumably had normal eyes and normal binocular vision until he was in an automobile accident, after which he developed a typical left superior oblique paresis. A complete myotomy, performed on the inferior oblique of the offending eye, reduced the hyperphoria to one-half prism diopter. This excellent surgical result with a relatively minor operation was possible because this young man had normal binocular sensory correspondence before the onset of the condition.

In the second case, the findings were essentially the same, but the history was entirely different, and a much greater surgical intervention was necessary. This was also a superior oblique case. The onset, however, was at two years of age, and we know, by inference, that the patient had very abnormal sensory correspondence and that the surgeon would get very little help from the binocular reflex in maintaining alignment. Even the deviation was essentially difficult. Although the diagnosis was the same as in the first case, a much more extensive surgical procedure had to be instituted because of the extremely abnormal sensory correspondence. A myotomy of the inferior oblique on the offending side, combined with a 3-mm. recession of the contralateral inferior rectus, was performed. The residual hyperphoria after the operation was three prism diopters, even though a more extensive procedure had been done. This is a point we must understand very thoroughly before interfering with these vertical cases—it is very important to know of the status of the sensory mechanism before operation.

Dr. Spaeth has called attention to the importance of recognizing inhibitional palsy in these cases. I agree with him that it is a very important point. They must be recognized. I would refer those who are not thoroughly familiar with this aspect of the subject to an article in the *Transactions of the American Ophthalmological Society* by Dr. Adler which is very clear on this particular subject. This condition is also explained

nicely but less clearly in the textbook of Chavasse. Dr. Spaeth has called attention to the fact that more than a cosmetic result is desired. The ideal sought is to obtain binocular vision, if possible.

A most important factor in obtaining binocular vision in these cases is the age at which surgery is instituted. It is not necessary to operate on these cases before the patients are three years of age, and, likewise, it is desirable to operate on them before they get past four years of age. In other words, the ideal time for surgery is between three and four years of age. Children treated at that time are still young enough to develop normal binocular vision. Dr. Spaeth has pointed out that, in this group of vertical disturbances associated with horizontal deviation, the results are frequently better than they are in the purely horizontal cases. It has also been my experience that we are much more satisfied with the surgery on the vertical muscles when the diagnosis and the treatment have been correctly performed.

Dr. George F. J. Kelly. I should like to ask Dr. Spaeth what his experience has been in cases of torticollis due to paralysis of an oblique muscle. When does the torticollis disappear after correction of the oblique muscle defect?

There is another point. If I heard you correctly, you said that when both a vertical component and a lateral component are present, whichever is the greater is operated on first. I also think I understood you to say that, when you correct the horizontal component, you always get an improvement in the vertical, and that, when you correct the vertical, you may get no alteration in the horizontal. Would it not be worthwhile to operate on the horizontal, because surely there will be some correction on the vertical, and maybe it would not be necessary to do so much on the vertical subsequently?

Dr. Edmund B. Spaeth (closing). Three things that Dr. Gibson brought out are, I think, quite true. The first emphasizes what White said right here on this floor many years ago: "Seventy-five percent of concomitant strabismus is accompanied by a vertical deviation." Too often nothing is done about it.

Dr. Gibson spoke about this matter of, "So many millimeters of recession or resection." This is more a delusion than a fact. There are many other things which enter into a vertical surgical situation. To correct vertical deviations by millimeters is quite impossible. It is disheartening to see the lack of results one will obtain in any type of surgery on an inferior oblique muscle when, instead of surgery on an inferior oblique muscle, one should have done the opposite surgery, resection or recession, upon the superior oblique muscle. It is only by a comparison of the total amplitude of the action of the conjugate yoke muscle to the muscle involved that one can decide whether an inferior oblique muscle or a superior oblique muscle should have been operated in these instances.

As to torticollis, there is no problem about this except that of the duration of time. If torticollis is not improved by monocular occlusion prior to the surgery, it will be a long-standing affair before the torticollis disappears.

As to the sequence of surgery in the vertical and horizontal, I have been distressed and embarrassed several times to find that subsequent surgery on the verticals has upset the previous surgical result on the laterals. If the vertical component is the greater, it is wise to take care of that before the lateral is even touched, because one cannot tell what certain effect this will have upon the lateral deviation.

George F. J. Kelly,
Clerk.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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SOCIETY PROCEEDINGS

One of the most attractive and popular features of the JOURNAL is that of "Society Proceedings." For a great many years, it has been a part of the JOURNAL to which the reader turns with the hope that something of utility, interest, and instruction will be forthcoming. Seldom has this hope been disappointed.

If properly reported, the society meeting can be easily visualized, as if you were there in person. The personality and experience of the essayist or demonstrator are displayed to advantage or disadvantage. Triumphs are scored, mistakes are revealed, and discussions, for the most part exceedingly shrewd and helpful, probe into the subject with acute discernment.

The proceedings, however, must not be taken too seriously or else the informality, that is so essential, is lost. You are permitted to theorize and speculate freely; something, perhaps, that is out of place in a formal presentation. You are also permitted to bring in personal experiences in discussing similar cases that you have had under observation,

without worrying too much about your style of delivery or the vocabulary you use. Questions are asked, and sometimes the answer is obviously avoided. All of these sidelights are reported in the proceedings, and it is necessary that they be reported, for otherwise the human touch is lost, and the spirit of the meeting and its spontaneity vanish.

Many times an opinion is expressed during a case report which throws a new light upon the subject, an idea that stimulates the reader's mind to elaborate more fully either in his own thoughts or, what is more significant, into action.

For example, in one of the meetings of the New York Society for Clinical Ophthalmology, Dr. Jack V. Lisman mentioned that the glaucoma associated with rubeosis iridis responds better to mydriatics than to miotics and thought that this is probably due to a mechanical squeezing out of blood from the capillaries of the iris as the pupil dilates. There is a great deal of food for thought here, and one should be stimulated by this to study further the problem of the control of such glaucoma.

Many other examples could be cited. As a matter of fact, if one went through all the society proceedings published in the JOURNAL during the last 10 years or more, and made a note of striking and unusual remarks, enough ideas for research would thus be engendered to keep one fully occupied for a long time.

The arranging and editing of the proceedings is a difficult task, skillfully performed by our Dr. Lyle. The form in which they are received often leaves much work to be done in order to make them readable without sacrifice of ideas, opinions, or individual style. The most important job, therefore, is that of the recorder or clerk of the society.

It is not every individual who has the knack of getting down on paper the essential matter presented at a meeting, and it is very easy to misquote or to leave out very interesting facts. Each society owes it to itself and to ophthalmology to give considerable thought to this factor and to choose with care one of its members for this important chore.

The large and wealthy organizations can hire a stenographer, but there is still work for the clerk in editing and coördinating the remarks. The smaller societies may not consider themselves able to afford the services of a professional stenographer. In this event, the entire burden falls on the clerk. For this reason, many organizations (and there are some 95 state and local ophthalmic societies in the United States) don't bother to keep a record of their meetings, or to send their proceedings in for publication.

This is a pity because many thoughts, ideas, and opinions are forever lost. The younger men who may hesitate to get up and discuss a paper before one of our national organizations, express themselves freely, as a rule, in their local meetings, and it is their fresh outlook and young ideas that we all need so badly.

It could probably be arranged, without increasing the dues too much, to hire a stenographer or to put in a wire recorder at every meeting of each society. The choice of a good clerk should not be too difficult, for in every community there is at least one individual who is qualified and eager to collect and to edit, perhaps in a preliminary fashion, the remarks that are made at a meeting.

The assignment is an important one. More organizations should be represented in the "Society Proceedings," and the JOURNAL will always welcome these contributions.

Derrick Vail.

THE VIRUSES

Vitamins and viruses were both discovered just 50 years ago, and in the intervening span few scientific revelations have so profoundly altered biologic thought. The first animal virus recognized—that of foot-and-mouth disease by Loeffler in 1898—is still the smallest yet identified. Since then virus infections have been found in every

form of life, including the lowly bacteria, and of the several hundred viruses now known, 35 affect man. No part of the ocular apparatus is immune, as the diverse complications of measles, mumps, and epidemic encephalitis illustrate. Certain viruses have a specific affinity for the eye only, as is apparent in trachoma and epidemic keratoconjunctivitis, and conceivably possible in sympathetic ophthalmia.

The mists of mystery about the viruses have cleared considerably. The term "filterable virus" is now dated. The size of virus particles has been accurately estimated through graded collodion filters, ultracentrifugation, and electron microphotography. The measurements range from 300 to 10 millimicrons. Progressive simplification in structure and function parallels the diminution in size. A group of the largest viruses, which includes psittacosis and the agents of lymphogranuloma inguinale, inclusion blennorrhea, and trachoma, have a close antigenic kinship, and are related to the rickettsiae in metabolism and staining qualities. Burnet, who maintains that all human viruses had a primary animal habitat, intimates that psittacosis continues the original strain while the others are specialized mutants. In contrast to the smaller viruses these exhibit some susceptibility to the sulfonamides, the ocular infections seemingly responding best to sulfacetamide (30 percent) locally used.

The viruses have descended presumably from a rickettsialike organism to their present state by successive extensions of their dependency upon the host. The virus group are obligate intracellular parasites who demand not only board and room, but digestion and respiration as well. With the delegation of more and more of their vital processes to the host cell, the viruses become smaller and smaller until the process of evolution in reverse arrives at the terminus, a gene-pattern molecule capable of reproduction only. The smallest viruses are not overmuch larger than the serum globulin molecule, which measures six millimicrons. Following the successful crystallization of the enzymes, urease by Sumner and pepsin by Northrop, Stanley, in 1935, demonstrated that a living virus, that of tobacco mosaic, could also be isolated in crystalline form. Since then numerous plant viruses have been so segregated; a typical example, the tomato bushy stunt virus, has been obtained in true 12-sided crystals absolutely homogeneous in size and shape, the particle diameter being 25 millimicrons; the molecular weight, 10 million; water of hydration, 70 percent. Like all virus molecules studied it is a complex of pure nucleoprotein.

The parasitized cells tend to react to the virus load by proliferation, but an excessive burden results in necrosis. In some virus diseases, as in the Rous sarcoma of hens, the hyperplatic response cannot be distinguished from neoplasm. Clinically the viruses can be roughly classified as pantropic, of which mumps is an example, dermatropic like herpes simplex, neurotropic like herpes zoster, and tumor forming like molluscum contagiosum and the common wart. The formation of inclusion bodies when present is pathognomonic of virus disease. These are colonies of elementary bodies, the infectious agent, which were first noted by Paschen in vaccinia and smallpox in 1906, and by Halberstädter and Prowazek in trachoma in 1907. By differential centrifugation the elementary bodies have been separated in purity, and, in 1931, Parker demonstrated that one elementary body could produce vaccinia. Thygeson removed all doubt concerning the role of the elementary bodies in trachoma by infecting a human volunteer solely with them.

An outstanding feat in virus control was the cultivation of sundry species on the chorio-allantoic membrane of the developing hen's egg by Goodpasture and Woodruff in 1931. From a yellow-fever virus serially transferred to chicken embryos from which the cerebrospinal system was removed, Theiler developed the invaluable strain, now known as 17 D, which although innocuous to man conferred complete immunity. This con-

ditioned mutant was in a way a fortunate accident, as the result has never been experimentally duplicated. Trachoma and inclusion blennorrhea are specifically human diseases, and their viruses cannot be grown in the chick embryo or animal tissues.

The viruses vary vastly in the antigenic response produced—from a solid immunity in herpes zoster to none in herpes simplex and trachoma. The first invasion of herpes is in the universally occurring aphthous stomatitis of childhood. The virus thence persists in apparent latency for life until spurred to activity by some factor, local or general, as the injection of typhoid vaccine or exposure to high temperature. Protection from viruses can be secured so far by prophylactic means only, which in order of effectiveness are active immunity, passive immunity, and quarantine. After the virus has penetrated into susceptible cells, it is safe from antibody attack, and serum injections then are of dubious value. As Rivers showed in 1929, if normal cornea is inoculated with vaccinia virus and then cultivated in antivaccinal plasma, typical lesions will nevertheless develop; while if the cells are bathed in immune serum before the addition of the virus, infection is prevented.

The successful treatment of virus diseases of the eye has been limited to sulfonamide medication in the psittacosis group, the removal of virus growths such as warts and molluscum contagiosum, and iodine cauterization of herpetic lesions. Viruses are not affected by ether and are destroyed by antiseptics with much greater difficulty than bacteria, for which reason 0.5-percent phenol can be used effectively as the standard preservative of vaccinia virus. The peculiar potency of iodine is probably due to its deleterious oxidizing activity. The viruses like the germinal cells are sensitive, too, to radiation. In experiments with herpes, Gundersen showed that ultraviolet rays are not the answer, nor probably are beta rays. In the eye, the local action of antiviral remedies can be easily observed. Now that radioactive isotopes are available, perhaps the proper radiation could be given by incorporating radioactive iodine in Cowen's solution and simply instilling the eye drops at proper intervals.

Numerous questions in regard to the local mechanisms of resistance to virus disease require solution. Why are some eyes more susceptible than others to the herpes and influenza viruses? Does the conjunctival secretion contain a substance capable of inactivating certain viruses? If so, it is probably something other than lysozyme. Why is the gastro-intestinal tract immune to virus infection? Is it because of the proteases and nucleinases present, and what action do these enzymes have on viruses? If virus disease is to be conquered, these problems among others must be resolved.

James E. Lebensohn.

A COURSE FOR ORTHOPTIC TECHNICIANS

Orthoptics as an important part of ophthalmic practice has become well established, after two earlier upsurges followed by recessions. It is an essential part in the intelligent treatment of many ocular muscle abnormalities, especially those associated with strabismus. Such opposition as there has been by ophthalmologists to orthoptics has been based largely on lack of understanding of its possibilities and limitations, furthered by disinclination to devote the necessary amount of time to this training and, to be honest, the disinclination to expend energy on meticulous and tedious work with uncoöperative and naturally unappreciative little children. Combine all of this with the recognized fact that complete success is the exception rather than the rule and that many cases prove, after much sweat and tears, to be quite unresponsive to treatment, and the reasons for the cold shoulders that many eye surgeons have turned to muscle and fusion training become obvious.

Granting that the practice of orthoptics is worthwhile and admitting that most oculists will not incorporate it into their personal activities, the obvious answer is the development of technicians. This has not proved easy. Few eye physicians were sufficiently conversant with the subject to be competent instructors and of those so qualified only a minimal number had the time, the facilities, or the inclination to give such teaching. Gradually, however, a small number of orthoptists, the earliest in the field being largely self-trained, became technicians in response to the demands of the ophthalmologists. There are as yet less than 100 certificated technicians practicing in the United States. By certificated, reference is made to certification by the American Orthoptic Council, which, coming into existence some 10 years ago, has sponsored and helped conduct examinations of those technicians desiring to take them who had met the preliminary requirements of the Council. The procedure is similar to that carried on for ophthalmologists by the American Board of Ophthalmology.

One of the principal difficulties for these prospective technicians, for whom there are of course no internships available for preliminary training, has been to get basic instruction and practical experience. This has been done in a somewhat unsatisfactory manner by university, clinic, and private preceptorships. Some students have received excellent ground work, others poor. There has been no uniformity. Not only has the training in many cases been sketchy, but it has been impossible to find enough places for the training of those desiring to study orthoptics. As a result there are not enough orthoptists for the ophthalmologists who wish to employ such qualified workers.

One step toward solution of this problem appeared to the American Orthoptic Council to be centralization of basic training preliminary to practical training. The former has been the more difficult to obtain, whereas there are many clinics, groups, and private offices where the latter can be learned, provided that a good foundation has been previously acquired.

Accordingly, largely through the efforts of Dr. Walter Lancaster, a course in fundamentals is to be given this year utilizing the facilities of Nasson College in Springvale, in the township of Sanford, Maine, June 28th to August 28th for prospective orthoptic technicians. The course will be under the direction of Dr. Lancaster who will also give an important part of the instruction. Among others who have generously volunteered to contribute an average of a week of their time to the program are Dr. LeGrand Hardy, who has undoubtedly done more than any other man toward the establishment of the American Orthoptic Council, of which for its first nine years he was president, and toward organizing the American Association of Orthoptic Technicians. He has given life and impetus to the entire program. On the faculty will be Drs. Adler, Swan, Costenbader, Regan, Beach, Burian, and Fralick. Tentative understandings have been arrived at with other ophthalmologists, but, because at the moment of writing the plans have not been completed, their names are omitted. Several widely known certificated orthoptists will be present to give lectures and individual instruction in the use of the special instruments that they employ.

Among the subjects included in this course are Anatomy, Physiology, Refraction, Optics, Diagnosis, and Treatment. Important also are courses in psychology, especially as applied to the child.

Following this two months' course, technicians will receive assignments throughout the country for their practical instruction which, at most places, will be for from eight to ten months. Thereafter, if their work has been satisfactory, they will be recommended for examination for certification.

The plan appears to be a sound one for unifying instruction and ultimately providing more technicians and should receive coöperation from ophthalmologists on whose

good will much of its success depends. The specifications of the course are published in "News Items" in this issue of the JOURNAL for the benefit of those desiring such information. It is anticipated that this course will prove such a success that it will be repeated annually.

Lawrence T. Post.

OBITUARY

CHARLES PORTER SMALL
(1863-1947)

Dr. Charles Porter Small was born at Bangor, Maine, November 16, 1863, the son of the Rev. Albion Keith Small and Thankful Lincoln Small. He died at Princeton, Illinois, September 25, 1947.

After his graduation from the Fall River, Massachusetts, High School in 1882, Dr. Small entered Colby College from which he was graduated in 1886. In 1889, he received his medical degree from Bowdoin Medical College and served a two-year interneship at the Maine General Hospital.

For two years, 1890 to 1892, he was in general practice at Waterville, Maine, but, in 1892, he came to the new University of Chicago and became its first physician in charge of student health.

Five years later, after preparation in Vienna, Dr. Small entered the field of ophthalmology and practiced his specialty in Chicago until his retirement nearly 40 years later. During these years, he was clinical associate of the Eye Department, Rush Medical College; clinical assistant, Northwestern University Medical School, and instructor in ophthalmology at the Chicago Polyclinic Hospital.

In 1914, Dr. Small became associated with Dr. Casey Wood, both in the practice of ophthalmology and in the editorship of the *Ophthalmic Record,* of which he was the secretary-treasurer. This publication was absorbed by the *American Journal of Ophthalmology* in 1919. Dr. Small was also a collaborator on the *American Encyclopedia of Ophthalmology, the Ophthalmic Yearbook,* and editor of the Eye Section of the *Practical Medicine Series.*

During World War I, Dr. Small served as a captain in the Aviation Examination Unit and was stationed both at Rock Island, Illinois, and Washington, D.C.

Dr. Small was a member of the American Medical Association, the Illinois State and the Chicago Medical Societies, the Physician's Club, Delta Kappa Epsilon, Phi Chi, and the Chicago Ophthalmological Society of which he was president in 1925.

E. V. L. Brown.

CORRESPONDENCE

CONCERNING DR. VAN HEUVEN

Editor,
American Journal of Ophthalmology:

On occasion of your report of Dr. van Heuven's speech at the January (1947) meeting of the Cleveland Ophthalmological Club (Am. J. Ophth., 30: 535 (April) 1947) I want to declare:

On the contrary, Dr. van Heuven's political feelings during the German occupation were very ambiguous. In the course of the occupation, he secretly subscribed to the Nazi-organization of Physicians (Nederlandts Artsenkamer). Furthermore, he published scientific articles in German journals (Zeitschrift für Psychologie und Physiologie der Sinnesorganen).

For these and other reasons his name was struck out from the list of the Dutch Medical Association after the liberation and to escape difficulties, he withdrew his name from the Dutch Ophthalmological Society.

(Signed) G. H. Jonkers,
Former Medical Staff Officer,
Dutch Underground Forces,
Utrecht, Holland.

Corneal transplantation: Truth and myth

Editor,
American Journal of Ophthalmology:

"A unique case of Elschnig, reported by Ascher, was cited of a 12-year-old boy whose one eye suffered from deep keratitis. The cornea of this eye was trephined without receiving a graft. After seven years, the defect was replaced by completely transparent tissue."

This I read in the excellent paper by Katzin and Kuo in the February issue of the JOURNAL, and I felt as if I were dreaming. Never had I heard of such a case; so, I went over my old publications and found on page 352 of the 1919 paper, quoted by Katzin and Kuo, their description as translated in the JOURNAL but with a headline saying in italics that this was a lamellar keratectomy; that is, a removal of the uppermost layers of the corneal parenchyma with preservation of the deeper strata. From the authors' quotation, however, it seemed to be a penetrating, not lamellar, trephination without replacement of an implant.

Elschnig's original, but always highly conscientious indications, never would have arrived at such a hazardous procedure. Even then, the operation quoted by Katzin and Kuo was a beautiful result and, most probably, the first successful lamellar keratectomy ever performed. How happy would Elschnig be to see that "his" corneal transplantation for which he fought through five lustrums, finally has been recognized as a useful procedure in well-selected cases, and is not just a fancy of a periculant imagination; that even his indications and contraindications essentially prevail.

A minor error in the quotation of the recent authors is that they located my histologic investigations in the 1919 clinical paper; the publication about the histology of keratoplasty appeared four years later, in Graefe's Arch. f. Ophth., 111:446-459, 1923.

(Signed) K. W. Ascher,
Cincinnati, Ohio.

Ophthalmic findings for and against sympathectomy for hypertension

Editor,
American Journal of Ophthalmology:

There is a wave of "jitterbug" surgery spreading through the large medical centers of the United States purporting to give relief by surgery from symptoms incident to hypertension. Thoracolumbar sympathectomy is one of the spectacular new-style procedures.

The ophthalmologist is especially concerned (or was at least concerned yesterday) in this new life-saving phenomena, because it is necessary that he classify the fundus findings into the artificial and arbitrary grading of Keith and Wagener, who designated four grades of vascular disease.

If the arteriolar changes in the eyes of the patient are graded in the first two groups indicating a very mild or a mild-plus type of sclerosis without any hemorrhages, then the patient is a good risk for sympathectomy in one or two stages, the operation being subdiaphragmatic or transdiaphragmatic or combined subdiaphragmatic and superdiaphragmatic. The surgeon has his choice depending upon how much courage he has.

In recent months, sympathectomy for the relief of hypertension has been recommended to include all stages of retinal arterial disease, regardless of the experience and objections of the older ophthalmologists who know that young adults with hypertension, associated with explosive vascular changes and including fluid and cellular infiltration of the optic nerve, are doomed to live a very short life.

Smithwick was first inclined to confine sympathectomy to moderate grades of arterior changes in the retina. Bolder surgeons are claiming results in cases of advanced retinopathy.

Dr. Arthur Bedell delivered a very splendid paper at the Philadelphia College of Physicians on January 21, 1948, proving by case records that sympathectomy was a dangerous operation in patients exhibiting a retinopathy

having grades three and four of vascular and retinal changes. Despite this experience, it was brought out in discussion by two surgeons present that sympathectomy might be extended to advantage to all grades of retinal destruction.

In the June (1947) issue of the *Pennsylvania Medical Journal* is a report by John Wesley Shirer, Pittsburgh, indicating that there is a possibility of prolonging the life of patients regardless of the stage of vascular disease as found in the retina.

Recently I treated a woman for hypertensive retinopathy associated with choked discs of both eyes accompanied by multiple vascular ruptures. The medical consultant insisted upon a sympathectomy on the grounds that my patient, who is now 50 years of age, might live five years longer. I refuse to accede to his recommendation. The patient is still living and comparatively happy to date.

Another patient seen by me in the past month, a young man in his early forties, has a malignant hypertension accompanied by definite kidney damage and retinal changes of an advanced type showing edema of the discs and tremendous retinal hemorrhages and star figures. Much against my advice a sympathectomy was performed on the patient a few weeks ago. At this present moment he is convalescing and the outcome is guarded.

Several years ago, two cases of sympathectomy performed for retinitis pigmentosa were reported at the Philadelphia College of Physicians. One of these patients recently applied to me for certification for blind pension. One does not read much in the literature today about sympathectomy for retinitis pigmentosa.

In my student days there was a Dr. Janesco, a foreigner who came to this country to display his skill in the treatment of glaucoma by cervical sympathectomy. Of course no one performs this operation for glaucoma today. Spectacular surgery has its day in print like Cueism and Mesmerism.

The point of issue is that the ophthalmologists should not be easily persuaded by the surgeons to recommend surgical intervention in cases of hypertension of long standing with extensive retinal damage. Merely reducing the pressure for the patient by a serious surgical procedure at a time when that patient is critically ill is neither wise nor logical.

I doubt whether anyone wishes to live or to have death postponed when there is present a constant threat of hemiplegia, coronary disease, or renal disease developing at a later period, incapacitating him to a life of invalidism. Unless the patient can be given reasonable assurance of his ability to return to a normal way of feeling, thinking, and acting, then the surgeon should not recommend such a serious operation as sympathectomy which is but a temporizing procedure.

We older ophthalmologists should hold to our philosophic point of view that just living is not life. When surgeons give statistics to the effect that the patient may live five years or more, we oldsters, in turn, should ask whether that patient will live a normal life or merely live every day in fear that he may not be able to reach the other side of the street.

I wish to join with Dr. Bedell and all other ophthalmologists who have had years of experience in recognizing the inescapable and not reversible path of certain systemic diseases as reflected in the eyes.

Miraculous things are happening in medicine, but these are principally in the field of preventive medicine. No one wishes to discourage the young surgical scientist from trying something new, but at no time must he achieve that aim by hastening the end by one minute, or by prolonging life for five years or more, when that is attended by mental suffering.

He must not play with God.

(Signed) Louis Lehrfeld,
Philadelphia, Pennsylvania.

Appeal for donations of slitlamps and other instruments for China

Editor,
American Journal of Ophthalmology:

For the past several years a nationwide campaign has been carried on in China to combat trachoma. This is largely supported by the National Blind Welfare Association whose sister organization in the United States is the Institute for Chinese Blind, 156 Fifth Avenue, New York City. The former secretary of the campaign organization, Dr. Pang Hsien Chen, writes that the need for instruments and supplies is most urgent. Six centers and 21 full- and part-time clinics have been set up in Free China but such equipment as slitlamps, ophthalmoscopes, operative instruments, tonometers, microscopes, and so forth, are lacking. Accordingly, the Howe Library of Ophthalmology is acting as a clearing house for the sending of available material to China. It is hoped that those ophthalmologists, and others, who have used slitlamps or other ophthalmologic equipment which they care to part with for this purpose, will contact us and arrangements will be made, so long as funds for transportation become available, to send them to China. All communications should be addressed to Miss Jeanette Loessl, Howe Library of Ophthalmology, 243 Charles Street, Boston, Massachusetts.

(Signed) David G. Cogan,
Boston, Massachusetts.

BOOK REVIEWS

CLINICAL NEURO-OPHTHALMOLOGY. By Frank B. Walsh, M.D., F.R.C.S. (Ed.). Baltimore 2, Maryland, Williams & Wilkins Company, 1947. Clothbound, 1,532 pages, illustrated. Price, $15.00.

It is impossible to do justice to a 1,500-page text in a brief review. Naturally one could not read the whole of it without delaying the review unduly. It is understandable that such an ambitious undertaking as the composition of this treatise required 10 years as the author tells his readers in his foreword. Furthermore, the accomplishment over so long a period must have entailed frequent rewritings even before the book was finished because of new material available during that time.

Examination of the table of contents which in itself covers 15 pages reveals the wide scope of this book and the many ramifications which are included. The first 90 pages are devoted to the visual pathways; their anatomy; descriptions of lesions in various parts of these nerves and tracts and the resulting disorders. Chapter two, of 60 pages, covers the anatomy and pathology and topical diagnosis of the other cranial nerves that have some relation to vision.

Throughout the book there is a multiplicity of illustrative cases, perhaps the most fascinating part of a fascinating book. One gets started on a subject and can lay the book down only with great reluctance.

The wealth of material would be unbelievable if it were not realized that, because of the size and importance of the Hopkins group of hospitals, much of the most unusual clinical material in our country finds its way through those doors.

The chapter on "Infections and Parasitic Invasions of the Nervous System and Their Ocular Signs, Including an Outline of Nervous System and Ocular Syphilis" covers almost 200 pages, the latter "inclusion" occupying about 80 pages. The frequent mention of numbers of pages is cited to impress upon the mind the completeness of this textbook, and it must be taken into account that the convenient two-column form is used, the pages are large, and the print easy to read. Many beautiful illustrations help to clarify and dramatize the text. Most of these cuts are from photographs although there are also excellent line cuts.

As is to be expected, "Tumors and Related Conditions" cover about one sixth of the book. The Johns Hopkins Hospital has been

traditionally a Mecca for the study and treatment of intracranial neoplasms since the pioneering work of Cushing and his famous successor, the late Dr. Dandy, has attracted there an abundant wealth of this material.

The reviewer is impressed with the extensive references. The author obviously did an enormous amount of collateral reading to make the book different from other texts on this subject. This and his own personal observations make the book a pleasantly intimate one.

The principal adverse criticism has chiefly to do with the size and weight of the book which is very difficult to handle. One keeps asking himself why not the same material in two volumes.

There is an excellent index of over 100 pages, the compilation of which alone must have required endless hours.

In summary, this is a wonderful reference book and, in addition, is so interestingly written that many pleasant hours can be spent rambling through its pages with only the thought of diversion.

Lawrence T. Post.

TRANSACTIONS OF THE OPHTHALMOLOGICAL SOCIETY OF AUSTRALIA. Volume IV, 1944, and Volume V, 1945.

After three years the Ophthalmological Society of Australia has again published a record of its meetings. In a group of essays various aspects of industrial ophthalmology are discussed. E. C. Black records some observations on the eye injuries of railway employees and considers methods of preventing them. L. D. Wright and A. L. Tostevin call attention to the importance of lighting in eyesight conservation.

Several papers deal with tropical ophthalmology. It is pointed out that there is an increased incidence of herpes-simplex keratitis in a population heavily infected with malaria but that there is little likelihood of precipitating a dendritic ulcer in a single case of therapeutic malaria.

J. Bruce Hamilton contributes an important analysis of tuberculous lesions of the eye. Among others, phlyctenulosis, Eales's disease, and heterochromic cyclitis are supposed allergic tuberculous eye infections. Three contributions add further clarity to the problem of congenital defects in infants following maternal rubella. An extensive and valuable analysis of crossed cerebral dominance is contributed by J. Ringland Anderson and Celia Weigall. Problems arise from the presence of a master hand and a master eye on opposite sides, and understanding of this condition is of the greatest importance in the management of diplopia and strabismus. The entire essay should be read.

In Volume V of the year 1945, C. G. McDonald contributes a comprehensive discussion of diseases of the arteries and their relationship to the eye. A table of salient facts makes perspicuous the corresponding names in pathologic classification, clinical classification, and clinical manifestation. This long discussion holds little that is not well known to the ophthalmologist about the fundus but presents with the utmost clarity the knowledge of internal medicine which is of the greatest use to the ophthalmologist in understanding processes of which he himself observes only a part.

The remainder of the volume consists of short interesting essays on a great variety of topics. There are several papers on phases of cataract extraction, one on ocular manifestations of malnutrition in returned prisoners of war, one on toxoplasmosis, one on sarcoidosis, and one on traumatic monocular glaucoma. The author of the last-named reports 18 cases and believes it to be a clinical entity which is conspicuously absent in ophthalmologic literature.

F. H. Haessler.

TRANSACTIONS OF THE SOCIÉTÉ BELGE D'OPHTHALMOLOGIE. No. 2. Jubilee meetings of September 28, 29, and 30, 1946, pp. 1-175.

This memorial volume opens with a short history of the Société Belge d'Ophthalmologie and its most famous members. It also contains many interesting and original papers. M. Alaerts reports on the human eye in the works of art. In discussing several of the most famous paintings, the author demonstrates the importance of the positions of the eyeballs, the lids, and their surroundings and stresses the variations in the expression of the face by making the most minute changes in the position of any of those structures. These facts are especially instructive for surgeons who not only intend to correct deformities or vicious scars but who also try to give to their patients a pleasant appearance, more compatible with their social life.

Beauvieux discusses the apparent blindness of the new-born, the gray pseudo-atrophy of the optic nerve. The author considers it to be a transitory congenital malformation, namely, a late development of the myelin-sheaths of the optic pathways. The prognosis is much more favorable than that of permanent blindness in retinal atrophy, which has comparatively small disc changes or disseminated chorioretinitis of syphilitic origin.

F. W. Law (London) reports on ophthalmic experiences and achievements during the war years. Zeeman describes his investigations of disturbances of the posterior ciliary arteries. Amsler emphasizes the increasing importance of diagnostic anterior-chamber paracentesis, the chemical and cytologic examination of the aqueous, the fluorescein test, and the quantitative grading of the Tyndall-phenomenon in clinical work. Those tests, although still incomplete, should lead to a better knowledge of the inadequately known vegetative functions of the eye.

G. Renard reports three case histories on sympathetic ophthalmia cured by subconjunctival injections of a 33-percent solution of a sulfonamide in increasing doses. E. Wolff recommends daylight in slitlamp examinations of precorneal films. G. P. Sourdille discusses such technical details in corneal transplants as retrobulbar alcohol injection in hypertension, iridectomy to prevent secondary adhesions, and the advantages of a light-weight trephine. H. Mantiulio surveys his and other authors' experiences on nicotinic acid as a retinal vasodilator.

Mme. S. Schiff-Wertheimer and Le Menn studied the relationship of retinitis proliferans and retinal detachment and they distinguish three different groups which not only differ in their clinical picture but also in their reactions to surgery and to clinical and anatomic cures. G. Renard presented four patients with central retinitis, apparently of tuberculous origin, characterized by the delicacy of the retinal lesions, the severe disturbance of vision, and the complete spontaneous recovery.

Alice R. Deutsch.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

5

DIAGNOSIS AND THERAPY

Cattaneo, D., and Carlevaro, G. **An ophthalmodynamometer for the measurement of the pressure in the ciliary vessels.** Ann. di ottal. e clin. ocul. 72:711-718, Dec., 1946.

The instrument described and pictured is like the familiar impression tonometer in general construction and appearance. The aluminum plunger works against two opposing springs so adjusted that the curve of variation for the different weights is as rectilinear as possible. This system of compensating springs makes it possible to shift the range of measurement, which is about 50 mm. Hg, to the interval required in the individual case. Instead of the footplate of the tonometer there is a totally reflecting prism, the surface of which measures about two square millimeters and is slightly curved to fit the sclera. With the aid of a loupe the examiner may observe the obliteration of the blood column in the vessels when the prism is applied to the eye. The instrument may also be used for measuring the pressure in the retinal vessels.

Seidel's and Duke-Elder's observations with respect to ophthalmodynamometry are reviewed, and an attempt is made to establish criteria for evaluation of the measurements obtained.

Harry K. Messenger.

Clark, W. B. **Local use of "sulfamylon" (Para-[aminoethyl]-benzene sulfonamide hydrochloride).** Arch. Ophth. 38:682-683, Nov., 1947.

Clark reports favorably on the use of "sulfamylon" in controlling contaminations with B. pyocyaneus. In no case was a sensitivity to the drug encountered.

R. W. Danielson.

Gilbert, W. **The prophylaxis and treatment of expulsive hemorrhage.** Klin. Monatsbl. f. Augenh. 112:149-156, 1947.

General and local lesions in the blood vessels and hypertension of at least 180 mm. predispose to expulsive hemorrhage. These conditions are frequently combined with high myopia and sometimes with other abnormalities of the eye such as corneal opacities or glaucoma. The danger lies in the opening of the vascular channels as well as in the sudden release

of the intraocular pressure. The author advises a preparatory iridectomy and venesection immediately before the cataract operation itself. The second eye of a patient who lost one eye through expulsive hemorrhage may be trephined prophylactically in the equatorial region of the bulbus. Posterior trephining in combination with venesection and a large conjunctival flap may sometimes save an eye that is undergoing an expulsive postoperative hemorrhage. Most eyes are, however, lost and prophylaxis is the most important factor. (20 references.)

Max Hirschfelder.

McGuire, W. P. **A corneal scissors.** Am. J. Ophth. 31:217, Feb., 1948.

Selinger, Elias. **Iontophoresis with contact lens type and eyecup electrodes.** Arch. Ophth. 38:645-653, Nov., 1947.

Selinger discusses the theory of ion transfer and the technique of using his instrument. In order to drive the proper ions into the tissues, one should know whether one wants to carry the ions with the positive or with the negative electric charge. The electrodes are then arranged in such a way that the flow of the current is through the tissues of the eye toward the indifferent electrode held in the hands.

A list of drugs arranged according to the polarity of the electrode to be used is given. Since iontophoresis causes a concentration of ions in the tissues and also prolongs the action of drugs, only weak solutions should be used. The following concentrations of the drugs have been found effective by different authorities: penicillin, 1,000 Oxford units per cc.; sulfonamide drugs, 5 percent; atropine, 0.25 percent; pilocarpine, 0.1 percent; acetylcholine, 1:400; quinine salts, 0.5 percent; calcium salts, 0.5 percent; epinephrine, 1:20,000; zinc sulfate, 0.25 percent.

R. W. Danielson.

Valerio, Mario. **Advantages of the combined use of heparin and dicumarol in the treatment of thromboses of the retinal veins.** Ann. di ottal. e clin. ocul. 72:719-725, Dec., 1946.

Heparin acts rapidly and briefly, and must be given intravenously. The action of dicumarol is preceded by a period of latency but is prolonged. Dicumarol may be given orally, and is much more economical than the very costly heparin. By the combined use of the two a maximal effect can be obtained promptly, and the required concentration of prothrombin in the blood can be maintained more readily than by the use of either drug alone.

Anticoagulant therapy is the treatment of choice in thromboses of the central retinal vein, but the dosage must be carefully regulated and the treatment prolonged. Treatment must be started early if good results are to be expected and sometimes should be supplemented with roentgenotherapy.

Harry K. Messenger.

6

OCULAR MOTILITY

Ambrose, Anthony. **Diagnostic muscle chart for determination of tropias, phorias, diplopia and muscle action.** Arch. Ophth. 38:681, Nov., 1947.

A chart is presented for use in the determination of tropias, phorias, diplopia and extraocular muscle action.

R. W. Danielson.

Berke, R. N. **Tenotomy of the superior oblique muscle for hypertropia.** Arch. Ophth. 38:605-644, Nov., 1947.

Berke discusses the operations that have previously been devised for relief from overaction of the superior oblique, and concludes that the condition is best treated by tenotomy or tenectomy of the offending muscle. This operation is best done under Tenon's capsule on the nasal

side of the superior rectus according to the technic here described. For adults local anesthesia is sufficient. For children a general anesthesia is necessary. Simple tenotomy will produce from 5 to 10 degrees of correction. A tenectomy will produce from 10 to 30 degrees of correction, depending on the amount of tendon removed and the amount of overaction present. This operation does not produce paralysis if the sheath is not severed with the tendon.

In the past nine years, 20 tenotomies or tenectomies were done on 13 consecutive patients. In none of these patients was a discernible weakness of the superior oblique muscle produced. In four out of ten tenotomies the tendons were presumably incompletely severed and the results were unsatisfactory. In all the tenectomies the result was good. (13 case reports are given.)

R. W. Danielson.

Candler, R. G. **The response of personnel affected by head injury to orthoptic treatment. Tr. Ophth. Soc. U. Kingdom** 65:57-63, 1945.

The author states that experience supports the view that orthoptic treatment provides a helpful background for recovery in defects of convergence and accommodation. The psychological approach which is possible with the treatment provides valuable help in the restoration of visual confidence for those patients with temporary paresis of extrinsic ocular muscles. Beulah Cushman.

7

CONJUNCTIVA, CORNEA, SCLERA

Almeida Reboucas, J. **Corneal ulcer from diplobacillus liquefaciens (Petit).** Rev. brasil. oftal. 6:87-99, Dec., 1947.

After describing the characteristics of this organism, the author relates a clinical case in a man of 27 years. A corneal ulcer was successfully treated with subconjunctival injection of penicillin dissolved in a 2-percent solution of novocaine, supplemented with 7-percent sodium sulphathiazole and 5-percent ointment of the same drug. The author distinguishes the Petit diplobacillus from the Morax-Axenfeld. With the former, corneal ulcer is always primary. The organism liquefies gelatin, grows abundantly on plain agar at ordinary temperature, and does not produce acid with the sugars. (References.) W. H. Crisp.

Bietti, Giambattista. **Results of penicillin therapy of trachoma.** Boll. d'ocul. 26: 209-226, April, 1947.

One hundred and fifteen patients received calcium or soduim penicillin, most of them an ointment containing 500 to 1000 Oxford units per gram, which was applied 4 to 12 times each day. Previous to, and during the medication, scrapings from the conjunctiva were searched for inclusion bodies and for evidence of secondary infection. The latter disappeared within 2 to 4 days after therapy started; the trachoma bodies took longer to disintegrate. The patients felt a definite relief after 24 hours; the conjunctival discharge regressed before the sixth day. Papillary hypertrophy and the typical granules receded slowly. Frequency of application enhanced the amelioration. In 43 cases of fresh trachoma, complete or almost complete healing was observed after 135 to 200 days of treatment. General treatment with sulfa drugs was followed by improvement in 10 patients of this group when penicillin had failed. For corneal complications penicillin was superior to the sulfa drugs. Xerophthalmia was favorably influenced as long as the therapy lasted. No untoward reactions were encountered in the whole group.

The prophylactic significance of this treatment is stressed. (5 photomicrographs.) K. W. Ascher.

Colenza, Domenico. **Marginal degeneration of the cornea.** Boll. d'ocul. 26:254-269, April, 1947.

Two cases of marginal corneal dystrophy, one of them coincident with a unilateral herpes zoster are reported. This lead the author to assume a neurodystrophic etiologic factor to explain this rare degenerative corneal disease. (Extensive bibliography.) K. W. Ascher.

Giardini, Aniceto and Farina, Luigi. **Conjunctival microsporid in the course of inflammatory cutaneous microsporia.** Ann. di ottal. e clin. ocul. 72:690-698, Nov., 1946.

The authors describe an acute conjunctivitis in the left eye of a 9-year-old girl who for two months had had an inflammatory microsporia on the back of her right hand. The conjunctivitis was characterized by typical lymphatic follicles localized predominantly in the lower cul-de-sac and by vesicles and hypertrophied papillae on the upper tarsal conjunctiva. Numerous eosinophils were found in smears, but no fungi or pathogenic organisms in either smears or cultures. Inclusion bodies were sought but not found. Microsporum lanosum was recovered from the lesion on the hand. A subcutaneous injection of trichophytin produced a generalized reaction, a focal reaction at the seat of the skin lesion, and a marked accentuation of the conjunctival manifestations. A second injection (for therapeutic ends) was followed in addition by a conjunctivitis in the right eye, which previously had been normal.

The skin lesion regressed under local treatment and with subcutaneous injections of trichophytin, and healed within twenty days. The ocular lesion also regressed, but a little more slowly. The eye was normal after forty days. It had received no local treatment other than irrigations with physiologic salt solution twice a day.

On the basis of the data pertaining to this case and of the very few similar cases reported in the literature the authors regard the conjunctival lesion as a microsporid, that is, a localized manifestation of an allergic state directly dependent on a mycotic focus in the skin.

Harry K. Messenger.

Katzin, H. M., and Kuo, P. K. **Histologic study of experimental corneal transplantation.** Am. J. Ophth. 31:171-190, Feb., 1948. (16 figures, 2 tables, 47 references.)

Law, Frank W. **Treatment of corneal nebulae by contramine.** Tr. Ophth. Soc. U. Kingdom. 65:173-179, 1945.

The author reports on the experimental work that Col. W. W. Jeudwine had carried out before his death. The work was so nearly completed that it was considered wise to report the results.

Contramine is the carbon disulphide product of di-ethylamine. The drug acts by virtue of its sulphur atom which has the effect of dispersing protein which has undergone the abnormal chemicophysical changes of dehydration and rehydration. The dispersion effected has an influence in causing the dissolution of fibrous tissue in the process of formation. The action is stated to be directly upon the protein in the blood, which is contracted and causes a diminution or disappearance of the lesions and manifestations. The preparation is toxic if the protein becomes overcontracted as a result of overdose.

Treatment is carried out with a small dose of 0.025 gm. to 0.125 gm. Six weekly injections constitute a course and four courses were given with an interval of

three months between courses. Twenty-five patients were treated and a table of the vision before and after treatment is included.

Six patients with recent corneal nebulae showed definite improvement and five of the nineteen with long standing conditions showed definite improvement, seven showed no improvement, five showed an improvement of one line, three of two lines and one of three lines on the Snellen chart.

The author concludes that the cases presented are not truly relevant but do provide adequate reasons for further trial. (2 tables.) Beulah Cushman.

Lordan, J. P. **Ophthalmological progress: sight restoration by corneal transplant.** California Med. 68:90-94, Feb., 1948.

The author surveys the early literature on the subject and reviews the present knowledge. The advantages of the different methods of keratoplasty are summarized and the technique of handling donor tissue is described. The establishment of eye banks has greatly facilitated the procurement of suitable graft material. O. H. Ellis.

Nairac, M. L. **An unusual case of symmetrical, bilateral, non-traumatic iris prolapse.** Brit. J. Ophth. 31:700-702, Nov., 1947.

On the Island of Mauritius, a young Negro woman complained of a sudden burning pain in the right eye followed by a fluid discharge. The following day the left eye became similarly affected. Pain and photophobia were intense. She was first seen two weeks later when each eye presented a large staphyloma in the upper quadrant. The pupils were irregular and drawn up. There were no signs of injury or even of any inflammation. The pupils dilated well to atropine. After cauterization with the electric cautery (the left bleb ruptured during the process) and covering the defects with thick conjunctival flaps healing occurred uneventfully. The most probable etiological explanation is that acute conjunctivitis with corneal ulcers was present and that these were ruptured by blepharospasm and rubbing. The curious aspect was the absolute symmetry of the lesions.

Morris Kaplan.

Rosso, Silvio. **Retrobulbar alcohol injections: indications, therapeutic action, and possible applications in postoperative complications of keratoplasty.** Ann. di ottal. e clin. ocul. 72:671-678, Nov., 1946.

Because of an early iritic reaction (photophobia, lacrimation, ciliary injection) following keratoplasty a patient was given a retrobulbar injection of 40 percent alcohol about ten days postoperatively. The irritation was relieved, and about three weeks later when the bandage was removed the cornea was clear; two months later the vision was nearly 10/10.

Another patient, who had previously had an unsuccessful keratoplasty, underwent a second operation of the same kind. For two weeks the transplant remained clear, but then became cloudy, and there was a rise of ocular tension. Two retrobulbar injections of 60 per cent alcohol were given at an interval of 12 days, and six weeks later the transparency of the graft was satisfactory.

An alcohol injection gives rise to anesthesia or hypesthesia, vasodilatation, and hypotension, alters the osmotic pressure of the blood and of the tissues, and causes dehydration. If injected into the region of the opticociliary nerves the alcohol causes temporary lowering of the ocular tension. Likewise vasomotor reactions produced by alcohol seem to mobilize those histiocytic elements which participate actively in the repair of corneal lesions. Because of the sedative effect of the alcohol the graft is exposed to less risk.

The strength recommended is 40 percent and one cc. is considered sufficient.

Harry K. Messenger.

Sydenstricker, V. P., Hall, W. K., Bowles, L. L., and Schmidt, H. J. **The corneal vascularization resulting from deficiencies of amino acids in the rat.** J. Nutrition 34:481-487, Nov. 10, 1947.

Rats of the Wistar strain were divided into control and deficiency diet groups. Quite regularly the first sign of ocular reaction to deficiency of amino acids or of protein is congestion of the scleral conjunctiva and engorgement of the limbal plexus. Following soon after this is slight thickening and diffuse corneal clouding, probably due to edema. Capillary "sprouts" shoot from the marginal limbal vessels. Diffuse nebular corneal opacities were seen in some. Phenylalanine, violeucine, threomine, valine, and arginine deficiency diets resulted in vascularization of the cornea. Protein-low diets in which any one of the ten essential vitamins is absent may result in vascularization of the cornea in the rat. F. M. Crage.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Esente, Ivan. **On a case of a mesodermal cyst of the iris in an eyeball with a previous perforating wound of the cornea.** Ann. di ottal. e clin. ocul. 72:597-609, Oct., 1946.

A case of a serous mesodermal cyst of the iris in the right eye of a 39-year-old man is described. Four years before the cyst was discovered the cornea of the affected eye had suffered a small perforating wound in the part overlying the cyst. Pathologic examination showed that both the inner and outer walls of the cyst were lined with endothelium, hence its truly mesodermal nature. For an explanation of the pathogenesis of the cyst Esente favors the theory of Hosch (1874), according to which trauma may result in obstruction of a crypt of the iris and thus cause a retention cyst, especially, adds Esente, in an eye such as this, which was genetically imperfect, as shown by extensive congenital pigment deposits on the anterior capsule of the lens and by the anomalous ("spherular") character of the pigment border of the iris.

The literature of iris cysts and their pathogenesis is reviewed at length.

Harry K. Messenger.

Kennedy, Robert E. **Cystic malignant melanomas of the uveal tract.** Am. J. Ophth. 31:159-167, Feb., 1948. (13 figures, 2 tables, 6 references.)

Moulton, E. C., and Moulton E. C., Jr. **Leiomyoma of the iris.** Am. J. Ophth. 31: 214-217, Feb., 1948. (2 figures, 8 references.)

Taliercio, A. **A case of iridocyclitis and optic neuritis from a focus of infection in the appendix.** Ann. di ottal. e clin. ocul. 72:663-670, Nov., 1946.

A 26-year-old agricultural worker had suffered for a year with severe and painful iridocyclitis that had resisted all treatment. Because of attacks of right-sided abdominal pain a diagnosis of chronic appendicitis was made, and an appendectomy was performed. Ten days later the eye was strikingly improved. Pain and tenderness had disappeared, the circumcorneal injection was much less, and a great part of the exudate in the anterior chamber had been absorbed. Previously the entire lower half of the cornea had been covered with thick lardaceous exudates. The fundus could now be seen for the first time, and it was noted that the optic disc was hyperemic and had blurred margins. Three weeks later the iridocyclitis was inactive, and the hyperemia of the disc had given way to pallor.

There can be no doubt of a causal relation between the appendicitis and the

ocular inflammation. The question of focal infection in general is reviewed, with particular reference to the work of Rosenow and his followers. It seems probable to Taliercio that the disease of the eye is due not to the presence of bacteria in the ocular tissues but to bacterial toxins with an elective tropism for ocular tissues. Harry K. Messenger.

Unger, Kuno. **Neurofibromatosis iridis. (Recklinghausen's disease).** Arch. Ophth. 38:654-659, Nov., 1947.

Two cases of neurofibromatosis involving the iris are reported with a short discussion of the disease in general.

R. W. Danielson.

Yen, Chen. **Concerning choroiditis proliferans.** Am. J. Ophth. 31:207-208, Feb., 1948. (2 figures.)

9

GLAUCOMA AND OCULAR TENSION

Comberg, W. **Mydriatics in the treatment of glaucoma.** Klin. Monatsbl. f. Augenh. 112:134-135, 1947.

Atropine and scopolamine may relieve the pain in blind or nearly blind eyes with absolute glaucoma. One can disregard the effect of the medication on the intraocular pressure. The relief from pain is due to a relaxation of the iris and a complete immobilization of the sphincter.

Max Hirschfelder.

Denig, R. **The restitution of the outflow from the anterior chamber by iridotorsion in primary glaucoma.** Klin. Monatsbl. f. Augenh. 112:97-99, 1947.

The author discusses certain aspects of his iridotorsion. The proper incision and a special spatula knife are described. It is stated that the opening in the sclera (1 mm. high and 3 mm. long) prevents the plugging of the filtering hole with iris tissue. The danger of prolapse of vitreous and ciliary body is less than in the sclerectomy of LaGrange. Denig also prefers iridotorsion in acute glaucoma.

Max Hirschfelder.

Denig, R. **Needle diathermy and its significance for sympathetic ophthalmia.** Klin Monatsbl. f. Augenh. 112:99-103, 1947.

The article reviews the history of diathermy puncture of the ciliary body from the early operation with Paquelin cautery of Fiore to the recent diathermy cautery of Strebel and Vogt. Animal experiments to investigate the mode of action of needle diathermy have never resulted in a permanent lowering of the intraocular pressure, chiefly owing to the fact that the vasomotor psychoreflex is primitive in animals. This lack of a strong psychoreflex with accompanying strong sympathetic reactions also explains the absence of primary glaucoma and sympathetic ophthalmia in animals. Needle diathermy destroys the vasomotor capillary nerves and in human beings extinguishes the sensory vasomotor reflex and psychoreflex. This results in a lowering of the intraocular pressure and, in secondary glaucoma, benefits the cyclitic inflammation. These considerations favor Vogt's diathermy puncture. According to the author's theory an undamaged uveal prolapse merely produces a glaucoma because of constant stimulation of the sensory vasomotor reflex which may possibly be increased through an exaggerated psychoreflex. In contrast, constant stimulation of a damaged and torn uveal prolapse leads by means of the vasomotor psychoreflex through direct reaction to a chemotactic inflammation which may involve the second eye in a sympathetic ophthalmia through an indirect reaction. The application of several diathermy punctures in both eyes should be helpful in sympathetic ophthalmia and should act by a depression of vasomotor reflexes and sympathetic reactions. Diathermy punc-

ture is not the surgery of choice for ordinary glaucoma. There are too many unknown factors such as the number of the destroyed capillaries, the variable behavior of the vasomotor psychoreflex, the impossibility of its destruction through the punctures: The procedure is indicated only in absolute malignant hemorrhagic glaucoma and in aphacic glaucoma.

Max Hirschfelder.

Gerard, R. **Contribution to the study of incomplete glaucoma.** Arch. d'opht. 7: 511-520, 1947.

Gerard states that the classical conception that increased intraocular pressure is primary in glaucoma, and that all symptoms are derived from this hypertension, must be abandoned. He refers to the new conception, introduced by R. Weekers, of incomplete glaucoma in which glaucoma without hypertension is one of the most typical forms. He reports five examples of this form and states that the pupillary alterations, field defects, and excavations of the disc are characteristic and differ essentially from the symptoms of optic atrophy. He states that the nerve changes noted in glaucoma without hypertension are not due to compression of the nerve by sclerosed intracranial vessels. Gerard concludes that chronic simple glaucoma results from alterations in the intraocular blood vessels. The article is documented by numerous visual field studies.

Phillips Thygeson.

Günther, G. **The intraocular pressure in absolute primary glaucoma.** Klin. Monatsbl. f. Augenh. 112:124-133, 1947.

The behavior of the intraocular pressure in 60 cases of primary absolute glaucoma was investigated. The tension curve showed the normal variation of higher night values in 56 percent of the untreated cases. In 36 percent the curves did not follow any regular pattern, and 8 percent had a continually high tension. The other eye of the same patient followed the normal pattern in 66 percent of the cases. The amplitude between highest and lowest tension was 10 mm. or less in one third, 20 mm. in another third with over 20 mm. in one fourth of the cases. These values were established during a twenty-four hour period. Medication with miotics leads to greater variations in the daily curve. Parallelism of the tension curve in the two eyes occurred in one half of the cases, but was sometimes lost after surgery. Cases of absolute glaucoma with pressures of less than 40 mm. responded well to miotics, whereas a return to normal values was rare whenever the initial tension ranged between 50 and 100 mm. Only one quarter of the patients with an eye blind from primary glaucoma had had adequate and correct treatment. Proper treatment could, in the author's opinion, have prevented blindness in at least 25 out of the 60 eyes and would have had a possible chance of success in 21 others. Early diagnosis and treatment are of paramount importance.

Max Hirschfelder.

Mügge, F. **Trephine-cyclodialysis as operation for primary glaucoma.** Klin. Monatsbl. f. Augenh. 112:104-113, 1947.

Trephine-cyclodialysis was first described in 1934 by Sallman and is, in the experience of the author, more efficient than the usual antiglaucoma operations. The operation opens the way for drainage of aqueous into the subconjunctival space. The trephine opening is made 7 to 8 mm. from the limbus in the lower outer sclera. With the patient in sitting position during the postoperative period any possible hemorrhage will drain readily through the trephine opening. A 1.5 or 2.5-mm. trephine is used. The cyclodialysis involves one-third of the total iris root. The article reports successful results in 82 percent of 28 cases, compared to only 50 percent with the Elliot trephine which

was, however, done, in more unfavorable cases. Permanent results and no postoperative infections are claimed. The theory of cyclodiathermy puncture is discussed. Mügge believes that it has an irritative influence on the secretory function of the ciliary body and that it increases the flow of aqueous. He believes that the procedure should be reserved for painful secondary glaucoma.

Max Hirschfelder.

Radnót, M. **The effect of testosteron preparations on the intraocular pressure.** Ophthalmologica 114:168-171, Sept., 1947.

Injections of a testosteron preparation named Androfort raised the ocular tension in three patients with chronic simple glaucoma.

Peter C. Kronfeld.

Toledo, Renato de. **Propedeutics of glaucoma.** Arq. brasil. de oftal. 9:101-120, 1946.

The author devotes twenty pages to a general review of the subject under various headings, including day and night variations in tension, provocative tests, gonioscopy, and clinical records. He includes a printed form of record to be used in the accumulation of clinical data.

W. H. Crisp.

10

CRYSTALLINE LENS

Alger, L. J. **Use of absorbable corneoscleral sutures in cataract surgery.** Arch. Ophth. 38:665-667, Nov., 1947.

Alger reports favorable on the use of 0000 plain surgical gut for corneoscleral sutures in cataract surgery.

R. W. Danielson.

Duverger, C., and Brégeat, P. **Some details on the intracapsular extraction of cataract.** Arch. d'opht. 7:379-389, 1947.

The authors describe their technique for intracapsular extraction. They dilate the pupil with adrenalin, administered subconjunctivally, just before operation. They use cocaine for topical anesthesia and procaine for Van Lint akinesia and retrobulbar injection. A superior rectus suture and Pley speculum are then employed. Incision with conjunctival flap is made with keratome and enlarged with scissors to the extent of one-half the circumference of the globe. A single peripheral or ordinary iridectomy is made after a single security suture has been placed at 12 o'clock.

For extraction they use the Green forceps, grasping the lens near the equator and making counter pressure with the Arruga or Daviel spoon. The rupture of the first zonular fibers below is made by lateral movements with the forceps. If the capsule should tear, traction is continued and the operation completed as an extracapsular extraction. If the complication of vitreous loss occurs, the peripheral iridectomy is always converted into a complete iridectomy except when the vitreous is entirely fluid. After the single security suture has been tied, the iris is replaced and additional sutures are then placed on each side and tied in half knots. Eserine and penicillin or a sulfonamide solution are then instilled and a monocular dressing applied. On the following day, daily instillations of 1-percent atropine sulphate solution are begun. The patients become ambulatory on the sixth or seventh day.

The authors stress particularly the advantages of keratome incision and enlargement of the wound with scissors.

Phillips Thygeson.

Hughes, W. F. and Owens, W. C. **Postoperative complications of cataract extraction.** Arch. Ophth. 38:577-595, Nov., 1947.

This paper is a very instructive report of a study that has been made of the causes, treatment and prognosis of complications following cataract extraction in

2,086 cases at the Wilmer Ophthalmological Institute. R. W. Danielson.

Kirby, D. B. **Intracapsular surgery of dislocated and subluxated lenses. Suture methods. Results of intracapsular surgery.** Rev. brasil. de oftal. 6:61-72, Dec., 1947.

This is a translation into Portuguese of the author's summary of an address regarding his special technique for dealing with resistant zonules. A summary of results in one hundred cases is included. W. H. Crisp.

11
RETINA AND VITREOUS

Appelmans, M. **Angiomatosis of the retina in the child.** Arch. d'opht. 7:489-510, 1947.

The author reviews the history of von Hippel's disease and refers to Charles Deval's description of it in his textbook published in 1862 and entitled, "Traite theorique et pratique des maladies des yeux." This was before the development of the ophthalmoscope and it was not until 1882 that E. Fuchs described the ophthalmoscopic appearance of the disease. Appelmans reports a case in a boy of four years. The right eye developed strasbismus at the age of two, and at four years of age the father noted a metallic reflex in the pupil. Ophthalmoscopic examination revealed a lobulated grayish vascular tumor of the retina with numerous white and yellow spots scattered over the surface. The left eye was normal. The tumor increased in size steadily over an observation period of two years. The blind eye was enucleated and microscopic study showed a complete detachment of the retina with a capillary angioma infiltrating the inner layers. Foci of glial proliferation were disseminated widely.

Appelmans discusses in detail the differential diagnosis, both clinical and microscopic, of this tumor from retinoblastoma, pseudoglioma, and Coats's disease. He notes that angiomatosis becomes bilateral in more than half of the cases and that the menace of cerebellar, medullary, and visceral lesions may continue until as late as the forty-fifth year. He notes the congenital and hereditary nature of the disease. Phillips Thygeson.

Ayres, Francisco. **Classification of the ophthalmoscopic pictures of arterial hypertension.** Arq. brasil. de oftal. 9:120-125, 1946.

This is a brief summary of the various "signs" of hypertension in the ocular background. W. H. Crisp.

Baillart, P. **Retinal hypotension.** Ann. di ottal. e clin. ocul. 72:705-710, Dec., 1946.

A diagnosis of retinal hypotension is made when application of the ophthalmodynamometer to the eye with a weight of less than 25 grams produces pulsation in the retinal arteries. In retinal hypotension, if the difference between the diastolic and systolic pressures is small, the blood stream does not have sufficient force to overcome the capillary resistance, and the hydrostatic pressure is insufficient to permit the normal metabolic exchanges between the blood and the tissues. The ocular symptoms, which are on the basis of local syncope, include the sensation of black spots before the eyes, transitory episodes of blindness, and accommodative and retinal asthenopia, which makes prolonged use of the eyes very trying. Failure of the capillary circulation may lead to loss of conductivity or even eventual atrophy of the nerve fibers. Gunn's dots in the macula are often associated with retinal hypotension, and closure of the central retinal vein may be due to a local hypotension or at least to a circulatory deficit. Sometimes the effects of retinal hypotension are mistaken for those of angiospasm, which likewise produces retinal anemia, but the con-

dition is only aggravated by the use of vasodilators, which are contraindicated in retinal hypotension.

Therapy is ineffectual but recognition of retinal hypotension clarifies certain functional disturbances and warns of possible threats to vision.

Harry K. Messenger.

Busacca, A. **The appearance of the normal fundus studied by the stereo-ophthalmoscope.** Arch. d'opht. 7:361-378, 1947.

Busacca employed the contact and glass and slit-lamp of Goldmann to study the fundus of the normal eye. He states that the technique is simple and that the examination can be made a routine clinical procedure. With pupils fully dilated it is possible to study an area having a radius of six disc diameters from the fovea centralis. Busacca used a magnification of 9.5 diameters.

The stereoscopic details of the normal macular region in adults of various ages are described and illustrated with drawings in black and white and in color. The author states that stereo-ophthalmoscopy is the only satisfactory method for a minute study of the details of the fovea centralis which he describes in minute detail. He compares the ophthalmoscopic findings with the histologic details and this adds considerable interest and value to his exposition. He notes that with stereo-ophthalmoscopy it is possible to distinguish in the fundus a series of surfaces and layer which enables one to estimate the depth and character of pathologic lesions. Phillips Thygeson,

Campos, Raffaele. **Detachment of the vitreous and detachment of the retina.** Ann. di ottal. e clin. ocul. 72:679-689, Nov., 1946.

Campus reports his study of detachment of the vitreous in 28 patients with unilateral detachment of the retina. For examination of the vitreous he used a modified slit lamp with an arc light and Lindner's angulated microscope. In place of a contact lens (with its obvious disadvantages) for eliminating the refractive power of the cornea he adopted Hruby's suggestion of using a plano-concave lens of 55D, worn by the patient in a trial frame. Such a lens has a useful surface of 20 mm., and for examining the vitreous in detail at various depths weaker minus lenses can be substituted for it.

In five patients, between 20 and 47 years of age, either emmetropic or with myopia not exceeding 1.25D, he found no detachment of the vitreous either in the sound eye or in the eye affected with detachment of the retina.

In another group of 5 patients, 55 to 65 years of age either emmetropic or with myopia not exceeding 6.00D he found a slight detachment of the vitreous in all the affected eyes and a very marked detachment of the vitreous in the sound eye of three of these patients.

In 18 patients, 19 to 57 years of age, with high myopia (7.50-22.00D) he found a slight detachment of the vitreous in nearly all the eyes affected with detachment of the retina, whereas there was a complete posterior detachment of the vitreous in the sound eyes in almost every case. Campos calls it a "curtain-like" detachment because the posterior portion of the hyaloid membrane is hung like a curtain at some distance in front of the retina.

From these assembled data it is inferred that in detachment of the vitreous the fundamental factors are age and high myopia rather than detachment of the retina. There is no parallelism in the degree of detachment of the one and of the other; in fact, it can be said that highly myopic eyes with a "complete" detachment of the vitreous are less likely to suffer detachment of the retina than those eyes with only a slight detachment of the vitreous or none at all. Hence the presence of a "complete" detachment of the

vitreous in a highly myopic eye is of good prognostic significance. The fact that detachment of the retina in these cases is usually associated with slight rather than with extensive detachment of the vitreous confirms the theory of Gonin-Lindner regarding the importance of adhesions between vitreous and retina in the genesis of retinal tears: the vitreous by its inertia, when the eye is rotated, exerts traction upon the retina at points of adhesion. When the vitreous is not adherent there is no traction, and hence no tear or detachment of the retina.

After operation for reattaching the retina the detachment of the vitreous was generally greater than before. This is readily understandable, since the replacement of the retina only increases the gap between it and the vitreous. The position of the latter is not affected by the operation. Harry K. Messenger.

Contardo, René. **Central serous retinitis or recurrent macular edema.** Ophth. ibero am. 8:251-256, 1946.

Macular edema in a woman of 35 years and a man of 48 years is described. Marked improvement followed ingestion and injection of methylic antigen. The corrected vision improved in the first case from 6/10 to 6/6 in one patient and from 5/30 to 5/10 in the other. Each case was believed to have a tuberculous origin. In the asthmatic patient the general condition also improved. (References.)

W. H. Crisp.

Doggart, J. H. **Symptoms of macular degeneration.** Tr. Ophth. Soc. U. Kingdom 65:180-186, 1945.

The unobtrusive course of many macular lesions leads to difficulty in the interpretation of the clinical history The following symptoms are given that may arise in macular disorders: Failure of central vision which may be slow or rapid, blurred vision, apparent bending of straight lines, incompleteness or discontinuity of objects, capacity to see objects relatively clearly by eccentric vision, positive scotoma, changes in apparent size of objects, uniocular diplopia, and interference with color vision. The history of visual disturbance accompanied or immediately preceded by aching behind the affected eye seems to increase the likelihood that inflammation and not degeneration may be responsible for the damage in question. When a macular abnormality remains limited to one eye for years it is all the more likely to be traumatic or inflammatory in origin.

Beulah Cushman.

Fialho Sylvio, Abreu. **Retinal arteries or arterioles.** Rev. brasil de oftal. 6:101-106, Dec., 1947.

This article is largely a series of quotations from Wagener's discussion of the subject (Trans. Amer. Ophth. Soc., 1946).

W. H. Crisp.

Gandolfi, Carlo. **The importance of cilioretinal arteries in circulatory lesions of the retina.** Ann. di ottal. e clin. ocul. 72:610-615, Oct., 1946.

In a case of occlusion of the central retinal artery presented by Gandolfi the central vision was eventually unimpaired, thanks to a large cilioretinal artery, though the visual field was much reduced. In a second case occlusion of a cilioretinal artery, notwithstanding the integrity of the central retinal vessels, resulted in a persistent paracentral scotoma. It was noteworthy that in this second case the central vision was likewise unimpaired.

Harry K. Messenger.

Granström, K. O. **Nomenclature in retinal changes associated with internal diseases, particularly hypertensive diseases and diabetes mellitus.** Acta. Med. Scandinav. suppl. 196, pp. 40-44, 1947.

In order to diminish the confusion in

describing the findings in patients with hypertension the author recommends that the "hypertensive fundus" be divided into the following four stages: 1. The arteries are narrowed and have an irregular lumen. The light reflex is broadened and there is arterio-venous compression. 2. The vascular changes are more marked and there are mild retinal changes. 3. Vessel changes are advanced and are associated with pronounced retinal hemorrhages and white exudates. 4. The classic albuminuric retinitis appears with edematous changes in the retina and swelling of the optic disc.

A similar classification is recommended for the findings in the toxemia of pregnancy.

The "diabetic fundus" is also grouped into four stages. These are characterized by: 1. isolated hemorrhages in the retina, usually round, 2. more severe hemorrhages with white spots in the retina, 3. many deep hemorrhages and many more white spots, and 4. severe hemorrhages into the vitreous with a proliferating retinitis. H. C. Weinberg.

Longhena, Luisa. **Concerning the etiology of the retinal detachment.** Boll.d' ocul. 26:227-253, April, 1947.

Exact biomicroscopic examination of 43 patients suffering from retinal detachment convinced the author that a chronic serous uveitis causes most if not all retinal detachments. This mild and latent inflammation is not a sequel of the retinal lesion; it can be observed before the development of the detachment and also in the other eye with completely normal retina. Longhena found that tuberculosis may be the most frequent cause of this chronic uveal inflammation; in some cases it may also be lues. Contributing factors were hyperglycemia, hyperazothemia, hypertensive heart disease. Eyes showing traces of this uveitis should never be operated on for the retinal detachment; local and general treatment of the uveal disease is indicated instead.

K. W. Ascher.

Morone, Giulio. **Tono-optic reactions of the pupil in tapeto-retinal degeneration.** Arch. di. ottal. 51:1-28, Jan.-Feb.-Mar., 1947.

The literature concerning the concept that tapeto-retinal degenerations arise from disturbances of the diencephalic hypophyseal system is reviewed. Changes in the tono-optic reaction of the pupil are said to arise from a similar disturbance and have been observed in cases of retinitis pigmentosa.

The author carried out pupillographic studies on patients who had disturbances of this system. He concluded that changes could exist without altering the pupillogram. Positive findings were of value but negative findings were not conclusive. Of the twelve cases of tapeto-retinal degenerations only one of retinitis pigmentosa had positive findings. The author believes that no definite connection can be demonstrated between disturbances of the diencephalo-hypophyseal system and retinal degeneration. If they do exist together it is probably because of their close association embryologically.

Francis P. Guida.

Rados, Andrew. **Macular hole with extensive peripheral detachment of retina.** Arch. Ophth. 38:596-604, Nov., 1947.

After a discussion of the literature and a clinical description of macular hole, the author reports a case complicated by a retinal detachment. There follows a discussion of the difference between macular holes and peripheral holes and the reasons why the latter are so much more apt to cause retinal detachment; the insertions of the extraocular muscles seem to be the most potent factor. R. W. Danielson.

Veirs, Everett R. **Periphlebitis associated with intracranial manifestations.** Am. J. Ophth. 31:168-170, Feb., 1948.

12

OPTIC NERVE AND CHIASM

Magnus, J. A. **A case of pseudo-glaucoma.** Brit. J. Ophth. 31:692-696, Nov., 1947.

A 74-year-old man presented himself for a change of reading glasses. Both fundi showed deeply cupped and somewhat pale discs. The tension was normal and repeated provocative tests failed to change this tension. In the right eye the field had a marked nasal step that reached the fixation point and a typical arcuate nerve fiber bundle scotoma. In the left eye the field showed a general peripheral depression. X-ray studies of the sella showed calcification of the internal carotid arteries.

It is possible that the pressure atrophy of the nerves caused a softening and degeneration of the fibers which resulted in a recession of the lamina and the cupping. The author believes that this was a pseudo-glaucoma due entirely to the pressure of the calcified arteries.

Morris Kaplan.

Wagner, F. **Clinical and histological findings in the optic nerve in acute wood alcohol poisoning.** Klin. Monatsbl. f. Augenh. 112:167-171, 1947.

Sudden amaurosis and papilledema occurred in a patient with methyl alcohol poisoning. After death edema of the brain was found. The eyes showed an extensive non-inflammatory edema of the optic nerve but no degeneration. The author believes that the edema is the cause of the sudden decrease in sight and that degeneration of the optic nerve and ganglion cells in the retina is a later result of the poison. He recommends lumbar puncture for early treatment. (Bibliography.)

Max Hirschfelder.

13

NEURO-OPHTHALMOLOGY

Morano, Massimo. **Late lid syphilis; considerations concerning four gummous manifestations.** Boll. d'ocul. 26:449-464, July, 1947.

Difficulties may arise in diagnosis and proper treatment of productive ulcerous lid lesions located in the tarsus and in the pretarsal subcutis. The pre- and post-therapeutic appearance of three eyes is shown in photographs. (Bibliography.)

K. W. Ascher.

Recupero, Enzo. **Adie's syndrome.** Ann. di ottal. e clin. ocul. 72:616-627, Oct., 1946.

This article is a review of the literature on Adie's syndrome and is accompanied by an extensive bibliography. No new data seem to be brought forward. Because of lack of demonstrable anatomic and pathologic changes in the nervous system Recupero is dissatisfied with all the various pathogenetic hypotheses. As to etiology, he concludes that syphilis can be invoked as a probable cause in a large number of cases, and that in certain other cases a hereditary factor is important. He finds little to say regarding therapy, but the question arises whether some of the B vitamins (riboflavin in particular) may be of value. Harry K. Messenger.

14

EYEBALL, ORBIT, SINUSES

Campos, R. **Concerning a special form of variable exophthalmos: exophthalmos with intermittent aggravation.** Arch. d'opht. 7:390-401, 1947.

Campos reports the case of a 15-year-old girl with an exophthalmos of two years duration and diminished vision in the affected eye. The exophthalmos had

progressed rapidly in the two months before the first examination. At that time the exophthalmometer reading was 22 mm. as compared to 17 mm. in the normal eye. However, when the patient's head was lowered the exophthalmos increased to 24 mm. It was reducible by pressure, non-pulsating, and auscultation revealed no bruit. There was no palpable tumor and movements were normal except for slight limitation of abduction. The Graefe, Moebius, Stellwag, and Geoffroy signs were negative. Vision was 10/10 in the normal eye and 2/10 in the other. Fundoscopic examination revealed a circumpapillary retinal edema. X-ray examination of the orbit showed two small round opaque bodies in the upper outer quadrant. At operation a number of large dilated varicose veins were seen and removed. After the operation vision improved to 5/10 and the exophthalmos was reduced to one millimeter of protrusion but there was slight ptosis and limitation of abduction and adduction. The radiopaque bodies were believed to be phleboliths.

The author considers the sign of increased exophthalmos after inclination of the head to be pathognomonic of varices of the orbit. He discusses in detail the different forms of variable exophthalmos and offers a classification.

Phillips Thygeson.

Lyons, F. M. **Contracted socket. The splint method of postoperative control.** Brit. J. Ophth. 31:703-709, Nov., 1947.

In the contracted socket the conjunctiva that remains should not be removed as in the operations based on the Wheeler procedure. This conjunctiva should be meticulously left or placed over the tarsal plates as far back as the fornix, if possible; this materially cuts down the incidence of entropion and affords a much more natural resilience and adaptability of the new socket.

In addition to this preservation of the conjunctiva a new method of keeping the acrylic mold in place after operation is most necessary to prevent return to the contracted state. The author has made a group of acrylic molds patterned after standard prostheses of varying size and into which is incorporated a steel nut which receives a short steel rod.

General anesthesia is used and a wide canthotomy performed. All adhesions are released and the conjunctiva preserved along the tarsal plates. The caruncle is preserved if possible. The largest mold over which the lids will close is selected and fitted with its steel rod. The socket is insufflated with penicillin and sulphathiazole powder. A thin epidermal graft is taken and made to cover the mold evenly. It is then placed in the socket, the rod removed and the previously placed canthotomy sutures tied. The lids are not sutured together. A pressure dressing is applied and left in place for six days. Then the sound eye is uncovered. A plaster of paris headdress is put on into which is incorporated a metal plate and clasp which will hold the rod to be replaced into the mold on the seventh day. On the seventh day the mold is eased out of the socket which is then irrigated with warm saline solution. The patient is allowed to be up and about and the mold is removed twice weekly until tendency to contracture is past. At that time, a final prosthesis is fitted. The molds and the splint arrangement can be used repeatedly. (3 illustrations.) Morris Kaplan.

Miller, G. L., Schlossman, A., and Boyd, W. H. **Spontaneous luxation of the eyeball.** Arch. Ophth. 38:677-680, Nov., 1947.

The authors report a case of spontaneous luxation of the eyeball in a 42-year-old obese negress and give a short review of the literature. R. W. Danielson.

Van Wien, Stefan. **Lymphocytoma of the orbit successfully treated by Roentgen irradiation. Report of a case.** Am. J. Ophth. 31:209-212, Feb., 1948. (2 figures, 5 references.)

15
EYELIDS, LACRIMAL APPARATUS

Bakker, A. **Xanthelasmata and autonomic nervous system. A new syndrome.** Brit. J. Ophth. 31:686-689, Nov., 1947.

Xanthelasmata are entirely harmless tumors usually found near the eye-lids. Bakker has found that they are much more common than is generally assumed and are often associated with various types of allergic disease. He studies four generations of a family in which both diseases were present to an uncommonly large degree. He feels satisfied that there is a relation between the two and feels that both are due to a labile autonomic nervous system. This dysfunction of the vegetative nervous system might be due to an imbalance of the cholesterol metabolism since many investigators have found an increased amount of cholesterol in the blood of patients with xanthelasma.

Morris Kaplan.

Corrado, M. **Erythematous dermatitis of the lids from penicillin.** Ann. di ottal. e clin. ocul. 72:455-466, Aug., 1946.

A case of allergic erythematous dermatitis of the lids that followed the therapeutic use of penicillin ointment (1000 units per gram) in the conjunctival sac is described. The diagnosis of allergy was confirmed by skin tests, and the patient was found to have an allergic diathesis (delayed sedimentation rate, exaggerated reflexes, and dermographia). It was subsequently found by experimentation on the same patient that intravenous injection of vitamin C for three days delayed the appearance of the allergic phenomena and lessened their severity.

The differential diagnosis of three types of hypersensitivity is discussed. Intolerance is a toxic reaction, like the reaction to a toxic dose of the offending substance in a normal individual. Idiosyncrasy is a primitive reaction that is not secondary to sensitization. Allergy is secondary to sensitization

Harry K. Messenger.

Foster, J. **Plastic repair of the lids.** Tr. Ophth. Soc. U. Kingdom. 65:113-135, 1945.

In plastic surgery the author highly recommends the use of hooks for retraction, patterns of Mackintosh, cigarette-tinfoil or cellophane, the plastic pen for outlining donor areas and the Gillies needle holder for intradermal suturing. He also advises the use of kationic soap antiseptic which neither alters the appearance of the skin nor kills grafts and the tissue glue (the patient's own plasma painted on the recipient area and an extract of his macerated white cells on the graft which produces adhesion of a skin graft in a few minutes and partial vascularization in 48 hours without a compressive dressing). Slight injuries may demand no more than simple suture. Fibrous tissue must be excised from the lids before skin is grafted in the treatment of ectropion. The use of hook traction aids in the excision of palpable fibrous bands.

Damage to the conjunctiva must be treated as skin injury with the excision of fibrous tissue and the supply of an epithelial covering. The author has found the use of oral mucous membrane preferable in the repair of a contracted socket. Damage to all three layers of the lid can frequently be repaired by the use of the sutures in layers. The repair of the canaliculus is most important if there has been a loss of tissue at the inner canthus. (27 figures.)

Beulah Cushman.

Grignolo, Antonio. **Possibilities and limits of penicillin therapy of blepharitis.** Boll. d'ocul. 26:117-127, Feb., 1947.

Eleven cases of squamous blepharitis and 39 cases of ulcerative blepharitis were observed for a period of two and seven months under penicillin treatment, and after discontinuation of the applications. An ointment containing 500 to 1,000 units per gram was used. In squamous blepharitis the results were negligible, and in ulcerous blepharitis possibly more rapid and more durable cures were achieved. Only one out of 39 ulcerous lesions did not respond. In one-half of the cured cases there was recurrence which responded well to repeated therapy. Cultures were taken from the lid borders and the germs obtained were tested for their penicillin resistance; there was no obvious parallelism between in-vitro response and therapeutic effect. The author attributes more importance to the "constitutional terrain" and stresses the importance of general treatment in conjunction with local applications. Among four tables, the second deserves especial attention for its meticulous and elucidating exposition of all pertinent data on 39 patients: their age, diagnosis, duration of disease, strength of ointment and frequency of application, systemic additional treatment, results, period of observation, recurrences, final result, microorganisms, isolated and inhibitory effect of penicillin in vitro. K. W. Ascher.

Macomber, W. B., and Berkeley, W. T. **Use of Neck Tubed Pedicles in Reconstruction of Defects of the Face.** Plast. and Reconstruct. Surg. 2:585, Nov., 1947.

Tubed pedicle skin from the neck is advocated for facial reconstruction because of greater similarity of skin color and texture, greater vascularity, ideal thickness, proximity of tissue, and production of minimal defect in donor area.

The tension on the tube and surrounding tissue must not exceed normal skin tension, and the tube should be constructed of sufficient length so that the defect can be easily reached by the flap. The width of the average neck tube is 4.5 to 5 cm., and the length varies in every case depending on the distance to the defect as mentioned above. In long neck tubes when the 3-to-1 length-to-width ratio is exceeded a central bridge is required. This serves as a relay to prevent ischemia or poor venous return, and the tube at this point should be greater in diameter than the rest of the tube to prevent constriction and circulatory embarrassment. Tubes can be used to bring skin and subcutaneous tissue, and also to carry additional neck skin to the face in the form of a flap. If these flaps are large, however, they should be transferred only after primary, secondary and sometimes tertiary delays. Surgical incisions in the neck should conform to Langer's lines, which run transversely across the neck. The formation of a tube in a vertical direction on the neck will result in a bowstring type of scar which will necessitate a Z-plasty for correction.

Twenty photographs and two plates of drawings are used to illustrate four case reports. The cases show large facial defects, and in one patient with extensive damage the eyelid is corrected with the end of the tube. Alston Callahan.

Marín Amat, M. **My surgical procedure for entropion of the lower lid.** Arch. Soc. oft. hisp.-amer. 7:808-814, Aug., 1947.

Marín Amat resents not having his operation included in Arruga's last book on surgery of the eye, and in Castroviejo's course on surgery of the cornea and the lids. He originally reported the technique in 1915. He attaches the lower lid to the orbital aponeurosis, at a point midway between the border of the lid and the inferior orbital border, with three to five sutures. An incision parallel to the border

of the lower lid and 5 mm. from it is made through the skin and the orbicularis. The protruding fibers of the orbicularis are excised; the sutures pass through the lower lip of the skin incision, through the orbital aponeurosis, and through the upper lip of the skin incision. The author has performed the operation in over a thousand cases and considers his procedure simple, rapid in execution, and functionally and cosmetically efficacious. (5 illustrations.) Ray K. Daily.

Radnót, M. **Rare tumors of the caruncle.** Ophthalmologica 113:270-275, May, 1947.

Some authors consider the caruncle as an island of skin. This view is only partly correct. The caruncle resembles skin in that it contains sebaceous glands and hair follicles but differs from skin in that it harbors accessory lacrimal glands and glands of Moll's type and in that its epithelium shows no keratinization. The more common tumors of the caruncle are papillomas, angiomas, nevi and dermoid cysts. The author reports in detail two unusual neoplasms of the caruncle. One, in a white man, 69 years of age, proved to be a cyst lined by several layers of oncocytes, a specific mucous cell first described by Hamperl (Virchow's Arch. 282:724, 1931). The cyst probably originated from an accessory tear gland. The second case in a white man, 67 years of age, was a local recurrence of a giant cell sarcoma. Peter C. Kronfeld.

Scuderi, G. **Leishmaniasis of the eyelid associated with keratitis.** Rassegna ital. d'ottal. 16:335-356, Sept.-Oct., 1947.

Instances of the presence of the Leishman protozoon have frequently been reported from Italy. The classification, staining peculiarities and structure of the trypanosome are described, as well as its cultural characteristics.

Two cases are reported in which there was an involvement of the prelacrimal region. In both there was a marked edema of the upper eyelid and the region of the lacrimal sac. Both were observed in the ulcerative stage. Ulceration of the cornea by the Leishman trypanosome is of a deep destructive type, similar to a pneumococcus ulcer, but first resembles a phlyctenule. The pain is severe and usually the whole cornea is involved and perforation occurs after three to four months. In the two cases reported the use of atabrine checked the keratitis promptly. (2 figures.)

Eugene M. Blake.

Seidenari, Roberto. **Study of the motility of the lacrimal sac after rhinostomy.** Boll. d'ocul. 26:103-116, Feb., 1947.

Raverdino's dacryocystorhinostomy method was used to study the mechanism of the lacrymal sac. A fine rubber ball, introduced into the drainage tube during the operation, was connected with a Marey's drum, the excursions of which were transmitted to a kymograph. Curves obtained showed that, even after the operation of dacryostomy, the lacrimal sac preserved its contractions. Whereas Roser, Schirmer, Hyrtl, von Graefe, Fuchs and others assumed that the lacrimal sac becomes dilated during blinking, which results in aspiration of the tears from the lacrimal puncta, the opposite opinion was supported by Aubaret, Arlt, Rochat, and others. In three of five patients examined, blinking produced a dilatation of the sac; in the other two patients, a contraction or compression of the sac was indicated by the kymograph curve. Differences in the anatomic relations of the orbicularis tendon are the cause for these discrepancies. Four pictures explain the insertion of the tubing into the stump of the sac, one photograph shows the patient seated at the kymograph, and four kymograph curves are reproduced. K. W. Ascher.

Stallard, H. B. **Plastic repair of the lids.** Tr. Ophth. Soc. U. Kingdom. 65:68-112, 1945.

In dealing with a healed wound the original defect must be reproduced by thorough excision of scar tissue and undermining of the skin edges before the reconstruction is planned. A drawing of the defect with photographs, radiographs and diagrams of the surgical procedure should accompany the patient to the operating room.

A small defect may be repaired by simple suture of the adjacent tissues or by undermining and sliding these together, but there must be no tension in such a procedure. In larger defects free grafts are used and it is desirable to use eyelid skin whenever possible. With extensive skin loss split-skin grafts (thick razor) are taken from the hairless area over the medial aspect of the upper arm or an epidermal graft (thin razor) is used.

Irregular bony surfaces should be covered by a sliding or rotation flap. The pedicle flap from the frontotemporal region is usually necessary for the reconstruction of the eyelids, although it seldom remains cosmetically or functionally very pleasing. A wandering pedicle graft may be taken from the abdominal wall to wrist and then to the eyelid or from the pectoral region to the neck and then to the eyelid.

Few instruments are used in plastic surgery but they must be in perfect condition. The technique of plastic surgery must be precise, purposeful, clean and finished. The handling of tissue must be minimal and hemostasis complete. Illustrations give the use of the different methods of closure and the use of the different types of flaps. (64 figures.)

Beulah Cushman.

Steinreich, O. S., and Callahan, Alston. **Reconstruction of the face and all four eyelids.** Am. J. Surg. 74:838-843, Dec., 1947.

A case is reported of a man who, from a severe gasoline burn, developed severe ectropion of all four eyelids, marked facial deformity with ectropion of the right side of the mouth, and granulating third-degree burns of the left parietal region of the scalp. Emergency skin grafting at an overseas hospital was successful in protecting the cornea from drying, and the vision remained 20/20 in each eye. The emergency procedures had not been performed with the purpose of ultimately correcting the deformities.

Six months after the injury, all four eyelids were repaired at one stage under ether endotracheal anesthesia. Incisions were made in the skin of the lids about 5 cm. from and concentric with the lid margins. All cicatricial tissue was removed from the lids and the margins of each pair of lids were united with a subtotal lid adhesion. Crescentic patterns of the required skin were made of transparent celluloid sheets, and an area of split-thickness skin of adequate size for these patterns was removed from the left chest with the Padgett dermatome. Pressure was applied by tying the alternate sutures of the juncture of the graft with the recipient skin over "torpedoes" of cotton wrapped with gauze, saturated in sulfathiazole and cod liver oil. Minor lid repairs were necessary. The tarsorrhaphy uniting the left lids was divided after four months, that uniting the right lids after nine months.

The scalp was repaired with 32 square inches of skin removed from the left side of the back with the Padgett dermatome. The face and lip ectropion was reconstructed with full-thickness skin transferred from the upper arm by means of a bicipital tube graft from each arm. In turn each tube was detached distally from the arm, and attached to the face; later detached entirely from the arm, and the skin

unrolled and migrated to correct the facial defects.

The final results seemed satisfactory.

Four photographs in full color and three in black and white illustrate the article. Alston Callahan.

Stern, H. J. **Autohaemo-therapy in hordeolosis.** Brit. J. Ophth. 31:766-769, Dec., 1947.

The author recommends the use of intramuscular injection of the patient's own blood in hordeolosis and has found it an effective, inexpensive form of therapy. He believes that abandonment of this treatment has followed indiscriminate use in a multitude of conditions with disappointing results. The treatment may cause a desensitization through stimulation of the reticulo-endothelial system and the formation of specific antibodies. Its use in hordeolosis by the author has been followed by lasting effects and few recurrences. O. H. Ellis.

16
TUMORS

Alagna, Gaspare. **Tumors of the reticulo-endothelial system of the eye. A reticulo-endothelioma of the conjunctiva in a patient with Kaposi's disease. A histopathogenetic contribution.** Ann. di ottal. e clin. ocul. 72:641-662, Nov., 1946.

A case of Kaposi's disease (multiple angiomatous wine-red spots and nodules of the skin on various parts of the body) in a 61-year-old man is described. About six years after the onset of the skin affection a tumor arose in the submucous layer of the conjunctiva, which on histologic examination proved to be a reticulo-endothelioma (or reticulo-histiocytoma) of angioblastic tendency.

The principal pathogenetic theories of Kaposi's disease are reviewed. The occurrence of this conjunctival tumor, which is probably not a metastasis but a local new growth arising from pre-existing reticulo-endothelial elements in the conjunctiva, confirms the theory that the disease is a generalized reticulo-endotheliosis, sometimes with special characteristics, and may be occasioned by an inherent anatomic and functional inferiority of the reticulo-endothelial system. Harry K. Messenger.

Borges Dias, Artur. **Malignant melanoma in the eyeball.** Arqu. brasil. de oftal. 10:92-95, 1946.

The single clinical record is of a case of malignant melanoma in a white male child aged 2½ years. There was appreciable softening of the bony floor of the orbit, especially on the temporal side.

W. H. Crisp.

Clifton, F., and Gordon, W. H. **A case of an adenoma arising in a sweat gland of the upper eyelid.** Brit. J. Ophth. 31:697-700, Nov., 1947.

A 70-year-old woman noted a mass in the upper eyelid that had grown slowly for five years. It had begun as a small crust on the edge of the lid. It was painless, firm, freely-movable, and could be transilluminated freely. It was easily removed in a tight capsule and the wound healed with good cosmetic result. The pathologic diagnosis was adenoma arising from a sweat gland. (3 illustrations.)

Morris Kaplan.

Cory, J. W. E. **Glaucoma secondary to fibrocystic disease of the bone.** Brit. J. Ophth. 31:731-737, Dec., 1947.

In a 58-year-old man the globe was displaced outwards and forwards by pressure of the tumor from within the orbit which obstructed venous drainage and thereby produced secondary glaucoma. X-ray films showed the condition to be fibrocystic disease of the bone; however, the full Hans Schüller-Christian syn-

drome was not present. It was not possible to determine whether the optic atrophy was due to the glaucoma or to secondary pressure on the optic nerve by the tumor. (5 figures.) O. H. Ellis.

Fairclough, W. A. **Direct inheritance in retinoblastoma.** Supp. New Zealand M. J. pp. 35-36, 1947.

A 50-year-old father who died of primary carcinoma of the liver, had both eyes enucleated at the age of two years. Three of his four children had retinoblastoma. Irwin E. Gaynon.

Gordüren, Süreyya. **Carcinoma of the eye.** Göz kliniği 5:105-112, 1947.

The author found 18 carcinomas in the region of the eye in 51,000 patients during the last five years. There were 11 carcinomas of the lids and most of these were at the external canthus, which he attributes to the application of irritants to this region by the villagers. There were seven epitheliomas of the conjunctiva and cornea. He saw no carcinomas of the lacrimal sac, orbit, or uvea.

F. H. Haessler.

Halpert, B., and Patzer, R. **Maxillary tumor of retinal anlage.** Surgery 22:837-841, Nov., 1947.

The authors report a benign neoplasm removed from the maxilla of a six-months-old infant, composed of tissue elements of the retina. They believe that this is the first growth of this nature ever recorded. The external carotid artery was ligated just before removal. Six days later the fundus of each eye was normal.

Bennett W. Muir.

Pascheff, C. **Studies on melanotic tumors of the eye.** Annuaire of the University of Sofia. 26:147-177, 1946-47.

With clinical and histologic reports Pascheff illustrates the various ocular neoplasms which originate from pigmented cells, and points out the part played by the melanotic cells in the morphology of the various melanotic tumors. The melanocytes comprise the melanoblasts of the retina, the melanophores of the uvea, the pigmented nevus cells, and the melanoblasts of the basal epithelial cells of the conjunctiva. Among the latter are included the melanocytes with granular dendritic processes, which Pascheff discovered in the basal epithelial cells of the limbal conjunctiva in spring catarrh, and which are identical with the cells of Langerhans' found in the epidermis.

All cells containing melanin may form hyperplasias or neoplasms. Melanohyperplasias are benign, and melanoblastomas are malignant. The melanohyperplasias are classified as follows: 1. Melanosis, congenital or acquired, which is manifested in strong pigmentation. 2. Melanoma, which may be epitheliomelanoma, melanophoroma, and epitheliomelanophoroma. 3. Pigmented nevus. The melanoblastomas are divided into melanoepithelioblastoma, melanophoroblastoma and melanonevoblastoma.

Melanoblasts form floccules in the iris and retina. Melanophores grow into melanophoromas in the uvea, and especially the iris, sometimes erroneously called nevus of the iris. Pigmented nevus cells form pigmented nevi which are seen on the corneal limbus and on the skin. Mixed hyperplasia, consisting of melanophores and melanoblasts are described in a report of a melanopapillofibroma of the conjunctiva. The same type of cells are the source of malignant tumors. Melanoblasts of the conjunctival epithelium form melanoepitheliomas of the conjunctiva. Melanoblasts of the retinal pigment epithelium form a melanoepithelioma of the retina, which was first reported by the author at the ophthalmological congress in Amsterdam. An interesting case of a cylindropapilloblastoma of the parsiliaris of the retina is reported for the first time in this article. Melanophores are responsible

for melanofibrosarcomas of the uvea, especially of the choroid, the conjunctiva, and the orbit. On the conjunctiva they are usually pedunculated. Melanofibrosarcoma or melanophoroblastoma of the orbit was described first by the author in 1929. Melanonevoblastomas of the conjunctiva, originating in the pigmented nevus cells are as malignant as melanoepitheliomas, from which they are differentiated by their typical nests. All blastomas are unilateral and malignant, and should be promptly and radically excised before glandular involvement takes place. Ray K. Daily.

17

INJURIES

Cortés, Hernán. **Traumatic aphakia and aniridia caused by contusion of the globe.** Arch. Soc. oft. hisp.-amer. 7:779-786, Aug., 1947.

Cortés reports a case of traumatic aphakia and aniridia in a man with an old degeneration of the macula in the uninjured eye. Because of the poor vision of the uninjured eye enucleation of the injured eye, which was indicated by the gravity of the injury, would have left the patient totally disabled. Conservative treatment was thus almost forced. Two months after the injury the scleral perforation was healed, the fundus was visible, and there were pale gray floating masses in the inferior portion of the eye. There were small holes in the periphery of the retina but the retina was attached everywhere. There was no sign of iris, and vitreous was floating in the anterior chamber. With the aphacic correction vision was better than two-thirds. The problem of industrial compensation is commented upon. In the discussion of the report Sanchez Mosquera described another unusual experience. One eye of a woman with bilateral senile cataract was injured by the horn of a cow. When the acute symptoms of trauma subsided, it was found that the cataract was dislocated, and her corrected vision was 0.5. Ray K. Daily.

Davids, B. **After-treatment of perforating eye injuries.** Klin. Monatsbl. f. Augenh. 112:136-148, 1947.

This paper is based on the therapeutic procedures used in 168 perforating war injuries of the eye which did not require immediate or very early enucleation. Certain phases occur in the course of a perforating injury. At first the mechanical destruction and possible infection of the wound stand in the foreground. Next to the surgical care and local mydriatics intensive foreign protein and fever treatment as well as chemotherapy with sulfonamides and penicillin are most important at this stage. After a few days the eye has either a panophthalmitis or it enters the stage of a chronic uveitis. A few of the eyes may heal quickly. The chronic uveitis of the majority of patients is the result of toxic reactions brought about by bacteria and by protein from destroyed tissues. Retained foreign bodies may cause an aseptic inflammation or have a chemical or electrolytic effect on the eye. Allergic tissue reactions appear in this phase as a result of the antigenic effect of bacteria and body protein. Foreign protein is strongly contraindicated in this stage. Anti-allergic measures are indicated and the author recommends calcium and pyramidon. Later on small doses of foreign protein may be used for desensitization. Retained non-magnetic foreign bodies like glass and small stones may be well tolerated and may become encapsulated. The prophylaxis against sympathetic ophthalmia includes the decrease of the hyperergic reaction through calcium, nonspecific desensitization through mild doses of foreign protein, chemotherapy, mydriatics in the uninjured eye and cautious removal of foci

of infection. Under the routine outlined 131 bulbi were retained with useful vision in one-third of them. (References.)

Max Hirschfelder.

Ferguson, W. J. W. **The treatment of intra-ocular foreign bodies.** Practitioner. 158:400-405, May, 1947.

This article summarizes the ophthalmologist's approach to the problem of the intra-ocular foreign body. The author stresses the importance of X-ray examination of all perforating ocular wounds in which there is the slightest suspicion of a possible retained foreign body. Methods for X-ray localization of the foreign body are mentioned.

In general, if the injury has not been of sufficient magnitude to destroy the eye, extraction of the foreign body is indicated. The most favorable cases are those in which the foreign body is magnetic. In these instances the giant magnet is used for extraction of the foreign body. The anterior route is selected if the foreign body is in the lens, iris, or anterior chamber. The posterior route, with incision through the sclera and choroid, is used when the foreign body lies in the vitreous chamber. The author mentions the use of surface diathermy at the sclerotomy site to reduce bleeding and also to reduce the risk of postoperative retinal detachment. When the foreign body is nonmagnetic, an attempt should be made to remove it with forceps if such an approach is feasible. Foreign bodies embedded in the cornea or sclera may be allowed to remain if the removal is difficult and if the foreign body produces no irritation.

The author mentions as complications of foreign body removal the occurrence of septic inflammation, iridocyclitis, and sympathetic uveitis. Of greatest importance in removal of intraocular foreign bodies is the minimizing of surgical trauma.

Benjamin Milder.

Flick, John J. **Ocular lesions following the atomic bombing of Hiroshima and Nagasaki.** Am. J. Ophth. 31:137-154, Feb., 1948. (5 tables, 6 figures, 13 references.)

Friedman, Benjamin. **Use of air injections into Tenon's capsule for localization of orbital foreign bodies.** Arch. Ophth. 38:660-664, Nov., 1947.

Friedman discusses the advantage of air injections in cases of multiple foreign bodies. The technique of its use is described and illustrated with four case reports.

R. W. Danielson.

Haik, G. M. **Intraocular foreign bodies.** J.A.M.A. 135:894-900, Dec. 6, 1947.

It is desirable to have the patient recumbent en route from the injury to the ophthalmologist, and the less is done by the first aid persons the better. Emergency removal is practically never indicated unless the globe is hopelessly and totally lost. Sympathetic ophthalmia allows a 21-day period of grace, and there were but 15 cases reported in the last war. Chemotherapy, antibiotics, and fever therapy (canned milk was used in place of fresh milk often, and worked well) are very desirable.

At the author's military installation they did not hesitate to use pentothal for adequate examination in all bilateral and serious injuries. X-ray localizations are discussed, and it is noted that they are sometimes incorrect, and that no detail for their efficiency should be overlooked. They also used a Carney locator, similar in principle to the Berman, but fashioned out of odds and ends available in a theater of war but useful for magnetic bodies only.

For extraction of magnetic particles, the magnet was used. Non-magnetic ones were left alone, or removed, depending upon the situation. The author stresses the importance of closure of all perforat-

ing wounds of the globe by diathermy. (5 figures, abstract of discussion.)

Bennett W. Muir.

Hoffmann, E. A. **Personal experiences with the least traumatizing removal of introcular iron.** Klin. Monatsbl. f. Augenh. 112:156-167, 1947.

Even the smallest pieces of iron and steel should be removed from the eyeball, unless one deals with an only eye and is certain of a rustless or very slowly rusting alloy. The sideroscope is useful in determining the presence of iron. X-ray localization after the method of Comberg (contactglass with lead markings) is most widely used and is especially useful in the modification of Leydhecker which permits two exposures with the patient supine. In doubtful cases with negative findings this method is supplemented by the skeleton-free X-ray after Vogt or the surgical skeleton-free X-ray after Franceschetti. Occasionally one can visualize a foreign body with the ophthalmoscope, and, in certain rare instances, the proof of intraocular iron is brought about by chemical analysis of the aqueous or its spectralanalysis. The presence of several pieces in the same eye should not be overlooked. The article discusses in detail the best method of removal of magnetic foreign bodies from the various locations. Iron can be tolerated in the scleral tissue, but should be removed from the sclera in double perforation. It is better to remove foreign bodies in the anterior chamber through a fresh incision after a few days of initial chemotherapy rather than immediately through the wound. The methods for removal of iron in the iris, lens and vitreous are discussed. For ciliary and retinal magnetic foreign bodies transcleral removal is strongly recommended and the danger of producing retinal detachment by using the giant magnet and the anterior route is stressed. A triangular scleral flap is described as a useful opening for such transcleral removals, especially if combined with diathermy cautery as a precaution against possible retinal detachment.

Max Hirschfelder.

Man, H. X. **A case of monocular diplopia.** Ann. d'ocul. 180:475-480. Aug., 1947.

Among the frequent structural causes of monocular diplopia are refractive and other changes in the cornea and lens with or without spastic accommodation; also peripheral holes in the iris which under proper conditions may form a second pupil. In the case reported a very small iris hole, traumatic in origin, was observed peripherally at 3 o'clock. With both eyes open, macular images are fused and the patient has binocular single vision. The extra-macular image in the left eye causes a crossed diplopia because both the iris hole and the retinal image are located temporal to the macula. When the eye was directed up and to the right the displacement of the retinal image was increased. The cornea was tatooed to cover the iris hole and eliminate the second image.

Chas. A. Bahn.

Orzalesi, Francesco. **Another communication concerning diathermy treatment of wounds of the corpus ciliare.** Boll. d'ocul. 26:81-86, Feb., 1947.

In a preliminary publication (Rassegna Medica Sarda, 1946) the author suggested destruction of the injured part of the ciliary body after traumatic lesions to the latter. It seems that this procedure will reduce the danger of sympathetic ophthalmia and will hasten the healing of ciliary body wounds by sealing against the entrance of possible infection. Orzalesi concedes that the number of patients observed and the time elapsed does not yet justify definite conclusions. (2 figures.)

K. W. Ascher.

Rees, T. R. **Perforating wound of orbit; report of a case.** M. Ann. District of Columbia 16:548-549, Oct., 1947.

A twig penetrated the left upper lid of a three year old boy and entered the orbit and intracranial cavity. It injured the optic, oculomotor, troclear, ophthalmic branch of the trigeminal, and the abducens nerve. The eyeball was completely fixed, anesthetized and blind. The twig rested in the interpeduncular space and was removed with forceps along the path of entrance. The eyeball was destroyed.

Irwin E. Gaynon.

Terol Altet, J. M. **Comments on 1500 cases of industrial injuries.** Arch. Soc. oft. hisp.-amer. 7:771-778, Aug., 1947.

Foreign bodies of the cornea constituted 75.41 percent of the injuries in this group. Biomicroscopic exploration of eyes suspected of a foreign body is obligatory. Their management requires anesthesia, exploration of the lacrimal passages, and asepsis of the conjunctiva. Foreign bodies should be carefully removed with a minimum of epithelial damage, and their removal should be followed by the introduction of an antiseptic ointment into the conjunctival sac, and bandage of the eye. The eye should be inspected with the slit-lamp on the following day for remains of the foreign body or rust and the patient should not be discharged until the epithelium has completely regenerated. Conjunctival foreign bodies were of no consequence. Corneal ulcers constituted 15 percent of the cases. Some occurred subsequent to the delayed removal of a foreign body. They were treated with an antiseptic ointment, and atropine, when indicated by a ciliary congestion. In four cases, or 0.26 percent extensive ulcerations developed which were controlled by surgical attention to the lacrimal passages, foreign protein injections, and atropine and antiseptic ointments locally. Subconjunctival hemorrhages caused by contusion absorbed spontaneously. Contusion of the globe with hyphema occurred in 0.2 percent of the patients. One patient with a recurrent hyphema and a secondary glaucoma was found to have an old iridocyclitis.

Injuries and burns of the lids presented no therapeutic problems. The excellent results achieved in two severe conjunctival burns with sulphuric acid and ammonia are attributed to the prompt removal of the necrotic conjunctiva and transplantation of buccal mucous membrane. The difficulty of a differential diagnosis between a traumatic and a self-inflicted conjunctivitis is illustrated with a case report. In two cases of ocular perforation the patient made an excellent recovery under treatment with sulfanilamide, foreign protein, and atropine and noviform locally. One eye with an intraocular foreign body ended in phthisis of the globe.

The good results obtained in this large group of injuries are attributed to the education of the workers to the importance of prompt ophthalmologic assistance, to the adequate use of protective measures, to the great efficacy of modern anti-infectious agents and to the progress in modern surgery. The author urges that industrial protective measures be enforced by deprivation of compensation for workers who fail to use them, and by punitive measures for employers who neglect to provide them.

Ray K. Daily.

Wilder, H. C. **Intraocular foreign bodies in soldiers.** Am. J. Ophth. 31:57-64, Jan., 1948. (35 figures.)

Wright, R. E., and Duncan, H. A. **Experiences with the giant electromagnet in the extraction of intraocular foreign bodies of a metallic nature, in the recent war.** Rev. oto-neuro-oftal. 22:51-54, May-June, 1947.

A soldier sustained a wound of the left eye, amongst other injuries, in a land-mine explosion. A metallic foreign body was found in the retina about three disc diameters below the papilla. Using the giant electromagnet and a posterior sclerotomy the foreign body was not easily removed. Success was achieved only after 75 four-second applications of the magnet at a second operation. As a result of experience with this case the authors feel that ordinarily the posterior route should be used when the foreign body is in the posterior segment and the incision should be as close to the foreign body as possible without injuring important structures. A fine pointed terminal should be used, the surgeon must persevere, the patient cooperate, and the magnet be first-rate. A knowledge of the physical and chemical characteristics of the foreign body is essential. In war-time rudimentary localizing procedures must be used to the utmost. Repeated applications of the magnet increases the susceptibility of the foreign body to extraction. Superficial diathermy coagulation of the sclera in the vicinity of a foreign body can produce an uncontrollable reaction. A portable electromagnet should be installed in stations in the theatre of operations. Edward Saskin.

18

SYSTEMIC DISEASE AND PARASITES

Abbott, K. H., and Camp, J. D. **Extensive symmetrical cerebral calcification and chorioretinitis in identical twins. (Toxoplasmosis.)** Bull. Los Angeles Neurol. Soc. 12:38-48, March, 1947.

The authors present case reports of identical twins each with bilaterally symmetrical, extensive dense calcification in the cerebrum with minor involvement of the cerebellum. Bilateral extensive chorioretinitis, with choroidal exudate associated with retinal angiomatosis was present. Since blood serum from each of the twins neutralized toxoplasma organisms it was concluded that the causal factor was probably chronic toxoplasmosis. (8 figures.) O. H. Ellis.

Appelmans, M. **Chronic superficial punctate keratitis due to onchocerciasis.** Ophthalmologica 114:129-146, Sept., 1947.

Onchocerciasis has received a good deal of attention in the Belgian literature, apparently because of the relatively high incidence of this parasitic disease in Belgians who had spent part of their lives in the Belgian Congo. Appelmans of Louvain now describes two cases of chronic superficial punctate keratitis in former residents of the Belgian Congo. The keratitis was associated with mild ciliary injection and photophobia; all other ocular structures appeared normal. Both patients showed a chronic nodular dermatosis and marked eosinophilia in the blood. Small pieces of the clinically uninvolved conjunctiva were removed for biopsy and were found to contain innumerable larvae of onchocera volvolus. The whole subject of onchocerciasis in Africa and Central America is reviewed. The larvae reach the eye through their own motility and not through the blood stream. Their specific affinity to the conjunctiva (first described by Applemans in 1935) greatly facilitates the diagnosis. The only form of treatment known up to now is the surgical extirpation of the nodules containing the parasite. For the cases of corneal involvement without nodules in the skin the author recommends five-per cent calomel ointment applied locally. He repeatedly refers to the study of the eye manifestations of onchocerciasis in Guatemala by William B. Clark (Arch. of Ophth. 36:644, 1946). Peter C. Kronfeld.

v. Bahr, G. **Intraocular vascular proliferations in diabetes mellitus.** Acta. Med. Scandinav. suppl. 196, pp. 24-39, 1947.

A characteristic feature of diabetes mellitus is the formation of new vessels. In the iris they are superficial and produce rubeosis iridis. These new vessels also appear in the retina and often extend into the vitreous as a retinitis proliferans. The author's cases illustrate retinitis proliferans in which the formation of new vessels is primary. Usually it is secondary to hemorrhages into the retina and vitreous. In three of the author's cases there were signs of renal damage which was very suggestive of intercapillary glomerulosclerosis (Kimmelstiel-Wilson syndrome).

New vessels are often found in the skin of diabetics and this rubeosis diabetica often gives young diabetics a red color to their face, hands and feet. The conjunctiva also may show dilated vessels with an increased number of capillary loops in diabetes. There may also be a number of military aneurysms, and a number of small vascular branches giving one the impression of vascular proliferation. H. C. Weinberg.

Ciotola, Guido. **A case of hydroa vacciniformis with ocular manifestations.** Boll. d'ocul. 25:520-536, Oct.-Dec., 1946.

A 20-year-old farmer became affected with lesions of the skin after exposure to the sun each spring since he was six or seven years old. Serosanguinous vesicles appeared on the skin of the face and dorsal part of the hands and left scars like small pox. At the age of nine or ten years the patient's right cornea became affected by opacities which were associated with photophobia and lacrimation and occurred at the time of the skin eruption. Two years later the same opacities developed in the left cornea. The bulbar conjunctiva of both eyes at both sides of the limbus on the horizontal meridian was yellowish, slightly thickened and adherent to the sclera. The vision was 2/10 in both eyes.

The cases reported in the literature are summarized and discussed. It is assumed that the lesion resulted from the action of ultraviolet rays on a skin that is sensitized by products of altered metabolism, such as hematoporphyrin. (3 figures, bibliography.) Melchiore Lombardo.

Di Luca, Giuseppe. **Changes of ocular fundus in the diagnosis of affections of the cerebral circulation.** Riv. oto-neuro-oftal. 22:161-176, May-June, 1947.

In a preceding work the writer called attention to a symptom complex based on the fact that when the blood flow of the carotid artery is stopped, the systolic retinal pressure of the affected side becomes lower than the systolic pressure of the other side and it remains lower on compressing the common carotid of the same side. The compression may bring about no general reaction or it may provoke symptoms of cerebral ischemia. The writer now reports four patients with general hypertension, in three of which sudden monolateral blindness occurred. The retinal artery systolic pressure was lower on the affected side. In the first patient, who had endoarteritis, the blindness was due to spasm of the central artery of the retina. A disturbance of circulation in the territory of both the internal carotid by the compression of the common carotid could be excluded. In the second and third cases no changes in the intracranial carotid territory were present. In the fourth case with normal vision in both eyes and severe general symptoms on compression of the carotid it was possible to determine that the lumen of the internal carotid was reduced in size but not occluded. The writer thinks that the compression of the common carotid is a useful functional test. (Bibliography.)

Melchiore Lombardo.

Etchemendigaray, A. N. **Changes in accommodation due to intestinal para-**

sites. Anal. argent. de oftal. 7:125-128, Oct.-Nov.-Dec., 1946.

The author feels that intestinal parasites throw a toxin into the blood-stream that causes a temporary weakness of accommodation. He does not state conclusively whether or not these toxins act directly on the ciliary muscle or on the oculomotor center. Ten observed patients with weakness of accommodation are presented from whose intestines ameba histolytica, Giardia cysts, Blastocystis hominis, or trichomonas were isolated. No statement is made regarding response to therapy. Edward Saskin.

Focosi, Marcello. **Ocular complications of acute lymphocytic meningitis and possible connections with acute poliomyelitis.** Boll. d'ocul. 26:417-432, July, 1947.

Two cases of benign acute lymphocytic meningitis with sixth nerve paralysis are described. All signs and symptoms disappeared rather quickly in both cases; one of them was probably due to the virus causing acute anterior poliomyelitis. (Three pages of references.)

K. W. Ascher.

Matteucci, P. **Schizophrenic syndrome and visual apparatus.** Riv. oto-neuro-oftal. 21:312-321, Sept.-Dec., 1946.

The writer studied the ocular motility and retinal circulation in schizophrenic patients to determine whether functional and organic changes of the eye are present. In 117 patients systematic researches were made in regard to the reflexes of the pupil, the extrinsic ocular motility, the retinal circulation and the ocular tension. Only the retinal hypotension may have some importance in this syndrome. (Bibliography.) Melchiore Lombardo.

Panzardi, Domenico. **Concerning the appearance of lens opacities in target cell anemia (Cooley).** Boll. d'ocul. 26:189-192, March, 1947.

In 1943, Holt observed lens opacities in a patient with Cooley's anemia. The author, working in Sassari, Sardinia, where the erythroblastic anemia is rather common, studied biomicroscopically the lenses of nine patients suffering from Cooley's disease. No cataracts, not even small congenital lens opacities, were encountered in all these patients. Hypocalcemia was found; cataract, however, seems to be a rare or incidental occurrence in patients suffering from target cell anemia. K. W. Ascher.

Panzardi, Domenico. **Unusual involvement of conjunctiva, cornea, and episclera in herpetic eye diseases.** Boll. d'ocul. 26:465-470, July, 1947.

A 43-year-old woman developed in short succession transient lesions in her right and left conjunctiva, in her left cornea, and in her right episclera. A labial herpes was also observed and inoculation in rabbit cornea corroborated the assumed diagnosis of herpes febrilis. (10 references.) K. W. Ascher.

Widerman, Arnold. **Eruptive fever with stomatitis and ophthalmia.** Ann. Int. Med. 27:830-834, Nov., 1947.

The author reports two cases of this disease also known as the Stevens-Johnson disease. The ocular symptoms and signs were itching, injection of the conjunctiva and sclera, and purulent secretion, all characteristic of moderate conjunctivitis.

Bullous lesions on the mucosa of the mouth and nose and sometimes vesicles or ulcers on the penis may occur. Constitutional symptoms are frequently present, usually severe, and are associated with high temperature and varying toxicity. Purulent conjunctivitis and corneal disease may result from secondary invaders. Panophthalmitis and even death has occurred. Stomatitis, Vincent's type especially, venereal disease, allergy, and

acute exanthemata must be differentiated from this disease. F. M. Crage.

19

CONGENITAL DEFORMITIES, HEREDITY

Beattie, P. H. **A consideration of aniridia with a pedigree.** Brit. J. Ophth. 31:649-676, Nov., 1947.

Five generations of a family with aniridia are carefully studied. Each member was not individually studied, but sufficient data were obtained from responsible sources to show that this dominant characteristic appeared in about one-half of all members. There were no cases of an affected person mating with an affected person; no consanguineous marriages were recorded. Environment was proved to have no effect whatever.

Thirty-one patients of this family group were personally studied by the author. Four patients had coloboma of iris or hypoplasia of the iris or both; ten had partial or complete aniridia of both eyes; twelve had bilateral aniridia and ectopia lentis; and one had partial aniridia in the right eye and coloboma in the left. These defects followed no definite pattern either in the same generation or succeeding ones but seemed to occur haphazardly in children of affected or normal parents. No fetal eye with aniridia became available for study and little is known about the embryology of the condition. No eye of this family became available for histologic study. As in other reported family studies of aniridia, lens opacities and glaucoma occurred much more frequently than average and the treatment of these conditions was much more difficult and associated with many more complications than usual.

Each examined member is described in detail. (58 references, 5 plates.)

Morris Kaplan.

Cohen, E. S. **A case of anophthalmia.** Harper Hosp. Bull, 5:135-138, Oct., 1947.

Microscopic examination of the tissue behind the conjunctiva failed to reveal any evidence of the layers of the optic cup. The lids and conjunctiva were normal. The left orbit was reduced in size. The optic foramen was normal on both sides. Irwin E. Gaynon.

Diethelm, W. **Ectopia lentis without arachnodactylia.** Ophthalmologica 114: 16-32, July, 1947.

The author's main point is to stress the existence of a hereditary, recessive form of ectopia of the lens and pupil without any signs of mesodermal dystrophy. In support of this view a family is described which, upon thorough examination, failed to show any signs of mesodermal dystrophy. The parents were first cousins and had normal eyes. Of the three children, one girl had ectopia lentis, one boy had ectopio lentis and pupillae and one girl had normal eyes.

P. C. Kronfeld.

Gát, L. **A case of persistent pupillary membrane.** Ophthalmologica 114:52-54, July, 1947.

Gát describes a congenital iris anomaly characterized by multiple radial white strands which take off from the ciliary portion of the iris and form a wreath-like structure in the anterior chamber in front of and concentric with the pupil.

Peter C. Kronfeld.

Hughes, H. L. **A case of bilateral coloboma of the optic disc.** Brit. J. Ophth. 31:689-692, Nov., 1947.

A patient is described who presented the typical fundus of coloboma of the optic disc. The vision in one eye was perception of light and the corrected vision of the other eye was 6/5. Many such cases of bilateral coloboma have been recorded and in most of them one eye was blind and the other exhibited nearly normal vision. The lesion is ascribed to defec-

tive closure of the optic cup at its extreme posterior position. Morris Kaplan.

Marin Enciso, M., and Lopez Gracia, E. **A case of Marfan's syndrome.** Arch. Soc. oft. hisp.-amer. 7:818-821, Aug., 1947.

A case of Marfan's syndrome with subluxated lenses and secondary rise of tension was treated by means of anti-glaucomatous iridectomies, followed about a month later with lens extractions. The lenses were extracted with a Kalt forceps, one arm of which was introduced in front of the lens, and one behind it. There was no vitreous loss, and the post-operative course was uneventful.

Ray K. Daily.

Meeker, L. H., and Aebli, R. **Cyclopean eye and lateral proboscis with normal one-half face.** Arch. Ophth. 38:159-173, Aug., 1947.

A case is reported in which cyclopean eye, lateral proboscis, cleft palate and cleft lip are associated. The cyclopean eye had a double cornea, with two irises and two pupils. The involved side also showed subnormal development of the skull. There was marked mental retardation.

Comparison of this case with the cases previously reported strongly suggests that the defects are the result of incomplete separation of monozygotic twins. Hereditary influences are of importance not only in the occurrence of the individual anomalies but in the formation of the twins on which their development depends. John C. Long.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Fairclough, W. A. **Industrial lighting.** Supp. New Zealand M. J., pp. 2-12, 1947.

A proper balance of light between the background and the work object secures the greatest comfort and efficiency. Visual acuity rises rapidly as illumination approaches five foot candles and then slowly until it reaches its maximum at 100 foot candles. Shadows and glare must be avoided. A daylight fluorescent lamp is most efficient. It produces one-half the total heat and one-fourth of the radiant heat of the incandescent lamp, and produces a high level of daylight quality over large areas without the use of excessive wattage or production of excessive heat.

Irwin E. Gaynon.

Kuhn, H. S. **Vision in industry.** Tr. Am. Acad. Ophth. pp. 54-63, Sept.-Oct., 1947.

In the medical and surgical care of eye injuries, the man with the injured eye should be sent promptly and directly to the plant ophthalmologist, and not first to untrained consulting physicians. Of emergency importance is the prompt and careful removal of foreign bodies, ocular and intraocular, as well as precise lid suturing. The use of ointments in caustic or acid burns is routinely discouraged.

A fair knowledge of the toxic hazards to which workers' eyes are exposed is essential. This includes not only the grouping of toxic agents physically and chemically, but also their uses in specific industries as well as their ectogenous or endogenous contact and course. Immediate and copious water irrigation is the most important factor in emergency treatment. This is best accomplished by immersing the head in a pail of water and opening the eyes. Alkali burns tend to heal slowly and imperfectly.

Close cooperation is essential for management, industrial workers and industrial ophthalmologists, and is usually best obtained through a medical director or consultant. Fact finding data secured by testing procedures should be carefully evaluated before they are used. The difference between the success and the failure is frequently determined by an understanding of the visual requirements of the operations in a plant. Although basic

principles are primarily important, their individual applications are more important. This is the lesson learned from ten years of progress in industrial ophthalmology.

Illumination and color problems are usually best solved by a consultant.

Chas. A. Bahn.

MacMillan, J. A. **Notes on the history of ophthalmology in Canada.** Am. J. Ophth. 31:199-206, Feb., 1948. (6 references, sources.)

Pechdo, M. and Gayral, L. L. **Pathogenesis and physiopathology of nystagmus in coal miners.** Arch. d'opht. 7:521-528, 1947.

Miner's nystagmus is a common and important occupational disease whose prophylaxis, treatment, and pathogenesis still remain unsolved. The authors state that Joseph Pechdo in 1893 postulated that toxic gases acted upon the central nervous system to produce nystagmus but that his report was neglected as a result of claims by Belgian and English ophthalmologists that faulty illumination in the mines produced the condition. Since then, however, much evidence has been advancd to support the theory of the role of toxic agents, and improved illumination alone has not reduced the incidence of nystagmus. The toxic products in coal mines are principally gaseous and the ordinary coal gas consists above all of methane but includes also hydrogen sulfide, carbon monoxide, and carbon dioxide. The gas content is particularly high in certain dead-end galleries. The authors note that certain mines are particularly apt to produce nystagmus. They conclude that treatment is primarily aeration before the nystagmus becomes fixed and that prophylaxis is entirely one of proper ventilation. Phillips Thygeson.

Price, Leo. **Eyesight conservation in garment industry.** Tr. Am. Acad. Ophth. pp. 39-46, Sept.-Oct., 1947.

The trend and purpose of industrial ophthalmology apparently includes the ophthalmic and optical examination of all employees by ophthalmologists, optometrists and other technicians; the fitting and dispensing of glasses at wholesale cost to employer or employee, job analysis, illumination problems, and more or less responsibility for the medical care of all ophthalmic and bodily diseases which might effect industrial visual efficiency. The mechanics of this program is illustrated by the experience of a large union with an organized eye and health center. Glasses were dispensed at an average cost of $5.34 per pair through the optical department. The concession privilege had previously proved unsatisfactory.

In the industrial prescription for glasses each individual should decide his specific working distance preferably by demonstration at work, and prescriptions for glasses must be in terms of specific individual requirements rather than those of the average. Especially in industrial workers past 40 years of age, exophoria may be created by indiscriminate refraction. Hand workers required fewer special working glasses because they can more frequently adjust themselves to the working distance necessitated by the lens that is worn. Workers with evidences of muscle imbalance, infections, and diseases such as cataract, diabetes, and glaucoma were treated at the Health Center or elsewhere.

This contribution should interest especially those who wish to follow the economic and technical trends and purposes of industrial ophthalmology and their relationship to the more or less socialized medicine of tomorrow.

Chas. A. Bahn.

Vail, Derrick. The prestige of ophthalmology. J.A.M.A. 135:71-73, Sept. 13, 1947.

The author feels that what should and does concern the ophthalmologist is the ignorance about his specialty observed in fellow physicians and the indifference they often show to his special knowledge and work. Some of the factors he believes are responsible for this decrease in ophthalmologic influence are the exclusiveness and withdrawal from the general medical field, and the segregation of his activities. The ophthalmologist's work is often performed in special eye hospitals and pathologic laboratories. The eye, ear, nose and throat specialist who is poorly qualified in ophthalmology, however capable he may be in otolaryngology, is responsible for a share of our loss of prestige. The solution lies in insisting that these men be given satisfactory training in ophthalmology. It is surprising and shocking to learn that even some physicians do not know the difference between ophthalmologist and optometrist.

The system of rebates is a blot on ophthalmologists and nothing can be said in extenuation of this widespread evil. There has been a gradual loss of part of the field of endeavor of the ophthalmologist to the neurologist, the neurosurgeon and the plastic surgeon, obviously because the ophthalmologists have not made good as a group. The solution lies in more and better training in order to offer convincing proof that the ophthalmologist knows more about neuro-ophthalmology than does the neurologist and that he can do better plastic repairs on the lids and adnexa that can the plastic surgeon. It is a sad truth that there is little ophthalmic representation in the general medical and surgical groups, and the only remedy is to take a more active part in the affairs of medical practice. Spectacular and notorious publicity can only be harmful and it is the duty of ophthalmologists as individuals and as a group to do all in their power to control it. Theodore M. Shapira.

Woods, A. C. The present policies of the American Board of Ophthalmology. Tr. Am. Acad. Ophth. pp. 5-15, Sept.-Oct., 1947.

A middle of the road policy is advised for the American Board of Examiners which should consider itself, and should be considered, as an agency whose duty is to determine and pass upon the clinical fitness of candidates as safe practitioners of ophthalmology. The history and accomplishments are detailed; its virtues and its potential vices are impersonally discussed.

The power which the Board has acquired should be used wisely, and not abused. Although open to criticism, the standards set by the Board have, on the whole, been reasonable and fair. Its certification indicates that the diplomate has had adequate and organized training which is presumed under normal conditions to produce a reasonably safe and competent ophthalmologist.

The one year preliminary internship is considered unwise. It tends to lower rather than to raise the level of ophthalmology for the reason that it tends to divert a number of excellent candidates from the study of ophthalmology. Forced to take this year at their graduation, they are often diverted into other fields. A properly organized service in ophthalmology should include the necessary training in general medicine and surgery. The second criticism involves all specialty boards including that of ophthalmology and is directed against their insistence on a certain basic training. These requirements are often so loosely specified that it is all but impossible to plan a program of study, or else so elaborate that they

require specially designed courses of instruction, which it is difficult, if not impossible, to obtain. The essential thing is that the candidate for certification have an adequate understanding of the basic sciences relating to his specialty, and not that he have pursued a designated course of study. A third criticism relates to the policy of some boards to insist that certification by the boards be a prerequisite for membership and promotion on hospital staffs. Education is essentially and primarily the duty and responsibility of medical schools and teaching hospitals, and not that of specialty examining boards. The continuance of this policy in teaching hospitals and research institutions will be disastrous. Many qualified investigators and specialists who services are vital would thus be debarred from entering important institutions and hospitals, and from promotion, unless they obtained the extensive clinical knowledge which the board required, much of which is relatively useless to them in the capacity they serve. The net result of this policy would be that medical schools and teaching hospitals would be sold into a form of bondage to clinical groups. Appointments and promotions would obviously be subject to the powers of an outside agency.

The last criticism is directed against the national societies, which require certification of specialty boards as an essential for membership. Although this policy tends to uphold the power, dignity and policy of these boards and insures for the membership of the societies a reasonable grade of clinical efficiency and training, it blocks the path of ophthalmic progress inasmuch as it excludes from membership specially trained men, such as pathologists and bacteriologists, who are devoting their lives to the investigations of ophthalmological problems. Each medical society should assume its own responsibility for the fitness and competence of its membership. The specialty boards are agencies whose sole duty is to determine and pass upon the clinical fitness of applicants as safe practitioners. They should not be given the right to veto candidates for membership in national societies. The national societies should admit without the distinction of class and caste, all fit medical men who are primarily interested in ophthalmology. Chas. A. Bahn.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. William H. Chaffers, Lewiston, Maine, died November 29, 1947, aged 60 years.

Dr. William Tarun, Baltimore, Maryland, died November 21, 1947, aged 77 years.

ANNOUNCEMENTS

STUDY COUNCIL COURSE

Since the courses offered by the Ophthalmological Study Council have proved of value in enabling students to obtain residencies and to prepare for the examinations of the American Board of Ophthalmology, the council will offer another course on the basic subjects of ophthalmology at Westbrook Junior College, Portland, Maine, from June 19 to September 11. Laboratory work in pathology, optics, slitlamp, and refraction will be given. The enrollment will be limited to 100.

AEROMEDICAL RESEARCH POSITION

The Air University School of Aviation Medicine, Randolph Field, Texas, is in receipt of an announcement from headquarters, United States Air Force, that the school has been allotted one of the limited number of special research positions recently authorized by Congress to attract outstanding scientists to service laboratories. This action by the Air Force is the first of a series designed to create an Air Force Aeromedical Center capable of fulfilling the needs of that force which emerged from the war as the nation's first line of defense. It is the intention of the School of Aviation Medicine to utilize the new allocation, which carries with it a salary of $10,000 to $15,000 per anum, to establish a civilian position-vacancy for a director of research. Inquiries concerning this vacancy should be addressed to the Commandant, Air University School of Aviation Medicine (27th AF Base Unit), Randolph Field, Texas.

COURSE FOR ORTHOPTIC TECHNICIANS

The American Orthoptic Council and the Ophthalmological Study Council is offering a course for orthoptic technicians comprising: (1) Nine weeks of lectures, demonstrations, and laboratory work on the basic sciences and basic skills, to be given by six or more well-known ophthalmologists and six or more orthoptic technicians. This will be followed by: (2) Six to 12 months of practical work in clinics or private offices, learning the art of orthoptics under the most favorable conditions.

The first part of the course will be given at Nasson College in Springvale in the township of Sanford, Maine, June 28 to August 28, 1948. Tuition will be $100.00; board and room for nine weeks, $200.00.

The second or clinical part of the training will involve in some cases a fee, in some cases no fee, and in many cases a salary, especially when, after a few months' experience, the student becomes a valuable assistant.

The class in the basic subjects is not limited. The number of places available at once in offices and clinics for the second part is limited to 30 or a little more. The course, as a whole or in part, can be taken to great advantage by technicians who are not beginners but already have had experience and wish to improve their knowledge and their skill with a view to better work and a higher salary in a more desirable situation. The demand for competent orthoptic technicians far exceeds the supply.

For information or registration apply to the American Orthoptic Council, 520 Commonwealth Avenue, Boston 15, Massachusetts.

DELTA-GAMMA SCHOLARSHIPS

The Delta Gamma Fraternity has a $1,000 annual fund, from which smaller scholarship awards are available for preparation of those intending to become (1) orthoptic technicians, (2) teachers of partially seeing children, or (3) specialists for blind preschool children.

Anyone wishing to specialize in one of these fields may be eligible for assistance, the amount in each case to be determined by the particular need and costs involved. If you want to enroll for training in one of these fields, apply for a scholarship to Mrs. Richard P. Miller, 39 West Jefferson Road, Pittsford, New York.

Candidates are selected with the advice of a professional committee: Chairman, LeGrand H. Hardy, M.D., of the American Orthoptic Council; Mrs. Virginia Smith Boyce, administrative assistant, National Society for the Prevention of Blindness; Miss Ruth E. Lewis, professor of social work, George Warren Brown School of Social Work, Washington University; Dr. Berthold Lowenfeld, director of educational research, American Foundation for the Blind; Miss Ruth B. McCoy, assistant director, New York State Commission for the Blind; and Lillian Ray Titcomb, M.D., president of executive committee, Nursery School for Visually Handicapped, Los Angeles.

ORTHOPTIC EXAMINATIONS

The annual examination of orthoptic technicians by the American Orthoptic Council will be conducted in September and October, 1948.

The written examination will be nonassembled

and will take place on Thursday, September 9, 1948, in certain assigned cities and offices and will be proctored by designated ophthalmologists.

The oral and practical examinations will be held on Saturday, October 9, in Chicago just preceding the meeting of the American Academy of Ophthalmology and Otolaryngology.

Applications for examination will be received by the office of the secretary of the American Orthoptic Council, Dr. Frank D. Costenbader, 1605 22nd Street, N.W., Washington 8, D.C., and must be accompanied by the examination fee of $25.00.

Washington university course

The Department of Ophthalmology of Washington University School of Medicine, St. Louis, has announced that its annual refresher course will be given from June 7 through June 26, 1948.

The course is purely didactic, consisting of 98 hours of lectures. The subjects covered will include corneal diseases, ocular therapy, surgery, anatomy and pathology, optics, the oculorotary muscles, glaucoma, embryology, fever therapy, perimetry, neuro-ophthalmology, headache, allergy, office-laboratory procedures, industrial ophthalmology, ocular syphilis, radiology in ophthalmology, tuberculosis, dermatology in ophthalmology, and practical refraction.

The tuition is $150.00, and the only prerequisite for those taking the course is a minimum of one year's training in ophthalmology. The course is designed to refresh the busy ophthalmologist, to review candidates for the American Board of Ophthalmology, and to enable the returned physician-veteran to reacquaint himself with his specialty.

Further details may be obtained from Richard G. Scobee, M.D., director of graduate training in ophthalmology, Washington University School of Medicine, 640 South Kingshighway Boulevard, St. Louis 10, Missouri.

Miscellaneous

Eye-Bank report

At the end of its second year of operation, the Eye-Bank for Sight Restoration, Inc., New York, announced that there are now 150 hospital affiliations in the United States and that contributions through membership support have increased 50 percent. Affiliate eye banks have been established in Boston and New Orleans. It is reported that glaucoma clinics and other special types of clinics have increased in number.

Dr. R. Townley Paton, vice-president of the organization, reported that in two years the eye bank has accepted 600 eyes from the public and that 90 percent of these had been used for transplantation. Eyes that could not be certified as suitable for the operation were used for research.

Navy vision program

The U. S. Navy has adopted a comprehensive vision-improvement and eye-protection program which affects several hundred thousand civilian workers in shore establishments throughout the country, in the Pacific and Caribbean islands, and in Alaska and Panama. By direction of Under Secretary of the Navy W. John Kenney and under the supervision of Capt. E. E. Saunders (U.S.N.), contracts have been signed authorizing Ortho-Rater programs in 78 naval shore stations.

As is the case with regular vision testing programs in industrial companies, workers failing to meet visual standards of their jobs will be referred for professional eye care.

George Washington University Hospital

The eye department of the new George Washington University Hospital scheduled to open this spring will serve not only the hospital's eye patients but also those suffering from diabetes, psychiatric disturbances, high blood pressure, and other illnesses.

The new hospital building will permit the establishment of an eye department as a major department of the hospital. As such, its staff will cooperate closely with other divisions in the diagnosis of illnesses not commonly thought of in connection with the eye, according to Dr. E. A. W. Sheppard, who will head the department.

In addition to assisting in diagnosis, the department will make available for Washington eye patients the most modern equipment to test and treat eye disorders. Services will include: (1) A shop to grind lenses and fit and adjust glasses. (2) Facilities for examining and treating eye diseases. (3) A classroom where clinics will be held and undergraduate students will receive instruction. (4) An orthoptic laboratory. (5) An (eye) operating room. The opening of this operating room is expected to relieve present congestion in Washington hospitals. Time allotted for operations by eye specialists now is strictly rationed. (6) A glaucoma clinic.

N.S.P.B. test of children

Work has been started on the evaluation of methods and instruments used to test the vision of school children who may need eye care, in a study sponsored jointly by the National Society for the Prevention of Blindness, the U.S. Children's Bureau of the Federal Security Agency, and the Missouri Division of Public Health.

Six different types of tests will be used in checking the eyes of 1,200 children in 20 elementary schools in St. Louis. Teachers, nurses, and a technician will run the children through the various tests. After school personnel have completed their tests, all children will receive an eye examination by oculists at Washington University Eye Clinics. Because of the many tests and examinations to be given, it is expected that the research will take approximately a year.

Coöperating in this study, in addition to the Washington University School of Medicine, is the St. Louis City Board of Education.

Societies

Trachoma organization

The International Organization against Trachoma was founded officially by decision of the XIIIth Concilium Ophthalmologicum at its meeting at Amsterdam, in 1929, for the discussion of matters of scientific, therapeutic, and international interest connected with trachoma. The last general assembly of delegates and members was held in London on April 21, 1939. The proceedings were reported in *La Revue Internationale du Trachome* for July, 1939, and in the *British Medical Journal.*

A meeting of the executive committee of the I.O.A.T. was held in Paris on May 17, 1947. Present were Dr. MacCallan, president; Dr. Wibaut, secretary-general; Professor Nordenson, president of the Concilium Ophthalmologicum; Dr. Ehlers, secretary-general of the Concilium Ophthalmologicum; Dr. Bailliart, président de l'Association Internationale de Prophylaxie de la Cécité; Dr. Lavery, Eire; and Dr. Churchill, secretary-general, Adjoint de l'Association Internationale de Prophylaxie de la Cécité.

The quarterly journal *La Revue Internationale du Trachome,* which is published in French and in English, is the official organ of the I.O.A.T. Publication ceased during the war but is hoped to recommence shortly. Articles by members of the I.O.A.T. may be sent to: Dr. Jean Sédan, 94 Rue Sylvabelle, Marseille, secrétaire général, La Ligue contre le Trachome.

Membership of the I.O.A.T. is by an annual subscription of 25 shillings sterling; this may be paid to the account of the I.O.A.T. at the National Provincial Bank, 23 Wigmore St., London, W.I., or its equivalent to Dr. F. Wibaut, P.C. Hooftstraat, 145, Amsterdam, Nederland. Larger donations from ophthalmologic societies are invited for the purpose of meeting the general expenses of the organization.

Further information may be obtained from the president: Dr. A. F. MacCallan, Westminster Hospital Medical School, 17 Horseferry Road, London, S.W.I., or from the secretary-general: Dr. F. Wibaut, P.C. Hooftstraat 145, Amsterdam, Nederland.

Reading program

The 76th meeting of the Reading Eye, Ear, Nose, and Throat Society was held jointly with the Diplomates Association of Berks County Physicians. The speaker was Dr. Leandro M. Tocantins, associate professor of medicine at Jefferson Medical School. He spoke on "The Critical Appraisal of Available Methods for the Control of Hemorrhagic States."

Georgia annual meeting

The Georgia Society of Ophthalmology and Otolaryngology held its annual meeting at the Fulton County Academy of Medicine, Atlanta, March 5 and 6. The lecturers included: Dr. Bennett Y. Alvis, St. Louis; Dr. Arthur J. Bedell, Albany; Dr. Ramon Castroviejo, New York; Dr. J. Brown Farrior, New Orleans; Dr. French K. Hansel, St. Louis; Dr. J. Elliott Scarborough Jr., Atlanta.

Louisiana-Mississippi meeting

The Louisiana-Mississippi Ophthalmological and Otolaryngological Society will hold its annual meeting at the St. Charles Hotel in New Orleans on Saturday, April 17, 1948. The program will include: President's Address, Dr. Noel T. Simmonds, Alexandria, Louisiana; "Secretional Obstruction and Bulbar Poliomyelitis," Dr. Thomas C. Galloway, Evanston, Illinois; "The Preparation of Patients for Intraocular Surgery," Dr. Walter Stevenson, Quincy, Illinois; "The Management of Complications of Ocular Surgery," Dr. Watson Gailey, Bloomington, Illinois; The J. Raymond Hume Memorial Address—"Vertigo: Differential Diagnosis and Treatment," Dr. J. R. Lindsay, Chicago, Illinois.

Hungarian medical week

In commemoration of the Hungarian War of Liberty, the Hungarian Medical Trade Union will arrange a celebrating medical week from September 4 to 12, 1948. The Hungarian Medical Society cordially invites eminent medical personalities and practitioners of foreign countries to be present and would be greatly honored by their active participation.

Preliminary information will be sent to personal addresses, institutions, and so forth all over the world. In consequence of the war, a great part of the addresses of medical men in our possession was destroyed. For this reason it is desirable to draw the attention of the foreign medical community to the above mentioned Medical Week by means of publication in the medical press.

Program of Milwaukee meeting

The Milwaukee Oto-Ophthalmic Society held its regular meeting on February 24, 1948, at the Milwaukee Athletic Club. The Mount Sinai Hospital Departments of Ophthalmology, Otolaryngology, Radiology, Pathology, and Neurosurgery had charge of the program which included: "Introductory Remarks," Dr. M. S. Fox; "Indications for Fenestration Surgery: Case Report," Dr. Gerhard Strauss; "Encephalitis and Chiasmitis," Dr. E. E. Grossmann, Dr. Norbert Enzer, and Dr. J. Mufson; "Ocular and Nasal Findings in Lesions of the Optic Foramen: Case Reports."—Ophthalmology, Dr. S. S. Blankstein; Otolaryngology, Dr. M. S. Fox; Radiology, Dr. M. Moel; Pathology, Dr. Norbert Enzer; and Neurosurgery, Dr. J. Mufson.

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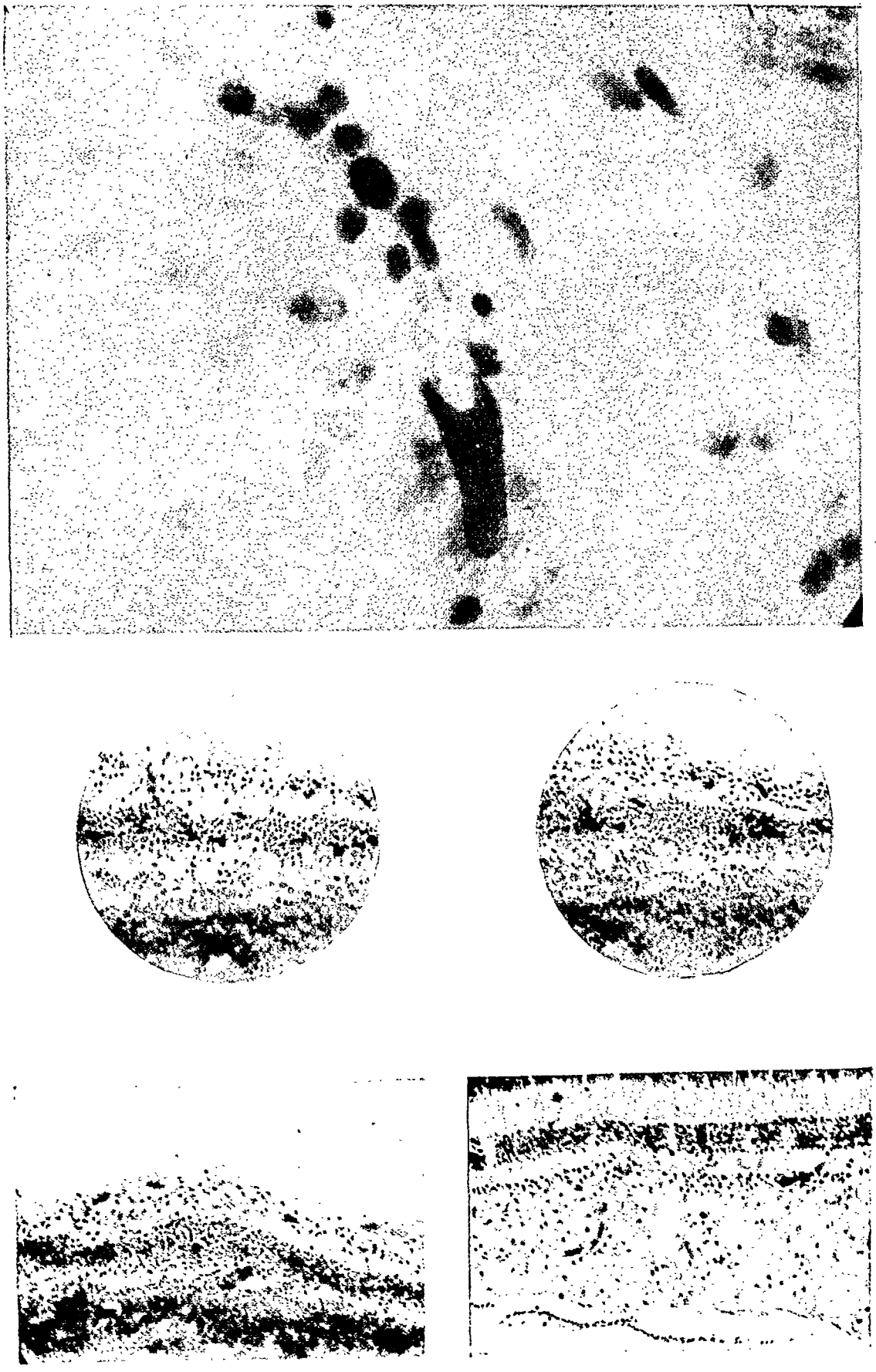


PLATE 1 (FRITZ AND HOGAN). FAT EMBOLI ARE SHOWN IN THE RETINAL VESSELS BY THE USE OF SUDAN-IV STAIN

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 31 MAY, 1948 NUMBER 5

FAT EMBOLIZATION INVOLVING THE HUMAN EYE*

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Prior to 1862 it had been surmised that fat embolism might follow injuries to the long bones or soft tissues. In that year, Zenker reported the first case of fat embolism in man. Since that time a fair number of case reports and studies of the condition have appeared in the literature.

ETIOLOGY OF FAT EMBOLISM

By far the greatest number of cases of fat embolism have followed injuries to the bones or soft parts of the body. Vance groups the factors causing this condition as follows:

1. Traumatic
   - A. To bones
     - (1) Fractures
     - (2) Jarring of bones
     - (3) Orthopedic operations
   - B. To soft parts
     - (1) Injury to subcutaneous fat
     - (2) Injury to fatty viscera
     - (3) Burns
2. Nontraumatic (dubious)
   - A. Diabetes
   - B. Childbirth
   - C. Injection of oily substances

The largest number of instances of this condition followed fractures of the long bones, particularly those of the lower extremities. Cases have been reported, however, following concussion of the bones, with liberation of fat into the circulation. Cases have been reported following manipulation of old contracted rheumatoid joints or other orthopedic operations such as osteotomies or excision of joints.

MECHANISM OF PRODUCTION OF EMBOLI

Depot fat is found in the subcutaneous tissues, omentum, viscera, and in the bone marrow. The fat in these various structures is stored within the confines of large cells. The marrow fat is the source of most emboli and may be liberated from the cells by direct rupture as in a fracture or by concussion from a blow. The vessels in the bones are held within the rigid Haversian canals and do not readily collapse following the injury. The liberated fat enters these torn vessels during or following the injury. This fat passes through the venous system to the right side of the heart and pulmonary circulation where fine emboli lodge in the capillaries of the lungs. Some of these capillaries may rupture, liberating fat into the alveoli, accounting for the fatty sputum which is occasionally noted. Some of the fat may pass through into the general circulation and result in systemic emboli. Fat may also be excreted by the kidneys, without the development of renal

* Part of the expenses connected with this research was met by the Florence Ellsworth Wilson Memorial Fund Fellowship in Ophthalmology.

† From the Eye-Bank Laboratory, New York, New York.

‡ From the Proctor Foundation for Ophthalmic Research and the Division of Ophthalmology, University of California Medical School.

damage. This accounts for the fat which is seen in the urine in many of these cases.

Symptoms and Signs

There are two main forms of the disease which may be encountered:

1. Pulmonary. The clinical symptoms in the pulmonary form may be of two types. The first develops soon after the injury and the symptoms are of acute and rapidly progressive pulmonary failure and are due to a massive flooding of the lungs with fat. The second type is more common and commences on the third or fourth day after the injury.

2. Systemic. The symptoms in this form depend on passage of fat to the various organs of the body after leaving the pulmonary system. In general the frequently involved portion of the body is the central nervous system. Restlessness, excitement, delirium, convulsions, and coma are frequently noted in this order. The skin may show petechiae; fat may pass into the urine through the renal glomeruli. Death may occur in from 2 to 6 days.

Ocular findings

A search of the literature shows only one case report which deals with the ocular findings (Evans). In this case a man, aged 23 years, was injured in a road accident. Twenty-four hours later the patient became drowsy. On examination he showed contusions, a fractured right tibia and fibula, right patella and right ulna. All fractures were set under ether anesthesia following admission to the hospital. Forty-eight hours after the injury, the patient was excited and developed incontinence of urine. He showed petechiae on the chest and neck, a slight squint of the left eye, and fat in the urine. Four days after the injury the fundi were examined and showed diffuse edema of the whole posterior pole, especially the macular regions. There were three crescentic areas of intensified pallor near the right macula. In the right eye there were two large subhyaloid hemorrhages, temporal and below the macula. In the left eye there was one smaller hemorrhage in the periphery. The ocular blood vessels appeared normal. Fifteen days after the injury the patient was much better and was able to read. The fundi showed less edema. Two months after the injury, the vision was 20/20 in each eye, and there was still a small remnant of the subhyaloid hemorrhage in the right eye but the left fundus appeared normal.

Because of the paucity of information in the literature concerning the ocular complications of generalized fat embolization and because the ophthalmoscopic and ocular histopathologic changes were so clearly and unequivocally observed in a typical case, it was deemed worthwhile to draw up a complete case report.

Case report

A 21-year-old soldier was admitted to the emergency room about 8:30 a.m. (Eastern war time), June 27, 1945, in shock.

History. At about 7:50 a.m., June 27, 1945, while the patient was on duty in the forward galley of a tug boat at the Boat Squadron Dock, a gasoline stove had exploded from an unknown cause and the concussion of the explosion had caused the following injuries:

1. Fracture, compound, complete, both tibias and fibulas, mid-third.
2. Fracture, simple, complete, medial malleolus, right tibia.
3. Fracture, simple, complete, posterior lip, left tibia.
4. Fracture, 9th rib posteriorly, right side, and 1st rib, left side.
5. Fracture, 1st sacral segment, simple, incomplete.
6. Wound, lacerated, parietal region of skull.
7. Hematuria, origin undetermined.
8. Shock traumatic; B.P. 40/15 mm. Hg.

Examination. At 8:40 a.m., the blood pressure was 120/80 mm. Hg. A 500-cc. transfusion of plasma was started immediately after admission. The pulse was in the range

of 84 to 88. Complete blood studies were ordered, including hematocrit, and the patient was immediately typed for blood transfusion. From 8:55 to 11:00 a.m., the blood pressure range was 115 to 130/75 mm. Hg. He was then given 500 cc. of whole blood.

After the patient's condition became stabilized, splints were applied to both legs. The patient was conscious and oriented at all times and discussed the accident quite freely.

X-ray films of the legs, pelvis, and chest were made, and the possibility of a head injury was kept constantly in mind. At no time were there any neurologic findings to indicate such an injury.

The patient was catheterized, for there was the possibility of a genito-urinary tract involvement, and bloody urine was obtained. A cystogram was obtained and showed no evidence of rupture of the bladder. The abdomen was soft. There was no pain nor tenderness over the kidney regions. The chest was clear, and at that time there was no evidence of a blast injury.

During observation and study, from 8:30 a.m. to 1 p.m., it was the opinion of the surgical department that this patient could be operated upon, the fractures reduced, and alignment maintained. At time of operation, red blood-cell count was 4,230,000; hematocrit, 40; and blood pressure, 108/80 mm. Hg.

Operation. Under ether and oxygen anesthesia, the legs were thoroughly scrubbed with soap and water, shaved, and alcohol and tincture of merthiolate applied. The wounds were debrided. The left tibia was united with transfixion screws, and the right tibia with transfixion screws and a 4-screw plate. During the operation, the patient received glucose, blood, and normal saline intravenously. He lost considerable fluid on the table. After fixation, casts were applied and the patient was returned to bed.

At 11 p.m., the patient was seen by the orthopedic department, and at that time he had recovered from anesthesia; the blood pressure was 116/80 mm. Hg; pulse, 116. He was talking about the accident, and his postoperative condition was good.

Course. He was next seen at 8 a.m., June 28, 1945. There was a very marked change in his condition. He was unconscious and reacted sluggishly to stimulation. There was very slight pupillary response to light, flaccid paralysis of the arms, and the temperature was 102.5°F.; blood pressure, 108/70 mm. Hg; respiration, 30; pulse, 130. Again the question came up as to the presence of head injury. The unconsciousness, the slight response to stimuli, and paralysis were all suggestive of a head injury. Acidosis, pulmonary edema, and secondary shock were considered.

Coma continued until time of death. Complete blood chemistry examination revealed no explanation for the coma. A spinal tap was done, and was grossly clear. Clinically there were no signs of increased intracranial pressure.

Eye examination. Ophthalmologic consultation on the same day revealed the pupils to be round and equal in size. They reacted briskly to light. Under homatropine mydriasis, the fundi showed round and oval, white, subretinal exudates completely surrounding both maculas and following the course of the main retinal vessels. There were no hemorrhages. The macula in the right eye appeared cherry red. Diagnosis was: (1) Multiple fat emboli of the retinal vessels. (2) Edema of the retina secondary to the embolism of the vessels.

Diagnosis. From the accumulated data, a diagnosis of fat embolism was based upon the following considerations: (1) Presence of fat in urine. (2) Coma in a man with multiple fractures. (3) Coma in a man without signs of increased intracranial pressure. (4) Eye-ground examination which showed embolic phenomena involving the retinal vessels. (5) Multiple petechial hemorrhages of skin and conjunctiva. (6) Chest films had a cotton ball appearance in the parenchyma of the lungs.

Later the same day the patient was seen

by Lieut. Col. Phillips Thygeson and Lieut. Col. S. Rodman Irvine, who wrote: "Media clear. Edema and exudates both fundi, more marked in right. Discs appear normal. No actual fat emboli seen but appearance of retinas suggest an embolic phenomenon involving central vessels."

On June 29th, the ophthalmologic note read: "There are multiple conjunctival petechiae in both eyes. Eyegrounds show no hemorrhages. Exudates increased in number in left eye. They are along vessels which appear quite normal."

The ophthalmologic note on July 3rd read as follows: "Cotton wool would best describe the exudates now. There are more of them along the vessels on the left and in one of them is a hemorrhagic area. On the right there are now many white exudates on both sides of the disc. The cherry red macula in the right eye persists."

About two days after admission, the patient had X-ray evidence of pneumonia in the right lower lobe. He was treated by oxygen, intravenous glucose and saline, multiple blood transfusions, intravenous vitamins, and concentrated albumen. He was also given penicillin intramuscularly in large doses, and from the 2nd to the 5th postoperative day, he was given 5 gm. of sodium sulfadiazine daily.

The patient at no time came out of his comatose state, and the course was gradually downhill. He developed an acute pulmonary edema, which disappeared on the sixth postoperative day after the administration of 100 cc. of concentrated albumen. Previous to this time, the man had been given concentrated glucose, atropine, and frequent tracheal aspirations. At times as much as 200 cc. of fluid would be obtained in one tracheal aspiration. Fat was never obtained in the sputum. Blood chemistry was relatively normal except for the blood chlorides, which were elevated on two successive days. This was taken care of by discontinuing the administration of intravenous saline. The red count ranged between three and four million.

The patient died on the 10th postoperative day, July 6, 1945, at 2:05 p.m.

General pathologic report

The following notes are all that have been found of the general pathology protocol. Scharlach-R stain was used.

Brain. Fat stain of the brain shows many capillaries plugged with fat emboli. Surrounding many of these emboli are seen focal areas of necrosis not associated with hemorrhage. There is seen in various portions of the section what appears to be free fat globules within the parenchyma and here and there early phagocytosis of the lipoid material is in progress.

Myocardium. Microscopic section of the myocardium shows nothing of note.

Lungs. Microscopic section of the lungs shows many of the alveolar spaces filled with polymorphonuclear leukocytes. The bronchioles are filled with purulent material. Many large phagocytes filled with brown-staining material are seen. Fat emboli can be demonstrated within the lung tissue. There is considerable hemorrhage within the alveolar spaces surrounding these emboli.

Liver. Microscopic section of the liver shows normal configuration of the liver lobules. The cytoplasm of hepatic cells is somewhat granular. Scharlach-R stain shows an occasional large droplet of fat within the sinusoids.

Spleen. Microscopic section of the spleen shows engorgement of the sinusoids.

Kidneys. Microscopic section of the kidneys shows many of the glomeruli in the H.-&-E. stain to contain what appears to be large clear spaces. Scharlach-R stain reveals that these areas are fat globules filling the capillaries.

Diagnosis. (1) Fat embolism (generalized fat embolization). (2) Pneumonia, terminal.

Ocular pathologic report

Gross examination

(Dr. Hogan, made this report.) Calottes had been removed from both eyes prior to

their reception at the laboratory. The specimens had been embedded in gelatin blocks and preserved in 10-percent formalin. It was not possible to identify the eyes as to whether they were right or left eyes or to render a gross description of the specimens.



Fig. 1 (Fritz and Hogan). Hemorrhage in the inner retinal layers (Sudan IV).



Fig. 2 (Fritz and Hogan). Focal area of retinitis. Note fat-filled capillaries at periphery of lesion (Sudan IV).

Technique

Frozen sections of the gelatin blocks of the embedded eyes were made with the freezing microtome. The cut sections were stored in distilled water containing a small amount of 10-percent formalin. The best sections were selected and stained with Sudan IV for fat. The stained sections were mounted on slides in a solution of either gum arabic or glycerin under glass cover slips. The cover slips were rimmed with paraffin or concentrated nitrocellulose to prevent drying.

Microscopic description

Cornea. The epithelium shows some atrophy and slight postmortem degeneration.

Limbus. Schlemm's canal is open and the

trabecular meshwork contains some clumps of dark uveal pigment.

Sclera. The sclera shows small, scattered globules of fat on the surface, but not in conjunction with any of the blood vessels.

Choroid. The posterior choroid, adjacent to the optic disc, shows several vessels just beneath the choriocapillaris which contain



Fig. 3 (Fritz and Hogan). Capillary fat emboli in inner retina (Sudan IV).

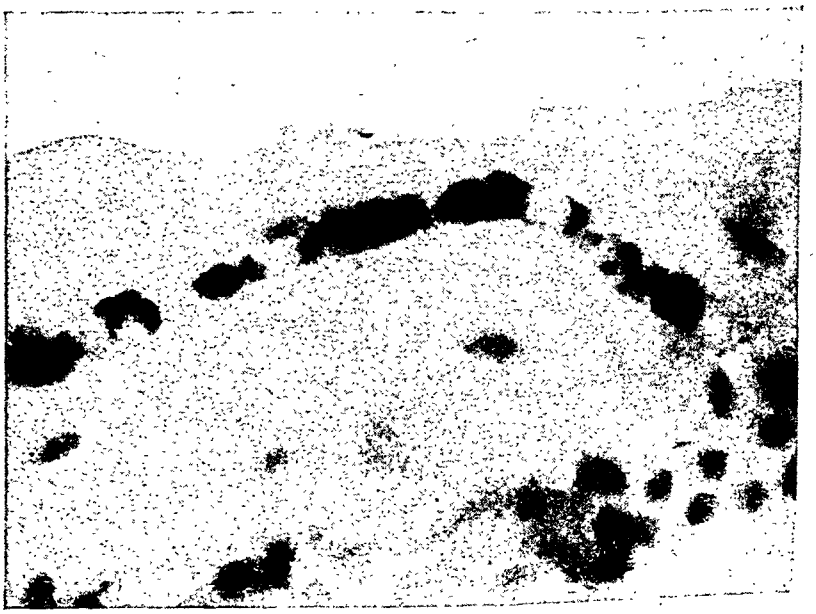


Fig. 4 (Fritz and Hogan). Embolus in retinal capillary (Sudan IV).

Anterior Chamber. There are several large dark clumps of uveal pigment in the angle.

Iris. The iris shows heavy pigmentation, but does not appear to be inflamed.

Ciliary Body. The stroma and processes show light diffuse edema and round-cell infiltration. Several small capillaries in the longitudinal portion of the ciliary muscle show fat emboli.

Choroid. The posterior choroid, adjacent to the optic disc, shows several vessels just beneath the choriocapillaris which contain fat emboli. The stroma around these vessels is chronically inflamed.

Retina. The principal changes in this eye have occurred in the retina, posterior to the equator. The temporal portion of the retina seems to be most affected, and there are extensive changes in the macula. The nerve-

fiber, ganglion-cell, and inner-plexiform layers are most severely affected. The following changes are noted in these areas: (1) Scattered, fine circumscribed hemorrhages in the nerve-fiber and ganglion-cell layers. (2) Focal areas of edema, hemorrhage, chronic inflammation, and secondary degeneration are seen in the inner portion of the retina (fig. 1). In and around these areas, the terminal retinal arterioles and capillaries are dilated and contain fat emboli which stain with Sudan IV (fig. 2). In some areas the capillaries have ruptured and fat lies loose in the retinal stroma. (3) Scattered capillaries in the nerve-fiber, ganglion-cell, and inner-plexiform layers throughout the retina show small fat emboli (figs. 3, 4, 5, and 6). Some of these vessels show perivascular round-cell infiltration. (4) In several areas, the inner limiting membrane shows interruptions and a fine fibrinous exudate fills the gap and lines the inner retinal surface.

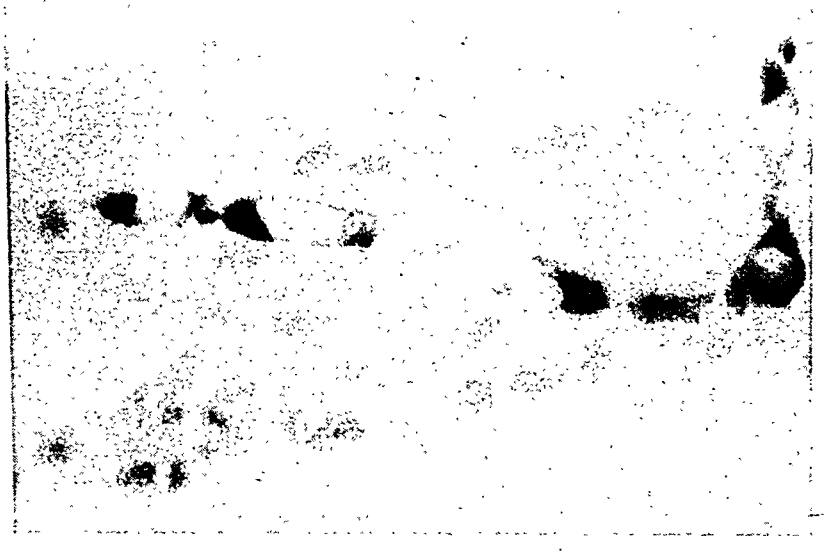


Fig. 5 (Fritz and Hogan). Fat embolus in retinal capillary (Sudan IV).



Fig. 6 (Fritz and Hogan). Embolus in retinal capillary (Sudan IV).

Optic Nerve. The disc appears somewhat

edematous, especially at the nasal and temporal borders. A number of capillaries in various sections show fat emboli. There are a number of small circumscribed hemorrhages on the disc, especially in the nerve-fiber layer on the nasal side. A few chronic inflammatory cells lie on the inner surface of the cup.

Vitreous. The vitreous details are obscured due to the necessity of embedding the specimen in gelatin.

Lens. The contents of the lens were lost in preparation of the specimen, but the capsule and epithelium appear normal.

Comment

The sections of this specimen show undoubted fat emboli in the terminal retinal arterioles and in the retinal capillaries. There are also a number of small retinal hemorrhages in the inner layers. The edema and degeneration of the retina seen in the areas of these emboli probably result from a lack of nutrition caused by blockage of the vessels. It is interesting that the larger retinal and optic-nerve vessels show no emboli.

The changes seen in the second specimen are identical with those reported in the above eye so it is not necessary to duplicate the description. In general the findings in the retina in this eye are not as severe as those seen in the fellow eye.

Diagnosis

1. Embolism, fat, retina, choroid, optic nerve, and ciliary body.
2. Retinitis, secondary to fat embolization.

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University of California Medical Center (22).

The authors' thanks are due to the following individuals without whose coöperation the reporting of this case would not have been possible.

Lieut. Col. Coy S. Stone (MC), Chief of the Surgical Service, Station Hospital, MacDill Field, Tampa 8, Florida, gave the authors the opportunity of making the diagnosis and observing the eye grounds during the life of the patient.

Miss Madeline Banton, secretary to Colonel Stone, assembled records that seemed irretrievably lost in the confusion following the rapid changes of personnel after capitulation of the Japanese.

Capt. Millard B. White (MC), pathologist of the Station Hospital, contributed the protocols and made the sections of the thoracic organs, the abdominal organs, and the brain.

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THE TEACHING OF OPHTHALMOLOGY*

The Harry S. Gradle Lecture

Derrick Vail, M.D.
Chicago, Illinois

We sincerely regret that Prof. Harry S. Gradle is not here with us, either to give this, the first Gradle Lecture, in person, or to hear its presentation. It is our great loss for Dr. Gradle, more than any other individual in the United States, thought more about and did more to stimulate the teaching of ophthalmology.

It was his genius that helped to develop the instruction courses that are so important in the life of the American Academy of Ophthalmology and Otolaryngology and its members, and it was he who conceived and executed the Home Study Courses in Ophthalmology that have guided and will continue to guide the early thinking and steadfast study habits of a neophyte ophthalmologist. He has written and talked much and thought deeply about all the phases of the teaching of our great specialty.

Shortly before his retirement, because of ill health, from the activities and the group of colleagues whom he loves, he was engaged in a plan to integrate all the ophthalmic facilities of Chicago and to form a continuous postgraduate course of ophthalmology, open the year around to any qualified physician, and covering every subject embracing the broad field of ophthalmology. It is the hope and ambition of the members of the Chicago Ophthalmological Society to carry out this plan to a successful conclusion. Alas, his genius and help are no longer available to us, and it will take much time and skill to come near to his expectations.

* Presented at the III Pan-American Congress of Ophthalmology, Havana, Cuba, January 7, 1948. From the Department of Ophthalmology, Northwestern University Medical School.

Teaching is responsibility

It is with considerable disquiet that I have accepted the invitation, and the great honor it imposes, to give the Harry S. Gradle Lecture, because until very recently my endeavors in the field of ophthalmic education have been limited and my outlook and experiences are just beginning to unfold. Yet the teaching of ophthalmology is a subject that is of the utmost importance to men and women everywhere and of the deepest significance to society. Eyesight is the greatest gift to mankind, and it is our chosen responsibility to endeavor to preserve, maintain, and restore, where necessary, the use of this priceless gift. The teaching of ophthalmology is a part of this grave responsibility and we will not have fulfilled our destiny until each one of us has added a bit to the pool of knowledge or has passed down parts of it to those who are to succeed us.

The teaching of ophthalmology entails a discipline similar to that of any other medical specialty, although the field that is covered is broader than most of them. Our material is the young physician, who has just completed his interneship, or the older physician, who wishes to take up the study and practice of ophthalmology either as a part of his practice or as the whole. But the seeds of our teaching should be planted earlier than this, in the minds of the undergraduate medical student and in some favorable cases by a postnatal approach, as those of us who have been lucky enough to have ophthalmologic fathers, and there are many such, can testify. Fortunate, indeed, are those individuals who have been exposed from the cradle on to the intellectual and

stimulating environment of ophthalmology and have grown up into the specialty as a natural birthright. Harry S. Gradle is one of these, and he is a great credit to a great father.

Qualifications of ophthalmologist

Our raw material must be of first rate quality. The individual seeking to make a success of the practice of ophthalmology must possess keen vision, excellent color discrimination, a steady hand, a courageous heart, sympathy and understanding and love for man. He must have a definite artistic temperament, a somewhat feminine quality of intuition, and he must be a perfectionist. He must have a high sense of duty, a conscience that pricks but does not stultify, and a masculine boldness that is at its best in emergency. He should be able to draw straight and curved lines with a pencil or knife. He should be interested in medicine and surgery, physics, optics, physiology, chemistry, and psychiatry. He should be a student of anatomy, embryology, and pathology.

The teacher should be an experienced clinician or laboratory worker, or both, with unquestioned intellectual integrity. He must be patient and sympathetic, logical, tireless, and efficient. But above all he must be interested in teaching, adaptable to new trends and situations, and eager to seize upon all tried methods of getting his subject across the barrier of his and his student's mind. Unfortunately, there are not enough of such individuals thus described, either teacher or student. But the ideal is there and it should ever be before us.

Facilities for teaching

On the whole, the physical plants and facilities for the teaching of ophthalmology throughout Pan America leave much to be desired. There are only a relatively few adequate places with ideal surroundings where ideal teaching to ideal students can be carried out. Yet if the instinct and urge, the wish and the ability are in the heart of a teacher, the student can learn even if there be nothing but a log for the two to sit upon, and sand upon which to draw the necessary diagrams. So, in the last analysis, it all comes down to the quality of the men, teacher and pupil.

Let us see how an individual, wishing to become one, develops into an ophthalmologist. These are the steps: (1) Undergraduate teaching, (2) graduate teaching, and (3) postgraduate teaching.

Undergraduate teaching

A recent study by a committee of the American Academy of Ophthalmology and Otolaryngology embraced an investigation of the curriculum of undergraduate ophthalmology in every medical school in the United States. Many interesting facts were disclosed upon which suitable recommendations to medical schools could be made.

There was a wide variation in the hours allotted, the subjects covered, and the methods of instruction. Some of the schools with great reputations were weak and others of lesser caliber were strong in this department. In some, the methods of instruction that were used were casual and haphazard, in others thoughtful and meticulous. The total number of hours varied from 24 to 118, the average being about 53 hours given to the undergraduate teaching of ophthalmology. The complete report of this committee is appended hereto. It rightly forms an essential part of this presentation.

*Report of the Committee on Undergraduate Instruction in Ophthalmology to the Council of the American Academy of Ophthalmology and Otolaryngology. October, 1947.**

The Committee on Undergraduate Instruction in Ophthalmology sent questionnaires to the ophthalmology department heads of 40 of the leading medical schools of the country. Replies were received from 37 regarding the amount and nature of the teaching given in their respective institutions. Appreciation is expressed by the committee for this coöperation since the ques-

* Published in the *Transactions of the American Academy of Ophthalmology and Otolaryngology*, Nov.-Dec., 1947, pp. 134-135.

tionnaire was somewhat long and involved. These replies were analyzed and carefully considered. Based on a study of them, the following outline is presented as a model for undergraduate teaching of ophthalmology. The committee realizes that modifications must be made by individual schools depending on available personnel and facilities and it is not their intention to present an exact outline, but rather to define in general terms certain goals that are considered desirable.

Outline for the Teaching of Ophthalmology to Undergraduate Medical Students. The anatomy and physiology of the eye may best be given as a part of the respective courses in the departments of anatomy and physiology. It is suggested that the services of the department of ophthalmology should be utilized in the presentation of these subjects.

The anatomy and physiology of the eye including physiologic optics might well occupy 20 to 24 hours, being approximately equally divided between the two subjects.

In the regular course of pathology one or two hours toward the end of the course should be devoted to the study of eye pathology. Here also the help of the department of ophthalomology might advantageously be utilized.

At the beginning of clinical instruction the student should be assigned to the department of ophthalmology for indoctrination in the use of ophthalmic diagnostic instruments for a period of from four to eight hours. This would include instruction in ophthalmoscopy, perimetry, external examination, the use of oblique illumination, the taking of vision, the gross examination of ocular motility, but no consideration given to the technique of refraction.

In the department of ophthalmology a minimum of 40 hours and a maximum of 60 hours should be required. Of this 20 percent to 40 percent may well be didactic and 60 percent to 80 percent clinical.

Didactic Instruction. The bulk of the didactic teaching should precede the clinical instruction in ophthalmology. The didactic teaching should be largely devoted to the relationship of ophthalmology and general medicine and to a study of the most important eye diseases met with in the general practice of medicine. To this end it is suggested that the first one or two lectures only be devoted to a review of the anatomy and physiology of the eye; a third lecture be on asthenopia and disturbances of ocular motility; a fourth on important eye diseases requiring differential diagnosis, such as conjunctivitis, keratitis, and uveitis, with special emphasis on glaucoma. All the remaining lectures, which therefore constitute a majority of the course, should be devoted to the various phases of medical ophthalmology. Under this head should be included such subjects as ocular manifestations of systemic diseases, syphilis, tuberculosis, diabetes, malignancies, blood dyscrasias, and vascular disease. Also the important subject of neuro-ophthalmology, including optic neuropathies and the ocular manifestations produced by intracranial lesions, should be considered. It is considered important that lectures should not slavishly follow textbooks, but should exceed the usual brief and relatively uninspiring textbook approach.

The use of visual aids to supplement teaching should be extensively employed.

Certain "don'ts" for the didactic course seem worthy of special mention, namely:

1. Do not discuss the technique of refraction.
2. Do not spend important time on the diagnosis of muscle anomalies.
3. Do not consider medical and ophthalmologic curiosities.

Clinical Instruction. Subjects in so far as possible should illustrate the material presented in the didactic lectures. Effective clinical teaching can be given only to small groups of students. Direct observation of surgery is of doubtful value. The salient points can be adequately covered with motion pictures. If surgical demonstrations are to be given, they should be confined to a few typical examples of common operations. The opportunity to observe operations may be offered as an elective.

History taking and actual examination of the patient by the student is an important feature and the student's work should be reviewed by the instructor. During this period of clinical instruction proper emphasis should be placed on the technique of the examination.

Since ophthalmology is a required course, an examination should be given at its termination.

Every student should be required to own his own ophthalmoscope and a suitable textbook.

It is urged that the departments of medicine, obstetrics, pediatrics, and neurosurgery require that an ophthalmoscopic record be made of each student on the patients assigned to him.

In so far as possible, elective courses in ophthalmology should be offered by the department. (Signed) Lawrence T. Post, M.D., *Chairman;* Edwin B. Dunphy, M.D., Derrick Vail, M.D., and Alan C. Woods, M.D.

Comment

The purpose of a good course in ophthalmology to the undergraduate medical student should be (1) to introduce him to an important and fascinating field of medicine, (2) to teach him ophthalmoscopy and the relationship between the eye and general diseases, (3) to teach him to recognize and diagnose the mutilating eye diseases that are likely to be encountered—such as glaucoma, iritis, conjunctivitis, and cataract—by any practicing physician, and (4) to teach him

the importance of consulting with the expert ophthalmologist who will be of great help to him and to his patient and who will gain his respect. The undergraduate course should not include refraction, ophthalmic surgery, and the various techniques of advanced study.

Graduate teaching

By graduate training I mean that obtained through residencies or preceptorship. It does not, nor should it, include short courses here and there. It is in this phase that the sincere, earnest, and talented young physician obtains his foundation of ophthalmic knowledge and practice, upon which his entire career rests and his integrity and intellectual honesty depend. There is a trend, and I think it is a wise one, for the development of special basic courses in ophthalmology to follow the interneship and to precede the residency.

Curriculum of training

This preresidential course embraces ophthalmic anatomy, histology, embryology, and pathology, optics, visual physiology, and principles of refraction. It includes the instrumentation and techniques of examination, such as inspection, observation, and notation, slitlamp biomicroscopy, tonometry, perimetry, gonioscopy, and especially ophthalmoscopy. The principles and care of the instruments are taught.

Emphasis is also given to biochemistry as it pertains to the eye, pharmacology and therapeutics, neuroanatomy, neurophysiology and neuro-ophthalmology, bacteriology, serology, and toxicology. Such miscellaneous topics as heredity, ophthalmic psychiatry, occupational or industrial ophthalmology, and so on, are essential parts.

A satisfactory basic course must cover, as far and as widely as possible, ophthalmology as it pertains to general medicine, for we are physicians first and ophthalmologists second.

Length of course

The length of such a course varies from place to place depending upon the talents and skills of the members of the faculty and on the physical facilities and equipment that are available.

A basic course without any clinical inclusion can be given adequately in four months. Clinical experience, enough at least to permit the graduate student to exercise the things that he has learned in the classroom, is desirable, but it prolongs the course six to nine months. This is not a misfortune for in the short course scarcely enough time is allowed for the student to digest and absorb the material that is presented to him.

The danger of a longer basic course is that the student considers, in some cases, that he has had enough training and will go out into practice without further to do.

At the moment this may be perplexing to the director of such a course, for as Prof. Alan C. Woods of Johns Hopkins has said, "There are a great number of poorly trained and educated men who have completed their military service, are dissatisfied with their former medical practice, and now take the opportunity offered by the G. I. Bill of Rights to enter a specialty which they correctly believe to be lucrative and erroneously believe to be easy. The great majority of this group are poor material and even under normal conditions would have great difficulty in obtaining hospital appointments. Under present conditions their chances of doing so are minimal."

Dr. Woods goes on to say, "I feel strongly that admittance to such basic courses should be limited to men who have either obtained their ophthalmological interneships or who have fair prospects of ultimately being properly placed."

Basic courses, therefore, no matter how long, should under no circumstances be considered as the final step in the training of an ophthalmologist.

When course should be given

There is too, at the moment, a controversy as to whether such a basic course should be given prior to or during the ophthalmic residency. There are excellent arguments to both sides, but I believe that, if some clinical work can be given along with the basic studies, the student is in a much better position to appreciate the residency training. It might be arranged, in addition, to give the resident about to graduate, a quick review in basic subjects.

Unfortunately, there are not enough residencies in the United States to take care of the demand and many a well-trained basic student has had to undertake a preceptorship of several years' duration. The final value of a preceptorship depends on the ability of the preceptor and the opportunity presented to the student to learn. Thus one can see that there is an enormous variation in the quality of the preceptorship between very bad conditions, even exploitation, on the one hand, to a glorious opportunity under a paternal, experienced, and loving hand of guidance on the other.

Residency training

Residency training has proved, in all fields of medicine, to be the best method of educating the physician, and it is especially so for the ophthalmologist. Whether it should be for two or three years' duration is a debatable point, but there comes a time when the young ophthalmologist must leave the nest and go on his own. The director of the department, jealous of his school or hospital, is usually pretty particular whom he chooses as resident and will see to it that the young man measures up to the highest principles and ideals. During the residency, the young ophthalmologist is expected to know his cases intimately; to read, study, and review the literature; and toward the end of his stay, he is usually encouraged to do a bit of research or to write a paper. He frequently takes some modest part in the teaching program, if there is one, of his hospital, and attends the local medical society meetings and staff conferences. His time is shared between hospital and outpatient work, and if he is fortunate and skillful and endowed by nature, he becomes a safe and even expert ophthalmic surgeon by the end of his term.

There are few hospitals in the United States that are equipped to offer residents educational opportunities of university standing. There is a need to tie together in some fashion these hospitals and the nearest university. The same thing applies to the study of the basic sciences, for it is in this important phase of his education that the young ophthalmologist needs guidance in his study schedule and in his study habits. The contact that he makes with the teachers in the basic sciences will lead to a closer union between the clinic and laboratory. It is no doubt difficult to find enough teachers for either the clinical or the basic-science studies. As time goes on, however, the number of residents who graduate will increase, and they should be able to assume much of this work.

Organization of residency

The residency should be organized as a real educational experience provided by qualified teachers who are willing to assume responsibility for adequate instruction. It should be a joint responsibility of medical schools and of those hospitals able to provide residencies of a satisfactory educational character.

A valuable residency should include careful supervision of the resident's work, particularly in his first few months of service. Organized regular ward rounds, with free discussion of the problems encountered and suggestions for their solution, are an essential part of any residency. Clinical conferences and staff meetings, not only those of the ophthalmic staff but also those of the entire hospital staff, must be attended by the ophthalmic resident.

The value of a journal club, with weekly meetings, has been well established. Under the direction of his chief, the senior resident should be given the responsibility for at least a portion of the conferences, seminars, and meetings. Reports, written by the resident, should be insisted upon, in order to develop his ability to organize his facts logically, to present them clearly, and to draw appropriate conclusions. He should be encouraged to speak from notes or memory, and thus develop his powers to speak effectively. It goes without saying that a good ophthalmologic library as part of a medical library should be easily available.

Experience in consultations

Consultations on his own, and particularly on other services, are of the utmost value, and every opportunity must be taken to foster and encourage them. The resident, who, as a future ophthalmologist, will be constantly called in consultation, should learn during his years in the hospital the value of such a consultation and how to conduct himself in meeting the patients and his colleagues. Therefore, he should be present as frequently as possible when his chief is called in consultation; and when he becomes the senior resident on his service, he can become a consultant to other services. When he is not satisfied with his findings, he should call upon his chief for assistance.

Living in a large hospital with other residents, he sleeps, eats, and lives medicine and ophthalmology. He shares in the experiences of the other services and he becomes acquainted with the different ways of doing things by different good men. To my way of thinking, there is no substitute for a good residency in the training of an ophthalmologist.

Postgraduate training

By postgraduate training, I mean that obtained upon completion of residency or preceptorship. It may follow the residency immediately and consist of, for example, a year or more as an assistant to a well-established and older ophthalmologist. Again, the postgraduate student may be a surgical fellow, traveling around from place to place, observing different techniques of different men with time to study, to experiment, to do literary or surgical research; or he may elect to spend some months in a physiological or biochemical laboratory learning methods and gaining experiences that may be useful later; or he may migrate for a space of time for special study in ophthalmic pathology in some great ophthalmic center.

Postgraduate training may come later and sporadically, through short refresher courses, or instructional courses, or through the special societies, such as this great body. Indeed, there is no end of opportunity and more and more of these courses are becoming available. They are of the utmost value to a man's life and career, refreshing his mind and lifting his spirit from the rut of daily practice and the making of money. All of us are here now, in spite of the expense and loss of time, because of that great hunger within us to learn and to experience more and new things that have to do with the work we love.

Technical aids to teaching

I have given much thought to a discussion of the technical helps for the education of an ophthalmologist. Scores of devices, such as moving pictures or films, animated drawings, slides, models—in short all of the contrivances now known as visual aids—are at hand. Sound film, technicolor, and television offer much promise for the future.

Our ophthalmic literature—books, journals, monographs, abstract journals, and so on—is becoming more valuable either directly or through microfilm. Language barriers unfortunately remain, and perhaps more thought should be given to a study of ways and means to overcome this difficulty more effectively. Home-study correspondence courses exercise considerable influence and may play a still more prominent part

not only in the education of the young ophthalmologist, but also as refresher courses for the practicing and older ophthalmologist. The true teacher is ever alert to methods and techniques whereby he can overcome the rather high threshold of resistance to new knowledge, a resistance that is so human in the student, in his colleague, and even in himself.

In the last analysis, however, the teaching of ophthalmology hinges on the character, the personality, the experience, the wisdom, the skill, the integrity, and, above all, the desire and love of teaching that is inherent in the teacher himself. Such teachers are few and far between. Such a teacher is our dear friend and colleague, Harry S. Gradle.

700 North Michigan Avenue (11).

MONOCULAR OPERATION FOR HIGH DIVERGENT STRABISMUS*

L. WEEKERS, M.D.
Liége, Belgium

In high divergent strabismus, the deviating eye is often amblyopic. The patient readily consents to operation upon that eye but he objects to letting the sound eye be treated surgically. That is one of the reasons why a binocular operation, if suggested, is not always accepted. Another reason is that the doctor is sometimes not very encouraging as regards the complete correction of the squint after the operation.

There follows a description of a monocular operation which gives excellent and constant results. We have been using it successfully, with some minor improvements, for the last 20 years.†

The operation consists essentially in temporarily attaching the internal rectus to the external rectus of the same eye. Being maintained in this position for seven days, new adhesions occur between the internal rectus and the sclera. The internal rectus is considerably shortened, and its action greatly increased.

PROCEDURE

Anesthesia. Instill a few drops of cocaine. Inject 1-cc. scurocaine (4 percent) in the orbit, 1 cc. along the internal rectus, and 0.5 cc. behind the tendon of the external rectus. This anesthesia renders the manipulation practically painless.

Step 1. Without incising the conjunctiva, the tendon of the external rectus is seized with forceps. A double thread is passed against the sclera under the tendon, or under the muscle just behind the tendon (fig. 1). It is essential to the success of the operation that this hold be a strong one. The thread is double so that it can bear a strong pull without cutting the tissues (fig. 1).

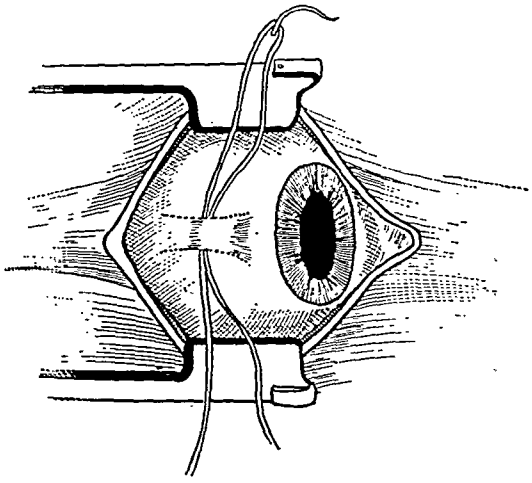


Fig. 1 (Weekers). A double thread is passed against the sclera under the tendon, or under the muscle just behind the tendon.

* From the Ophthalmological Clinic, University of Liége.

† Weekers, L.: Bull. Soc. belge d'Ophth., 78:43, 1939; Ophthalmologica, 96:210, 1939.

Step 2. The conjunctiva is dissected along the nasal half of the limbus from the 12- to the 6-o'clock positions. This dissection is carried far back; it must be sufficient to enable a complete covering of the cornea (fig. 2).

Step 3. This step consists in attaching the internal rectus to the dissected conjunctiva.

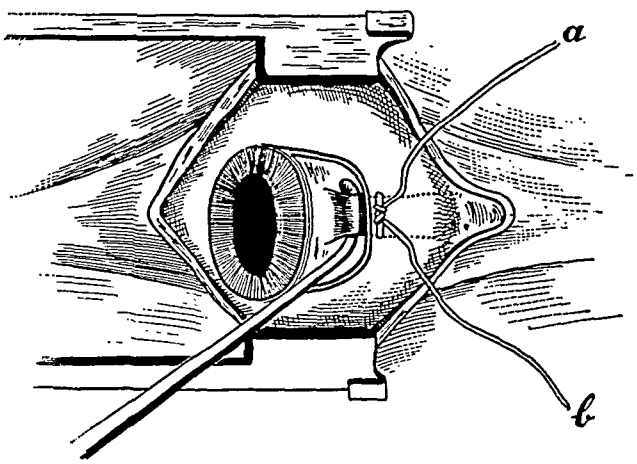


Fig. 2 (Weekers). The conjunctiva is dissected along the nasal half of the limbus from the 12- to the 6-o'clock positions. This dissection must be sufficient to enable a complete covering of the cornea.

A strabismus hook is placed under the tendon of the muscle. A strong silk thread is then passed as follows: (1) Through the conjunctiva, from outside inward, at about 1 mm. from the border, at a point corresponding to the lower edge of the internal rectus; (2) under the muscle; and (3) through the conjunctiva again, from inside outward, at a point corresponding to the upper edge of the muscle. The two ends of the thread are strongly tied. Both conjunctiva and muscle are included in the knot. This device insures a hold which does not risk letting go (fig. 2). The tendon of the muscle is cut with a cataract knife, close to the sclera.

The internal rectus and conjunctiva are severed from the globe and the adhesions which still attach the muscle and Tenon's capsule to the eyeball are cut backward with scissors.

Step 4. The double thread which passes under the external rectus is tied loosely. At that step of the operation, the knot remains unfinished.

Step 5. The thread on the internal rectus has two ends, a and b. One of them (a) is introduced into the loop made by the double thread of the external rectus (fig. 3).

Step 6. The double thread of the external rectus is now tightened further; the thread (a) of the internal rectus is caught but can still slide in the knot. All through this part of the operation, care is taken that the threads cause no trauma to the cornea.

Step 7. Everything is now ready for advancement of the internal rectus. The assistant by means of two forceps seizes the

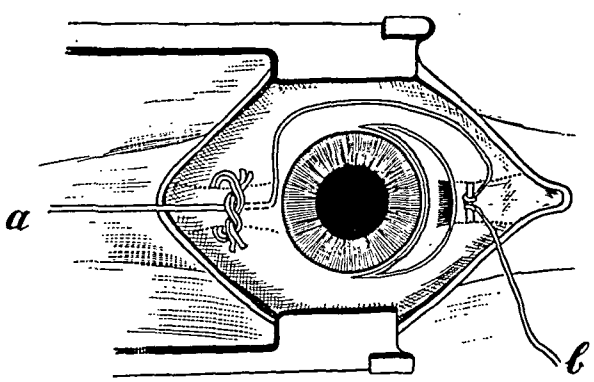


Fig. 3 (Weekers). The thread on the internal rectus has two ends, a and b. One of them (a) is introduced into the loop made by the double thread of the external rectus.

upper and the lower parts of the looped thread around the external rectus. He rotates the eye strongly inwards, carefully avoiding any deviation in height. The operator ties the two ends (a) and (b). The internal rectus and the conjunctiva slide over the cornea. The globe now is strongly convergent, with the cornea completely covered by conjunctiva.

Postoperative care

After the operation, astreptine (p. aminophenylsulfonamidum) in powder form is introduced into the fornix and a binocular

dressing is applied which is to be renewed after four days. It is preferable that the patient remain in bed. Seven days after the operation, the threads are removed on the operating table, under locally instilled anesthesia. The excess conjunctiva and muscle covering the cornea are excised with scissors.

Results

With the technique described above, the shortening of the internal rectus allows a correction of 35 to 40 degrees. Whatever one may fear, the ocular movements postoperatively are in no way limited.

Sometimes the strong tension of the internal rectus causes some enophthalmos, but ultimately this lessens or even disappears.

The cornea withstands the operation without any damage.



Fig. 4 (Weekers). (A) Divergent strabismus following a tenotomy on the internal rectus of the left eye during childhood. (B) Operation: shortening of the internal rectus of the left eye.



Fig. 5 (Weekers). (A) Divergent strabismus following a tenotomy on the internal rectus of the left eye during childhood. (B) Operation: shortening of the internal rectus of the left eye.

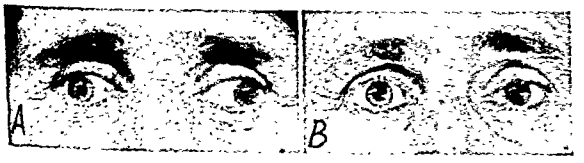


Fig. 6 (Weekers). (A) Divergent strabismus following bilateral tenotomy on the internal rectus during childhood. (B) Operation: shortening of the internal rectus and tenotomy on the external rectus of the left eye.

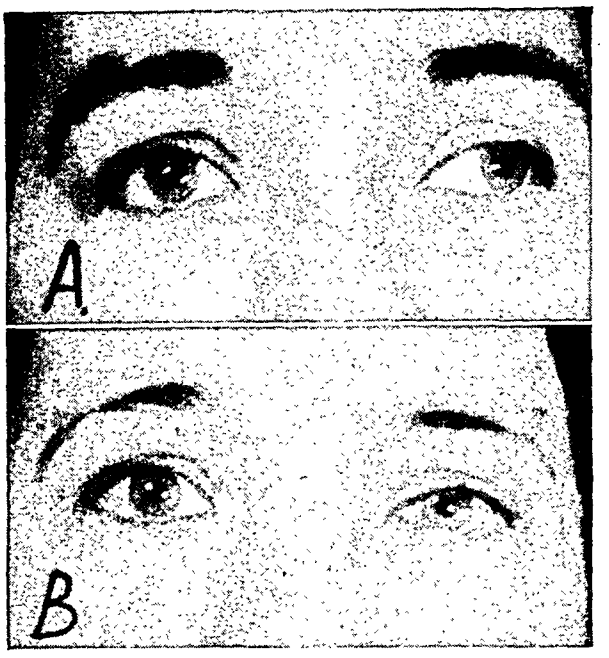


Fig. 7 (Weekers). (A) Weakness of both internal recti. (B) Operation: shortening of the internal rectus of the left eye.

The operation is indicated in all forms of divergent strabismus (concomitant, paralytic, or others).

The procedure has often given excellent results even in the divergent strabismus

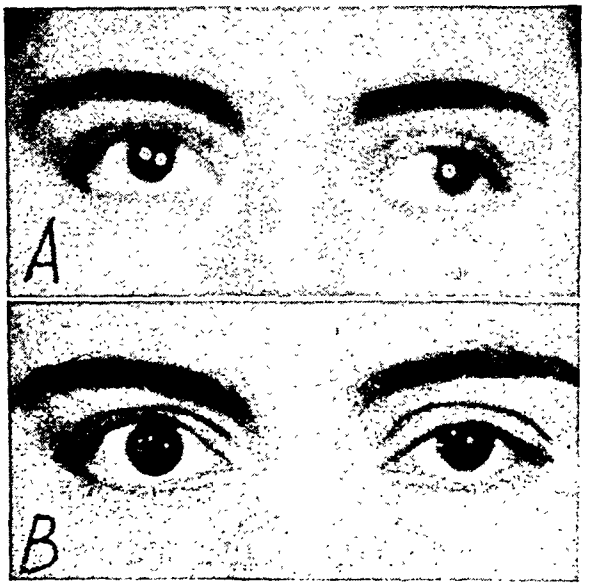


Fig. 8 (Weekers). (A) Weakness of both internal recti. (B) Operation: shortening of the internal rectus and tenotomy of the external rectus of the left eye.

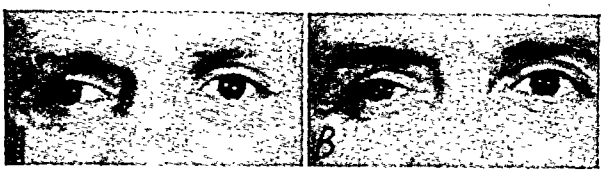


Fig. 9 (Weekers). (A) Divergent strabismus following trauma and loss of vision of the right eye during childhood. (B) Operation: shortening of the internal rectus and tenotomy of the external rectus of the right eye.

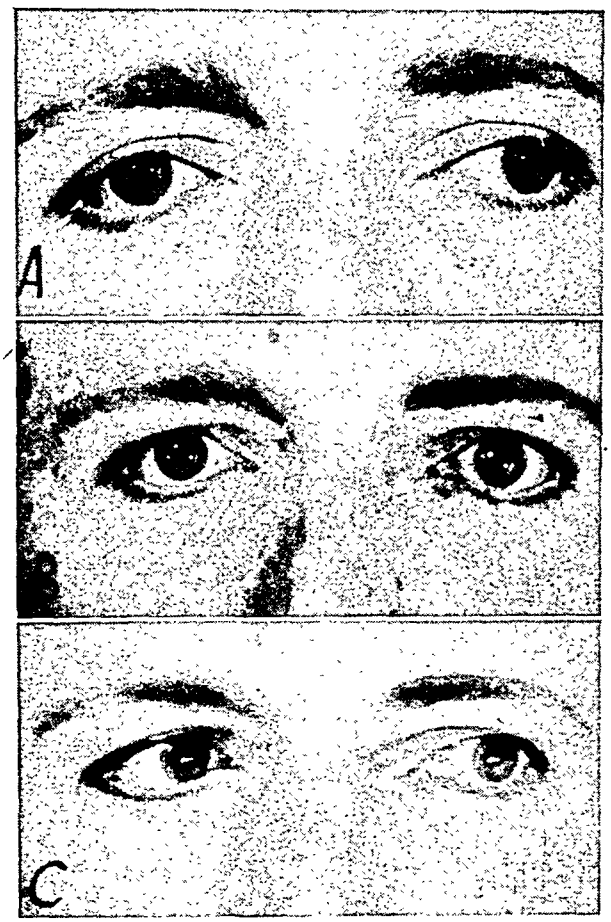


Fig. 10 (Weekers). (A) Weakness of both internal recti. (B) Operation: shortening of the internal rectus and tenotomy of the external rectus of the left eye. (C) The abduction of the operated left eye is very satisfactory.

which may follow tenotomy (unilateral or bilateral) of the internal rectus. When in such a case the tenotomized muscle cannot be found, the suture is attached to Tenon's capsule, and the results are as successful as when the muscle itself is sutured.

When the degree of divergence is considerable, and when surgical correction is incomplete, a partial or total tenotomy of the external rectus of the same eye is performed a month later. The tenotomy completes the correction, and it has the advantage of compensating the enophthalmos. Even in such cases, the mobility of the eye is not affected. Tenotomy is performed usually without hospitalizing the patient.

Photographs of patients with divergent strabismus, on whom this surgical procedure was used, are given herewith, showing their appearance before and after the operation.

Summary

The operation outlined consists essentially in provisionally attaching the internal rectus to the external rectus muscle of the same eye. The internal rectus thus forms new attachments to the sclera; it is considerably shortened; and its action is greatly reinforced. If necessary, the correction is completed a month later by a tenotomy of the external rectus.

This procedure is particularly suitable in high degrees of divergent strabismus. One of its great advantages is that it is monocular, and it avoids undependable scleral sutures. The results are excellent and constant.

66, Boulevard de la Constitution.

MILITARY OPHTHALMOLOGY IN THE EUROPEAN THEATER*

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WITH DISCUSSIONS BY F. PHINIZY CALHOUN, JR., M.D., AND TRYGVE GUNDERSEN, M.D.

The purpose of this paper is briefly to consider some of the problems of ophthalmology in the ETO, as they were met in a general hospital which was on the scene early and remained through the war in Europe. A comparison of the ophthalmic experience of the 298th General Hospital with that of other ETO medical units, and with those of other theaters, may bring out both generalities and variations of interest and future value.

This paper does not attempt to analyze surgical and therapeutic methods in detail, nor to make a study of the type of missile, location of injury, and resulting structural and visual damage. These problems are being thoroughly and well handled by a number of papers now appearing, based on more complete records than are available to me.[1-3]

Such studies require the time and data available best in an eye center in this country. No man has had opportunity to follow ocular patients from combat to final discharge. Those in the zone of the interior, at the end of the line where the patient and his medical record are before them, have probably had the best opportunity of assessing methods of care and results of injuries.

The 298th General Hospital began receiving patients at Bristol, England, in November, 1942, and continued active there until May, 1944, when it ceased professional work to prepare for the continental invasion. The first general hospital to open on the continent, it took charge of the Marine Hospital at Cherbourg, Normandy, in mid-July after D-Day, working there until the end of October. Late in November it opened a tented hospital on the outskirts of Liége, Belgium, and functioned on that site until the late summer of 1945. Total admissions on all services for the three sites were 35,702 up to June 25, 1945, and the total of all operations was 7,302.

TYPE OF WORK AND PROBLEMS MET

These facts are of importance in considering the type of work and problems met. In common with most general hospitals in England, we served troops who were training and staging for the cross-channel invasion.

WORK AT BRISTOL

Although we began functioning as a hospital at Bristol in November, 1942, no ophthalmology was done until December, when a total of 12 patients were admitted, and 10 outpatients were seen.

All the inpatients at the start were British, arriving by boat from the North African Theater. Nearly half of them were postoperative enucleations, for whom no treatment was necessary. Most of them were transferred on to British hospitals within 48 hours, and no operations were done during the month.

The number of inpatients dropped to a low of three and rose to a peak of 26 during January, due to the rather rapid inflow and transfer of British African casualties, whose ships docked at Bristol.

The outpatient or EENT Clinic Building was not completed and opened until February 20, 1943. It was not until then that refractions and the procurement of spectacles was started. During the next 14 months, work steadily increased as more troops arrived in Britain, despite the opening of additional station and general hospitals.

CHERBOURG HOSPITAL

In Cherbourg we were the only hospital serving that area for many weeks. We were

* Read before the Section on Ophthalmology, American Medical Association, Atlantic City, New Jersey, June 13, 1947.

50 miles from the line of combat, and soldiers injured at the front were evacuated almost invariably direct to England. We saw few of them but were hardly able to keep up with the rush of injured and ill from among the many thousands of troops and prisoners-of-war stationed on the peninsula.

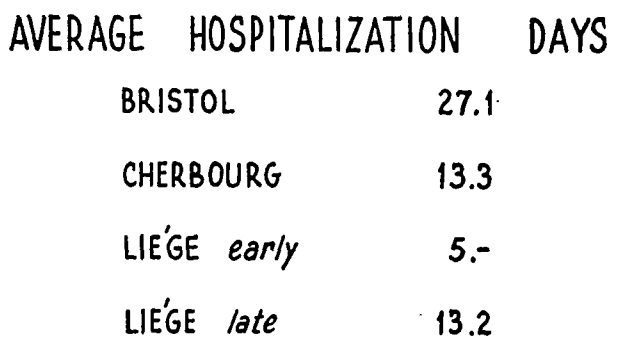


Fig. 1. (Marshall). Average hospitalization of ophthalmic inpatients.

This rush was particularly true of the outpatient clinic. Our appointments for refractions often ran a week in advance. There were many dispensaries in the area, but few medical officers would venture to handle even the simplest of ocular conditions, and they were not expected to carry out the special examinations for refractions and physicals.

Many a G. I. in that period wanted, and was even urged, to join the paratroopers. Such men came in by the dozen for the physical examination that was part of their application form. It bothered us a little to have to spend so much of our time on healthy men when we had come to France expecting to take care of the wounded. We functioned at Cherbourg as a station and general hospital for over three months.

Liége circumstances

In Liége circumstances differed again. With the five other general hospitals in the city we received combat injured from our section of the front, which was an hour away in November, 1944, and only 14 miles away in mid-December at the height of the Battle of the Bulge. At year's end we were averaging nearly 40 outpatient visits a day, including our ambulatory inpatients. Inpatients, injured in combat, poured in, many of them with other wounds, many of them remaining only until they could take the next jump to the rear. Those with minor injuries could often be healed and returned to duty direct. Our hospital, because of its location nearest to the airport, was designated a holding and evacuation unit for patients being sent by air from all other Liége hospitals. This last meant a tremendous flow of patients who stayed with us from a few minutes to several days, depending on how soon the next squadron of C47's came in to get them for transport to England or to western France.

Variations in work

During three years our work varied from that expected of a general hospital to that of an evacuation hospital. The treatment and handling of patients changed greatly with the current holding or evacuation policy.

At one extreme, at Bristol, nearly every case except progressive incurable conditions was made as fit for duty as he ever could be at our hospital, since we could keep him under treatment for as long as 180 days.

TOTAL IN-PATIENTS

	U.S.	BRITISH	CIVILIAN	GERMAN	TOTAL
BRISTOL (1 YEAR, 6 MONTHS)	127	36	1	1	165
CHERBOURG (3 MONTHS)	76	2	2	6	86
LIEGE (7 MONTHS)	358	1	1	8	368

Fig. 2 (Marshall). Total inpatients.

At the other extreme, during the winter in Liége, we were required to evacuate a man immediately if he could not be cured and returned to duty in a week. The necessity behind this was the demand for beds. Only

when transportation would itself be dangerous could a patient be kept.

This resulted in innumerable patients being evacuated without indicated treatment being undertaken. It was felt fairer to the patient and to the next hospital to evacuate the patient immediately to the UK, where the oculist could operate without rush and follow the convalescence through.

In Liége, most of the patients requiring extraction of a foreign body or linear cataract extraction, had already had preliminary surgery a few days previously, such as excision of prolapsed uvea and a conjunctival flap. Care was taken not to postpone surgery that was urgent, but many a patient, who often had additional wounds, was sent back to western France or to England, where there was less stress, better equipment, and fewer buzz bombs, all conducive to better ophthalmic results. The average stay of an ocular patient in our hospital is shown in Figure 1.

Figure 2 shows the total number of ophthalmic inpatients admitted, an average of 9.2 per month at Bristol, 28.7 at Cherbourg,

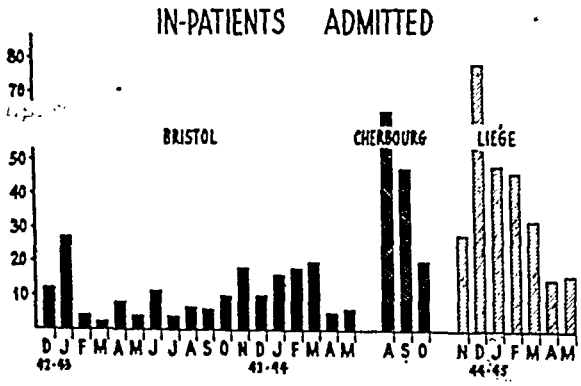


Fig. 3 (Marshall). Ophthalmic inpatient admissions per month.

and 52 at Liége. The graph in Figure 3 shows admissions monthly. The high number in December and January, 1942-43, was due to receipt of boatloads of casualties from Africa. Later such arrivals were entrained immediately for other hospitals that had opened inland. A general rise is noted through 1943 until two months before D-Day, due to a steady increase in the number of troops. The drop before D-Day was due to the freezing of units in southern England.

The high load at Cherbourg dropped as the combat line moved away to the east, and as other hospitals arrived and opened. We

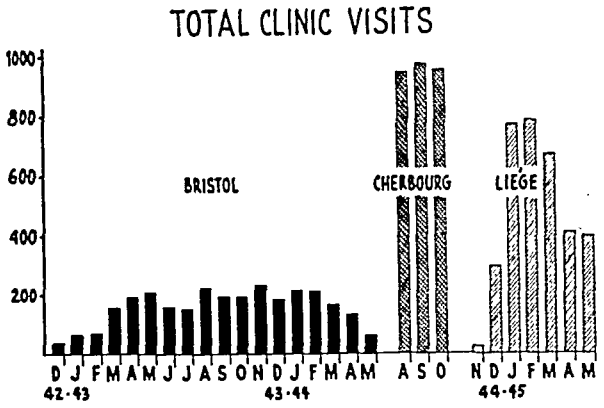


Fig. 4 (Marshall). Ophthalmic outpatient visits per month.

handled relatively few combat injuries at this site.

The peak at Liége in December, 1944, and January, 1945, was due partly to an active front near us, and still more to the Battle of the Bulge, which was close enough to force all Liége hospitals to make plans for retreating to the rear. Wounded arrived the same day as injury. We were acting additionally as a holding unit. With the spring pushes to the Rhine, the flow of casualties remained heavy, and remained so to the end, for forward hospitals kept emptying their beds in order to advance.

In general, the outpatient load (fig. 4) ran parallel with the general hospital load and with admission of inpatients. It was exceptionally heavy in Cherbourg, increased partly by required ocular examination of candidates for paratroop service. The number of refractions there was also heavy, a large portion due to arrivals of troops from the States who had been shipped out before being supplied with spectacles. The combat front had to make up the deficiencies of the home front. Again there was a peak in refractions in January and February, 1945

(fig. 5), when the scores of men came in who had lost everything in escaping before the German counterattack at Christmas time.

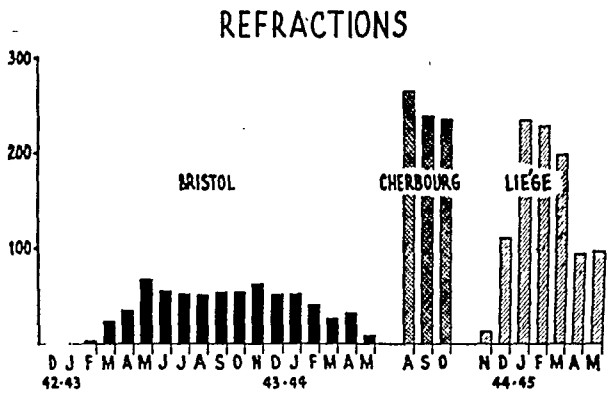


Fig. 5 (Marshall). Total refractions per month.

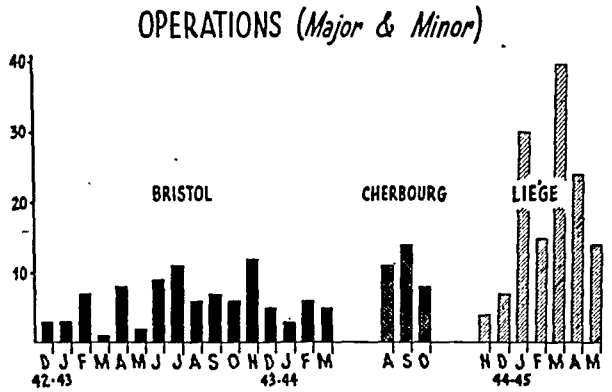


Fig. 6 (Marshall). Operations per month (major and minor).

OPERATIONS PERFORMED (IN-PATIENTS ONLY)

	BRISTOL	CHERBOURG	LIEGE	TOTAL
Foreign body conjunctiva, cornea, sclera	5	9	18	32
Foreign body intraocular	3	3	3	9
Foreign body orbit, lids	-	2	5	7
Repair laceration globe, flap, etc.	4	10	10	24
Repair and plastic lids	10	2	11	23
Sebaceous cyst, nevus, chalazion, etc.	9	3	10	22
Enucleation	6	4	13	23
Paracentesis	-	4	3	7
Pterygium transplant	3	4	4	11
Retinal detachment	1	-	-	1
Cataract, linear	2	-	1	3
Miscellaneous	3	2	1	6
	46	43	79	168

Fig. 7 (Marshall). Operations performed (inpatients only).

Among these a large percentage had no copy of their prescription for lenses. A complete examination had to be made again.

The amount of ophthalmic surgery was perhaps surprisingly small, as shown in Figures 6 and 7. It was highest at Liége, because of the flow of combat casualties, and does not represent the total amount of surgery indicated on inpatients. Many foreign bodies, many traumatic cataracts, and some enucleations were deliberately sent on to the rear or to England. Attention is directed to the fact that no surgery was undertaken at any time for strabismus. This was in line with theater policy.

Of the purely ophthalmic surgery seen near the front two conditions were impressive. One was the great number of men with

DISPOSITION OF PATIENTS

	BRISTOL		CHERBOURG		LIEGE	
	NO.	%	NO.	%	NO.	%
Duty	100	58.4	50	58.1	144	40.
Evacuated	28	16.3	30	34.9	196	54.4
Transfer to British Hospital	24	14.				
Transfer to U.S. Hospital	5	2.9			2	0.6
Transfer to other Service	7	4.1	5	5.8	5	1.4
On other Services	2	1.1			11	3.
St. Dunstan's	4	2.3				
Miscellaneous	1	0.6	1	1.2	2	0.6

Fig. 8 (Marshall). Disposition of patients.

multiple corneal foreign bodies, usually bits of sand imbedded at all depths, and, of course, often perforating. Such foreign bodies should not all be removed at once, but a judicious balance should be kept between removing the more irritating ones and not stirring up reaction to remove others. The other condition met, mentioned also by Culler,[4] was the relative difficulty in enucleating eyes that were literally exploded and shredded by a missile going through. The third impressive lesson of war was the vast amount of intraocular damage that may result from contusion injuries, whether direct or remote, for which there is little therapy. But it has been truly said my many authors that the professional care and scientific problems of military ophthalmology are the same as those in civil life.

Disposition of inpatients is shown in Figure 8. Well over half the patients at Bristol

and Cherbourg were returned to full or limited duty. When dealing mostly with combat casualties at Liége, this figure dropped to 40 percent, while evacuation of patients to the rear increased to 54 percent. Of course, many patients were evacuated because of other wounds, such as fractures. The evacuation figure was lowest, 16.3 percent, at Bristol, where we could hold a patient up to 180 days to effect a cure. Even then many of the patients shipped back home went because of congenital or preservice defects, rather than failure of therapy.

Figures 9 and 10 give a condensation of principal ocular diagnoses. Most patients had more than one, or several, diagnoses.

A comparison of the causes of ocular conditions, Figure 11, is revealing. Combat injuries were naturally highest at Liége. Yet that figure was exceeded at Cherbourg proportionately by noncombat injuries. Preëxisting disease and injuries were highest at Bristol, where all troops were carefully screened and classified physically in preparation for the invasion. The proportion of noncombat disease, of which uveitis is an example, remained fairly constant, while the incidence of severe hysterical amblyopia, listed as combat disease, happened to be perfectly constant.

Of practical interest is an analysis of the causes of blindness in one or both eyes, newly acquired during service.[5] About three fourths of the instances in which both eyes were blinded were due to combat injuries.

The noncombat injuries causing bilateral blindness were usually explosions, sometimes accidental, sometimes due to negligence, as when a cartridge was swept into a fire unknowingly and exploded. One accident was due to high-tension current causing third-degree burns and electric cataracts. The single instance of bilateral blindness due to disease was optic atrophy following ingestion of methyl alcohol.

Figure 12 reveals also that, particularly at Cherbourg, the frequency of loss of vision of one eye due to noncombat injury was distressingly frequent.

Figure 13 lists in partial condensation the

PRINCIPAL DIAGNOSIS (*Condensed*)
IN-PATIENTS, NONTRAUMATIC

	BRISTOL	CHERBOURG	LIÉGE	TOTAL
Congenital and development defects	11	-	1	12
Functional and refractive errors	20	2	20	42
Lids and conjunctiva	15	6	44	65
Cornea and sclera	19	5	14	38
Uvea	15	9	13	37
Retina	5	1	4	10
Nerve, optic	4	4	8	16
Old injuries	10	-	8	18
Strabismus, palsies	4	-	6	10
Lens	1	1	-	2

Fig. 9 (Marshall). Principal diagnoses (condensed) inpatients, nontraumatic.

PRINCIPAL DIAGNOSIS
IN-PATIENTS, TRAUMA IN SERVICE

	BRISTOL	CHERBOURG	LIÉGE	TOTAL
Laceration lids and vicinity	5	2	17	24
Fracture orbit	3	2	5	10
Contusion by nearby missile	9	1	24	34
Contusion by direct blow	4	13	39	56
Burns and blast	1	2	8	11
Abrasion cornea and conjunctiva	-	-	25	25
Wound globe, previously enucleated	19	2	11	32
Foreign body cornea	4	10	48	62
Foreign body intraocular	8	8	19	35
Foreign body orbit	1	2	8	11
Laceration or perferation globe	11	9	76	96
Enucleated, in for prosthesis	2	-	4	6
Miscellaneous	5	2	5	12

Fig. 10 (Marshall). Principal diagnoses, inpatients, trauma in service.

CAUSE OF OCULAR CONDITION

	BRISTOL		CHERBOURG		LIÉGE	
Injury, combat	39	23.5%	7	9.2%	183	50.3%
Injury, noncombat	16	9.6	42	55.2	79	21.7
Injury, pre-existing	8	4.8	-	-	1	0.3
Disease, pre-existing	49	29.5	4	5.3	23	6.3
Disease, noncombat	52	31.3	22	28.9	74	20.3
Disease, combat PN	2	1.2	1	1.3	4	1.1

Fig. 11 (Marshall). Cause of ocular condition.

causes of noncombat injuries. One concludes that war is a dangerous game even out of combat. At Bristol the greatest single cause in this group was a flying fist in personal assault, or a knee in football. In Cherbourg, by far the greatest number were caused by

explosions in the hand, or equally close. Perhaps because they were new to war and typical, souvenir-minded Americans, many a soldier in Normandy attempted to keep, deactivate, or alter into cigarette lighters various German shells and cartridges, particularly the attractive German 20-mm. ack-ack shell. This shell had a double and highly

NEWLY BLINDED

	Unilateral						Bilateral		
	*CI	%	*NI	%	*DIS	%	CI	NI	DIS
BRISTOL	20	57.1	6	17.1	9	25.7	4	3	-
CHERBOURG	6	23.	14	54.	6	23.	-	1	-
LIEGE	82	76.6	23	21.5	2	1.9	17	1	1

*CI = *Combat injury*
*NI = *Noncombat injury*
*DIS = *Disease*

Fig. 12 (Marshall). Newly blinded.

CAUSES OF NONCOMBAT INJURIES

	BRISTOL	CHERBOURG	LIEGE	TOTAL
Fell or bumped object	3	-	13	16
Object thrown or swung	2	9	12	23
Fist, knee, etc.	4	4	7	15
Handling arms	-	1	7	8
Vehicle accidents	-	1	11	12
Explosion in hand or nearby	1	15	8	24
Explosion in fire	-	3	2	5
Hammering, chopping	3	1	7	11
Fire, chemicals	1	1	6	8
Mines, booby traps	1	4	2	7
Cut by glass in fight	1	-	1	2
Electric burn	1	-	-	1
Miscellaneous	1	1	1	3
				135

Fig. 13 (Marshall). Causes of noncombat injuries.

sensitive firing mechanism, which went off too easily and too often.

Some explorers of forts were caught and injured by accidental explosions, over-inquisitiveness, or booby traps. Almost invariably the eyes were involved, either by superficial foreign bodies or by perforating wounds.

The 20-mm. shell injury became a clinical picture that could be diagnosed down the hall on admission—a man brought in with both hands heavily bandaged, face and neck covered with bleeding points, and one or both eyes padded. Three times I removed cancellous bone from around or even within the eyeball, in each instance a piece of bone from the patient's own finger, which had been blown off by the shell in his hand, or in a vise while he worked on it.

Considering total figures, the largest number of noncombat injuries were caused by explosions nearby, as by shells, grenades, and detonators. Nearly an equal number were caused by something thrown or swung at the eye, as boards, branches, a bayonet, stone, rifle barrel, nail, and so forth. The last eye I enucleated in service was that of a nurse, the globe ruptured by a swinging golf club. Many men accidentally bumped or fell onto objects in the confusion and darkness, and many an eye was lost in personnel fights.

In 1942, Col. Derrick Vail, before becoming European Theater Consultant, proposed that means be found to protect eyes in war. Visors, made of metal, were studied in this country and in England.[6] They would interfere with the field of vision but if used at the right time would save scores of eyes. Rycroft[7] suggested using the antigas shield, a simple goggle of plastic, in various noncombat activities where particles of metal or chemical may fly toward the eye. Unquestionably, better protection would save many eyes in combat, while goggles and more care would reduce greatly the devastating number of eye injuries from accidents and carelessness behind the lines.

Ophthalmic problems of wartime

Now, I venture to comment on several ophthalmic problems of wartime, realizing full well that others have had more experience and are better informed to discuss them than I. Let me preface these remarks with an expression of gratitude to Col. Derrick Vail, who, as Senior Consultant in Ophthalmology, was the first to foresee these administrative problems and was constantly and successfully striving to effect their solution. His planning and energetic work

made a tremendous difference in the entire picture.

The problem of how to keep busy, up-to-date, and dexterous is a universal difficulty of the doctor at war. In England, many ophthalmic officers were allowed to attend lectures and meetings of British ophthalmic groups; some fortunate ones spent a two-weeks period observing work at Moorfields in London. An ophthalmic club was formed, which held several worthwhile meetings. And after hostilities, a group under the leadership of Maj. F. P. Calhoun took a series of lectures at Oxford, then toured the island visiting prominent clinics. It is impossible to be prepared for large-scale combat without idle troops and officers, if sufficient medical personnel is present to carry the combat load later. But that medical personnel must be kept active in their work and constantly stimulated.

At least in general hospitals, it was early agreed that the Sections of Ophthalmology and Otolaryngology should be separate in personnel and management. This is proper, avoids friction, is logical. The head of each section, if adequately trained, should be entitled to the rank of major.

Ophthalmology seemed to have no special problems in finding a place to work that did not apply to most of the hospital. Whether it be in a tent, a hut, or a building, a little imagination easily arranged an adequate outpatient clinic in the available space, even to a dark room. In England, a few hospitals had a special EENT major operating room. In the 298th General Hospital, all major surgery was done in the general operating rooms.

Electric current varied

Electric current was at times a problem for all. At Bristol American equipment took 115 volts, and American connecting plugs would not fit the British receptacles. The British current supplied was 220 volts. The search for transformers and plugs was long and trying, and it took months before all was smoothed out. At Cherbourg and Liége electric current was undependable, so that, in the clinic, battery current was used almost entirely for examining instruments. Water supply was fitful at Cherbourg, and was cut by a single bomb at Liége, which almost closed the operating room for a few days. An army general hospital in that theater was not set up to be completely self contained and independent. In our specialty it must be remembered that correct current is essential for use of the diathermy, the electric magnet, and the Projecto-chart.

Equipment problems

Surgical and diagnostic equipment for ophthalmology is an important problem now being reviewed by the Subcommittee on Ophthalmology of the National Research Council. Colonel Vail spent his early months in Britain seeking adequate ophthalmic equipment for his officers. Table of Equipment (TE) was not bad, but allowed for much improvement.

Getting the items allowed was still another problem. Strabismus hooks and cilia forceps were a dime a dozen, but tenotomy scissors were scarce, and a Schiøtz tonometer was almost never seen at all. It is not easy to make one list that will suit all surgeons. Yet such an analysis as is now under way should find room for worthwhile changes.

We were supplied with a Lancaster hand magnet and a retinal detachment outfit that attached to the Bovie unit and both did well. Perimeters were not supplied, but were obtained for a few by luck. Another instrument, not supplied by the army to the European Theater but found to be essential, was a slitlamp. Most of us in England eventually acquired a British-made simplified slitlamp that was adequate, and a few found their way to the continent before VE-Day. In the future, a slitlamp should be standard for any general hospital, although it may be necessary to develop a simplified, more portable model for this purpose.

In late 1942 and early 1943, the African

Theater seemed to have priority over Britain in American supplies. Therefore the six general hospitals first to arrive required and received through lend-lease much British ophthalmic equipment. Some of this was excellent, well above usual military quality. Without it we could hardly have functioned. The ophthalmic equipment eventually assembled at the 298th General Hospital by D-Day was more than ample, perhaps more complete than any other U. S. hospital in England. This was due to the continued efforts of Colonel Vail, and our honest search over a period of a year and a half. Having thus prepared for the rush anticipated after the invasion, it was particularly painful to be ordered to leave all this in place, turning the entire hospital and its equipment over to another unit in May, 1944.

Optical problems

One major problem was the optical one. Unquestionably this will always be with us, and will almost certainly increase in another war.[8] A poignant example of the importance of the problem is that at one time the British had 7,000 men at camp near Cairo who had been evacuated from the front for replacement of glasses.[9] A man who cannot see adequately is a casualty and as noneffective as a wounded man.

Today in war, good vision is required for flying, for aiming, and for driving a vast mechanized army on wheels; and behind the lines, many a farmer boy becomes a clerk or a radar operator and discovers his eyes need help. In addition, many men with special ability and training are so valuable that they are needed despite glasses. Unquestionably, from the viewpoint of manpower and man hours, the whole field of refractions and spectacles is one of the biggest that needs careful study and solution for the future.

Like others, I ran into this problem from several angles. During a brief training period in Arkansas, I had seen a capable ophthalmologist and his willing but untrained assisting officer attempt the impossible of refracting up to 100 inductees a day. In England, there was more leisure, and many a hurried refraction was repeated and the lenses perforce changed, a waste of time and lenses.

Refraction needs

Another minor problem at Bristol was the number of men, especially Negroes, working as stevedores at Bristol channel ports, who legally acquired a day of rest by arranging for the long trip by ambulance from their station to the 298th General Hospital for refraction. They had ample symptoms, and poor visual acuity, but the vision improved miraculously as soon as a trial frame was put on, whether it contained any lenses or not.[10] There is no sure way of determining whether or not a soldier needs glasses, if he has symptoms, without refracting him. Scores of refractions proved unnecessary except for making that decision.

In England, everyone was checked physically, which disclosed many cases of amblyopia and disqualified men who never had met induction standards. This caused many to be sent home, another waste of time and effort. It also proved to be a waste of manpower, for the return flow became so heavy that it was stopped, the new policy being to keep men in Britain who had only one good eye, or a high refractive error. We put them on limited or noncombat duty. The British, harder pressed, sent their one-eyed men almost up to the front line.

Delivery of glasses

In Cherbourg, troops were arriving by shiploads. Many had not received their glasses before leaving home. Delivery of spectacles in the States at that time seemed to take about four weeks or more. In Britain, we got delivery in from 3 to 7 days for ordinary strengths. In Cherbourg, delivery took three days or more, depending on the quality of the courier service at the moment.

In Liége, we had delivery in 24 hours most of the time. The story of supplying spectacles and gas-mask lenses in the European Theater is an interesting one that could be told by Colonel Vail or one of his optician officers.

Breakdown in record system

The Battle of the Bulge brought home the realization that despite repeated directives there was an actual breakdown in the system of keeping records of the individual prescription for glasses. Men swarmed in for new replacement spectacles. They had lost everything, their personal records, their headquarters records sometimes, and often their "dog" tags.

To supply new glasses they had to be examined from the beginning again, and this despite regulations requiring that their prescriptions be in two places in their records and a third independent copy on their person. As Sir Stewart Duke-Elder has remarked for the British, in the early days provision for glasses was inadequate because their importance was not foreseen and because their enormous wastage was not anticipated. He was forced to change the whole set-up for the British Army. It is probably not practical to put the prescription on the dog tags, but every effort should be made to devise a more certain means of always having it on the person of the soldier.

Optometrists did excellent work in the ETO, and without them the number of refractions done would have been only a portion of the actual accomplishment. They varied of course in their aggressiveness and personality, their self confidence and ingenuity. They were always responsible to a medical officer in their professional work. Effort was made to put them where they could give the most help. I believe most ophthalmologists were grateful for the help they received from them. Placing optometrists in a medical service corps is a logical step, and will allow them a rank more commensurate with their technical ability.

Gas-mask frames were not satisfactory. The gas-mask insert lens, hurriedly supplied to all who seriously needed them before the Normandy invasion, seemed to work very well. Not as important, nor as well solved, was the need for a simple, reliable test for night vision.

Diseases encountered

A few diseases encountered, although not differing from those found in civilian ophthalmology, had peculiar aspects in the service. One was pterygium, which was something every eye man not too busy was eager to tackle, for it afforded an opportunity to "keep his hand in" with little serious risk. The problem was that of recurrence. One soldier at Valley Forge Hospital in this country had had 13 recurrences and 12 operations. Toward the end of the war in Europe some pressure was made from higher levels to avoid surgery for pterygium except in the most severe degrees.

A similar situation was found with strabismus. Many a surgeon with little surgery to do did muscle cases to benefit both the patient and himself. Such correction of a severe cosmetic defect has been advocated[11] in order to improve personality and to enable reclassification to full military duty.

On the other hand, I have watched over Prof. Ida Mann's shoulder at Moorfield's while she interviewed a British soldier dropped from his army because of diplopia following surgery for squint, with excellent cosmetic results. And I have seen an American G. I. evacuated back from the front with the same story, and with the ophthalmologist's name typed plainly on the first section of the field medical record.

Both surgeons were good and did good work. Neither soldier seemed to be a malingerer or quitter. Nevertheless, diplopia of a disqualifying degree seemed surprisingly prevalent following surgery for strabismus in service, and it, therefore, became a service-connected disability. Such surgery was

officially frowned upon in the ETO.

Uveitis in all its forms was a problem because it incapacitated a man for so long. A total of 34 cases of endogenous or nontraumatic uveitis were seen, the larger number at Bristol. Phlyctenular keratitis for some reason was much more frequent in England than on the continent.

What to do with the one-eyed man in an army is a question that should be given a studied and clear answer before another war. He lacks stereopsis, yet many a one-eyed man drives well. Wiley Post flew around the world successfully with only one eye. Amblyopia is frequent; enucleations increase as the war progresses. Need the lifelong amblyope be restricted in ordinary duties? The newly blinded must of course go through a period of readjustment.

The newly developed plastic prostheses, made by staff dental officers, proved relatively simple, very satisfactory when done by a capable man, and a happy solution to a difficult shortage. That story has been told elsewhere.

Several authors during and since the war have emphasized the importance of discovering early the presence of ocular injuries, which may so easily be overlooked in the presence of additional, often more severe wounds. The answer is training of forward medical officers to examine the eyes routinely, at least superficially, for signs or symptoms of ocular injury or defective vision.

Sulfonamides and penicillin, which were given to all wounded almost without exception, reduced the incidence of serious ocular infection almost to the zero point. Gross infections were few, and I saw no case of sympathetic ophthalmia in three years' service.[12]

Management of ophthalmic patient

The management in service of an ophthalmic patient varies with many factors. The actual medical care differs little or none from civilian methods. That point has been repeatedly made by many authors. Intervening conditions pose many problems, however.

A patient may arrive who was injured 10 minutes before in his company area, or 10 hours before at the front with no previous treatment, or 3 days before, with prolapse excised and a conjunctival flap in place, or 30 days before with a month's treatment in a station hospital intervening.

He may or may not have other injuries which take precedence. You may be allowed to keep him six months, or be urged to evacuate him the next day. You may have all needed equipment for his required surgery, or you may be without electricity and water.

In these respects military ophthalmology differs greatly from civilian. Although a few general rules could be laid down, each patient needed an individual decision. The need for beds and current directives, his general condition or other wounds, the amount of preliminary surgery already done, and the period required for convalescence all were factors that made up the picture. Occasionally equipment was decisive. Another factor that undoubtedly altered management was the training and confidence of the ophthalmologist, a factor that probably weighed in both directions depending upon the man.

As patients and their records came back from the front, it was possible soon to assess the capability and conscientiousness of those ahead who were doing ophthalmic surgery. Such an evaluation became of importance when the patient arrived with his wounds or eye hidden by a partial or total conjunctival flap. Important and useful as they may be, and perhaps essential, conjunctival flaps, like a plaster cast, hinder revaluation of the patient's condition as he travels back through the chain of evacuation.

How close behind the lines should a capable ophthalmologist be? This would seem to depend on the stability of the line, the speed of evacuation, and the capability of the general surgeons at the front. It would

seem highly desirable that an ophthalmic casualty be able to reach a trained ophthalmologist within 24 hours following injury. Barring that, he should reach the hands of a general surgeon well versed in ophthalmic first-aid procedures. Some of the surgical auxiliary teams had such men, who in a pinch could and did do an excellent excision of prolapse with conjunctival flap. After preliminary study and surgery by a trained ophthalmologist, the patient, if seriously injured, should be flown to an ophthalmic center, where good equipment, adequate help, and some peace of mind for both patient and surgeon are available. As noted by Duke-Elder, the proportion of injured eyes lost in World War II was only half that of the previous war, the reduction being due not only to advances in surgery, but also to the increased speed with which the injured patient was placed under trained care.

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Discussion

Dr. F. Phinizy Calhoun, Jr., (Atlanta, Georgia): The basis for my comments on this paper is my service as ophthalmologist for the 2nd General Hospital from February, 1942, until October, 1945, of which 40 months were spent in the ETO.

Like Dr. Marshall's unit, my hospital functioned in three main sites, the first in Oxford, the second near St. Lo, and the third in Nancy, France. I have read with interest Dr. Marshall's full-length detailed report and I would like to compliment him on the careful records he has kept and on his splendid analysis of his cases. His tables show distinctly how the type of work and method of handling of eye cases varied with the military situation, and, in general, the tables are representative of the type and volume of work done in other outstanding general hospitals in the ETO.

Probably the most important single factor in the effectiveness of eye care in England and in France was the fine work of the Senior Consultant in Ophthalmology, Colonel Vail, and of his successor, Colonel Greear. The presence of these men to correlate all eye care, to prod the chiefs of supply and personnel, to put ophthalmology in the limelight, and to forward international relations, was very essential and effective. I

am proud of the splendid way in which they met and overcame almost unbelievable difficulties in policy, and in men and equipment, elevating ophthalmology from a relatively obscure position in military medical care to a very secure one.

I would like to say a word about the ETOUSA Ophthalmological Society formed in early 1943 at the suggestion of Colonel Vail. In the beginning, composed of the handful of eye men in the ETO who were doing eye work, this little organization was paramount in bringing us together so that we managed to have three large meetings before the preparations for D-Day scattered us.

The distinguished honorary members of the society were Colonel Vail, Brig. Sir Stewart Duke-Elder, Lieut. Com. Edwin B. Dunphy, Sir Ian Fraser of St. Dunstans, and Air-Commodore V. C. Livingston.

Dr. Eugene Anthony did a splendid job as editor of the "Journal," and three issues were published. This little journal was very important in the dissemination of eye information to all of us. Besides containing short biographies of the members, the "Journal" gave case reports, abstracts, short original articles of topical interest; summarized military eye directives which changed frequently and often never reached us in any other way; and gave us the latest information about services for glasses, diathermy, magnet, prostheses, and pathologic specimens.

Most important of all, I believe, the "Journal" had a helpful-hints section, which proved a great aid to us in our improvisations. We very quickly learned that we had to improvise to be of any use ophthalmologically, and this section in the "Journal" helped us along those lines. There were set forth simple methods of sterilizing solutions and instruments; of making our own sulfa ointments; measurements for the construction and marking out of a home-made Bjerrum screen; methods for the construction of perimeters, irrigating tips, depth-perception apparatus, and so forth. A good replaceable eye dressing in use at the 5th General Hospital was publicized. I know of one man who constructed from odds and ends a satisfactory slitlamp, and of several who made effective magnets from radar equipment.

I wonder if any of you have thought enough of your three issues of the *ETOUSA Journal of Ophthalmology* to have them bound. They have already become collectors' items, and your medical library would be glad to get them.

Another factor that contributed greatly to the success of eye care in England was the close coöperation of the British, not only as civilian and military groups, but as individuals. Prior to the landings in North Africa in November, 1942, no American equipment was made available to us, and for the next year only a little was available. We, therefore, had to depend almost entirely on British facilities and equipment, which, incidentally, was always of high quality. The British helped greatly in the spectacle program, began the training of some of our blind at St. Dunstan's, furnished us prostheses, a magnet and diathermy service, individually loaned us instruments and equipment, and were always willing to aid us with our problems.

This coöperation was further brought home to me after V-E Day when, in July and August, 1945, I was asked to help Lieut. Colonel Greear, the senior consultant in ophthalmology, organize a posthostilities training course in ophthalmology to be given at Oxford, England, under the direction of Prof. Ida Mann. Eminent British ophthalmologists throughout the United Kingdom were interviewed and worked into a time table. I found that the lecturers, all prominent in British ophthalmology, were most eager and willing to do all they could and on one refused the invitation to participate. This spirit was a great tribute to the friendly and coöperative relationship between American and British ophthalmologists established

during the war by the successive senior consultants in ophthalmology.

Although allocations were made for 40 men to attend the course, which lasted four weeks, the base commands, due to redeployment responsibilities, unfortunately could only incompletely fill their respective quotas, and only 22 men were released to attend the course.

The course was successful in providing a taste of academic ophthalmology to men who had been doing military ophthalmology for varying periods of time. These men were uniformly eager and appreciative of the opportunity offered them by the U.S. Army, and were repeatedly impressed by the education, poise, and ability of the British lecturers, many of whom were internationally known.

Amid the historic and scholarly surroundings of Oxford, to sit at the feet of Ida Mann, H. M. Traquair, Foster Moore, Eugene Wolff, Charles Goulden, McCallan, R. E. Wright, John Foster, Greeves, and others, was indeed an impressive and memorable experience for each American student of ophthalmology.

Dr. Marshall has asked me to say something about air casualties, since my unit treated a large number of all types in 1942 and 1943. Excluding the many cases of accidental injury and the few cases of solar retinitis and of eye changes due to frostbite, there were 33 crew members of the heavy bombers of that period who received eye wounds due to enemy shell fire.

Since most of the injuries were due to the 20-mm. cannon shell which exploded at a fairly constant distance from the airman upon striking the duraluminum skin or plexiglass, most of the wounds were combined with concussion and were due, at least in part, to flying particles of aluminum or plexiglass. The fragments of the brass percussion fuse and the steel casing of these projectiles, together with the large steel fragments of anti-aircraft fire from the ground, were additional sources of eye injury.

All but four of these 33 men had other severe wounds, usually of the head. I cannot fully explain why the right eye was injured more severely and exactly twice as often as the left. It was miraculous that only 8 of the 33 had even a slight injury to the opposite eye, and only one case was permanently blinded in both eyes. Seventeen, or about one half, of the 33 had a penetrating wound of the eye, and 9 of these required early or subsequent enucleation.

One half the cases of penetrating wounds were due to metallic fragments and one half to plexiglass fragments. Only 2 of the 8 cases with metallic intraocular foreign bodies proved to be magnetic, and in one of these cases the foreign body was magnetic in both eyes. Magnetic foreign bodies were frequently found in other parts of the body, and every effort had to be made to exclude them in the eye.

In the 16 cases in which a nonpenetrating injury was the principal diagnosis, a rupture of the choroid, manifest as an indirect concussion injury, was present in 7 cases. Most of the remaining cases were multiple plexiglass foreign bodies of the cornea. Although the airman's eye wound resembled most closely the land-mine wound of the foot soldier, I believe the air injury was more often unilateral and showed less tendency to reaction and infection. Unlike the sand and gravel and powder particles in the land-mine injuries, the eye tolerated small particles of aluminum and plexiglass without continued reaction.

I would like to mention several impressions with which I returned after service in the ETO. First, the extreme importance of the careful rehabilitation of otherwise healthy soldiers who have very suddenly and irrevocably lost one eye due to severe injury. We learned that if they were allowed to sit around and were not immediately taught confidence in themselves and helped

in learning a new way to judge depth, they would quickly grow psychologically past any useful military service in the ETO or elsewhere. Early and persistent efforts at ping-pong was one of the most useful things in this rehabilitation.

Secondly, the complete conjunctival flap with a pursestring suture not only made further evaluation and treatment by the next ophthalmologist difficult, but in several cases provided a shortened postenucleation socket due to a too firm and too abundant inclusion of conjunctiva.

Thirdly, I believe that the many cases of uveitis, particularly exudative choroiditis, resulted in a longer incapacity and a longer combined loss of time from duty, than almost all other conditions.

Fourthly, I believe that in the future some modification of the Berman locator will be a most useful instrument in the early management of foreign-body cases, and that such an instrument will be basic equipment. I might also add that in my experience in the ETO I was never successful with either the Mellinger or Solus giant magnets in cases where the Lancaster hand magnet had failed.

DR. TRYGVE GUNDERSEN (Boston, Massachusetts): I have been asked to add the experiences and resulting points of view of those of us who were in the North African and later the Mediterranean Theaters where our forces were engaged in a war without interruption from November, 1942, to May, 1945. The action involved long campaigns through enemy country which varied from deserts to snow-capped mountains. It involved seven widely separated amphibian landings, one of which was relatively ill-fated.

It is to be remembered that at Anzio the entire beachhead was under daily enemy shell fire for more than five months. Furthermore, long holding operations at times made the warfare in this theater similar to that of World War I. It was a theater which involved almost every phase of modern warfare.

Besides being the most enduring fighting battlefield of World War II, the North African and Mediterranean areas offered an interesting battlefield from a point of view of sanitation and health. It is of everlasting credit to the medical department of the United States Army that over 500,000 Americans could be kept in that disease-infested country and remain as healthy as if they were at home.

I shall only mention the almost complete absence of such scourges as typhoid, smallpox, typhus, plague, and leprosy. Malaria was certainly uncommon, too. Duke-Elder states that practically the entire French Army of 32,000, and to a less extent the British, fell a victim to trachoma during the Napoleonic campaign in Egypt in 1798-99, and immense numbers of them were sent home blind.

During my service in these theaters, 26,223 patients were admitted to our hospital, of whom 1,936 were eye patients. In addition, I saw 3,075 for refraction, and 1,090 for other conditions in the outpatient department. This comprises a total of 6,101 patients seen by me.

The diagnosis of trachoma was made only seven times. In six, the infection was obviously old. Only one soldier contracted the disease overseas. Other ophthalmologists had comparable experience.

Dr. Marshall has mentioned how to utilize ophthalmologists in the theater. Everyone will grant that early operation is ideal and that the first operation should be the definitive one. Therefore, one's first thought is, "Place the eye surgeon forward as far as possible." But competent eye surgeons are rare. In my visits to each of our 84 hospitals, I found only seven doctors who had been certified by the American Board of Ophthalmology. There were perhaps an equal number of qualified, though noncertified, men.

The flow of casualties from a military

front may be compared to the flow of a river, for instance, the Mississippi, with casualties trickling or often flooding down from every rivulet, feeding the whole stream, through the Ohio, the Missouri, the Arkansas, and so forth. Every drop of water must be treated, preferably as soon as it falls from the sky, but remembering not to miss a single drop. It would be folly to waste good men by placing them along the Teche of Louisiana, the Fox of Wisconsin, or even the Chicago River of Illinois.

The problem of distributing ophthalmologists can be met by the creation of mobile ophthalmic teams, who might be hurried in to cope with flooding areas. This was part of the British plan. The disadvantages were the handicaps involved in doing major eye surgery under field conditions and the necessity of early or often immediate evacuation of patients postoperatively. Since eye casualties are transportable as litter patients with binocular bandages, and since they can no longer be considered emergencies—thanks to sulfonamides and antibiotics—it is my opinion that patients fare better when promptly evacuated to a first-class eye surgeon in a first-class hospital (eye center), be it several hours further behind the lines.

A different problem arises in regard to refraction. Equipment for refraction was not authorized for evacuation hospitals at the onset of World War II. Until this serious defect was rectified, combat men had to be

	No. of Cases	% of Total Hospital Admissions	% of Patients Seen Including O.P.	% of Patients with Eye Diagnosis
Total hospital admissions	26223	100		
Battle casualties	7090	27		
Injuries	4504	17.2		
Disease	14629	55.8		
Total patients seen in Eye Clinic (Including out patients)	6101	-	100	
Refractions	3075	-	50.4	
Out patients	1090	-	17.86	
Total patients admitted to hospital with eye diagnosis	1936	7.37	31.74	100
Primary eye diagnosis	1172	4.46	19.2	97.8
Secondary eye diagnosis	764	2.91	12.54	2.2
Eye patients admitted to hospital as battle casualties (3.38% of all the patients admitted to hospital as B.C.)	241	0.91	3.95	12.50
Eye patients admitted to hospital due to injury, accidental (5.63% of all hospital admissions due to injury, accidental)	255	0.97	4.17	13.17
Eye patients admitted to hospital due to disease (9.83% of all hospital admissions due to disease)	1440	5.49	23.62	74.33
Total glasses ordered 1374 (44.68% of refractions)				

Fig. 1 (Gundersen). Table showing number and classification of patients seen by the Eye Section, 6th General Hospital, from March, 1943, to December, 1944.

evacuated to general hospitals or station hospitals in the communication zone for an ordinary refraction. During the Anzio engagement, the problem became serious because of the large numbers of soldiers applying for evacuation and the difficulties involved in evacuating them.

The general hospitals in the Naples area were unnecessarily cluttered with these otherwise healthy men. Not until Maj. William H. Droegemueller and Maj. Edmund B. Alvis, each with an assistant, volunteered to establish a refraction clinic on the Anzio beachhead was this problem solved. These two ophthalmologists performed over 1,200 refractions on this dangerous beachhead. Their service has never been fully recognized, and I wish to commend them before their colleagues assembled here.

For those of us who joined the Army after our 40th birthday, and for many others, Army life was technically a voluntary project. Those who were by nature provident and farsighted did everything possible to anticipate their wants and increase their efficiency. Some studied the Officers' Guide Book; others took correspondence courses in everything from the detailed organization of a pack artillery regiment to just how to pile manure in the accepted Army manner. The benefits derived therefrom were somewhat questionable.

Of greatest benefit to me were the tools of my trade, which I carried with me. My ophthalmic surgical kit was small, but carried my favored instruments. The contents which I found most useful included my own needle holder, speculum, assorted forceps, chalazion clamp, six packages of Kalt corneal needles, several spools of 0.0025 fine silk, a set of Walker pins, several good Stille scissors, and a magnetic probe. In addition, a complete set of instruments for corneal transplantation happened to give me great pleasure.

While in Morocco, where human life is cheap and animal life is cheaper, our hospital established an animal farm with an excellent Arab diener who nursed our animals for fifty cents a day, plus three meals of good army food. There was an abundant supply of rabbits, other rodents, and some monkeys. It gave great opportunity for experimentation during the quiet periods.

The diagnostic equipment that I carried

	20 March 1944		25 June 1944		25 Sept. 1944		25 Feb. 1945		Average	
	Actual Number	%	Actual Number	%	Actual Number	%	Actual Number	%	Actual Number	%
Total Hospital Census	33,861		32,668		25,767		22,275		28,643	
Less P.W. & Allied Troops			4,762		2,202		1,960		2,231	
Total Hospital Census (U.S.)	33,861	100	27,906	100	23,565	100	20,315	100	26,412	100
Battle Casualties	9,361	28	11,509	41	7,924	34	2,670	13	7,866	29
Injuries	4,282	13	4,226	15	3,412	14	3,103	15	3,756	14
Disease	20,218	59	12,171	44	12,229	52	14,542	72	14,790	57
Total Eye Cases	672	1.98	604	2.16	553	2.35	362	1.73	646	2.06
Eye Battle Casualties	244		248		224		99		204	
% of Eye Cases		36		41		41		28		37
% of Census		.71		.89		.99		.49		.77
% of Battle Casualties		2.60		2.15		2.82		3.70		2.57
Eye Injuries	88		94		68		45		74	
% of Eye Cases		13		16		12		13		13
% of Census		.26		.33		.26		.22		.28
% of Injuries		2.05		2.22		1.99		1.46		1.96
Eye Disease	340		262		261		208		267	
% of Eye Cases		51		43		47		59		50
% of Census		1.01		.93		1.10		1.02		1.01
% of Disease		1.68		2.15		2.13		1.43		1.80

Fig. 2 (Gundersen). A consolidated report showing battle casualties, injuries, and disease. (Summary of four "spot checks.")

with me included two ophthalmoscopes (fortunately, these had large handles which accepted the standard Army dry-cell battery), a retinoscope, my own trial frame, and cross cylinders. These items were used daily, and obviously suited me better than anything the Army offered.

There was little hope of carrying heavy books until the hospital library became organized. When this happy day was announced, the librarian accepted my three volumes of Duke-Elder's textbook and several other classics from my own shelves.

Dr. Marshall has given us an interesting account of his long and splendid service for the American soldier. It is a pleasure to add my own statistics and those of the Mediterranean theater to his (figs. 1 and 2).

DR. DON MARSHALL (closing): I wish to thank Dr. Calhoun and Dr. Gundersen for their valuable and most interesting additions to my paper. Their experience was far wider than mine.

CANCER AND THE LENS

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AND

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Cancer of the lens has never been observed. What are the anticarcinogenic factors which render the lens immune to cancerous invasion?

The lens is composed of epithelial cells which continue to multiply throughout life, and constitutes a complete, metabolically active organ in itself. It is, however, characterized by certain special features which distinguish it from all other organs. Hence it appears logical to focus attention on those features which make the lens a unique structure. Some of these cannot at present be related to the biology of cancer; for others the underlying mechanism is unknown. The discussion of these possibilites is presented in the hope that it may stimulate experimental research.

ACCESS TO THE LENS

Assuming that cancerogenic substances are introduced into the organism or originate within the body outside the lens, what are the chances for the carcinogen to reach the lens proper?

Passage. The lens is suspended by means of the zonule fibers like a spider in its cobweb. An agent can reach the lens only through the aqueous; it must be able to pass through the ciliary processes and be soluble in the aqueous.

The ciliary processes present a formidable barrier against transmission to the lens from without. Larger molecules, such as protein or bilirubin (even in severe jaundice†), do not pass into the aqueous. Two possible deterrents, therefore, may prevent a carcinogen from acting upon the lens. The agent, because of its chemical structure, may not pass into the aqueous at all; or it may enter the aqueous only in such insignificant amounts that the threshold concentration for carcinogenic actions is never reached.

Diffusion. If it be assumed, however, that a carcinogen should penetrate the barrier of the ciliary processes and concentrate in suf-

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† Unpublished experiments.

ficient strength in the aqueous, it would still have to penetrate the lens capsule in order to reach the lens proper. The capsule provides another barrier because it permits diffusion only at a very slow rate.

If the permeability of the capsule decreases with advancing years (as assumed by several authors[1]), age, generally promoting development of cancer, would exert an adverse influence in the lens.

Solubility. The aqueous is a true watery solvent and is practically devoid of colloids, protein, and fat.[2] The majority of carcinogens studied so far are water-insoluble. Hence a carcinogen belonging to the group of water-insoluble agents could not reach the lens.

Secondary aqueous. The physiologic properties of the aqueous change radically after tapping the anterior chamber. The secondary aqueous, formed after draining off the primary, resembles blood plasma in many respects. By applying this technique, it should be experimentally feasible to expose the lens to known carcinogens in adequate concentrations, and thus learn how the lens reacts to a carcinogen when contact is actually made.

Biologic considerations

General nutritional factors. The lens, unlike other organs, does not depend upon the blood for nutrition; its nutrition is derived from the aqueous. The chemical and physical differences between these two media are associated with another difference of equal significance. Other organs possess means for controlling the influx of nutrients through regulating the blood supply; the intensity of normal-lens metabolism is dependent upon the composition of the aqueous. No mechanism is known through which the lens could induce the aqueous to furnish nutrients at an increased rate if higher requirements than the normal should arise, as would be the case if cancer should develop.

The lens may then be considered as an organ under permanent and rigid caloric restriction throughout life. To a certain extent its low metabolic activity is indicated by the rate of oxygen consumption. Even in youth oxygen consumption is only a fraction of that of other body tissues. Increasing age further reduces the respiratory activity. The lens with a cataract takes up even less oxygen than a normal one.[1]

Caloric restriction is known to have an anticarcinogenic effect on cancer incidence and development. The conclusion may therefore be drawn that the lens, an organ with a minimum of metabolic activity, cannot be very susceptible to cancer. Age and cataract formation (in which glycolysis also drops far below normal) create conditions even less favorable for cancer. If, however, cancer should get a foothold in the lens, the first few malignant cells would find a paucity of nutrients and would be unable to induce more ample nutrition by stimulating ingrowth of vessels. Rather, in the initial state when most vulnerable, they would be compelled to compete with the normal lens cells for the scarce available nutrients.

Special nutritional factors. The energy requirement of the lens is supplied by carbohydrates, probably in the form of glucose alone. Of the two mechanisms for glucose utilization in the body—aerobic oxidation to CO_2 and H_2O, or anaerobic glycolysis to lactic acid—the anaerobic process is much more important.

The normal energy metabolism of the lens is thus keyed to a type of glucose utilization which cancer in the lens—most likely of epithelial origin—must adopt due to the lack of oxygen. Thus the first few cancer cells would have to begin life in competition with a group of normal cells which are dependent upon the same type of glucose metabolism. The advantage of cancer cells over normal cells would not exist in the lens.

In contrast to other normal tissues (which utilize both mechanisms) the lens alone possesses a complete glycolytic enzyme system, but a vastly inferior respiratory enzyme system. Neither cytochrome nor cytochrome oxidase are present in the lens cells.[1]

A highly developed capacity for anaerobic glycolysis does not suffice in itself, however,

to render tissues cancer resistant, as evidenced by the retina. The retina exhibits the highest glycolytic activity of any tissue studied so far, and it also has a significant oxidative capacity; yet cancer develops in the retina (retinoblastoma).

Other biologic considerations. The suggestion has been made that cancer cells originate and begin to proliferate in response and as an adaptation to conditions which interfere with the growth and proliferation of normal cells.[3] On the basis of this hypothesis, the increase of cancer incidence with advancing age has been referred to the retardation of growth, associated with senescence, promoting discontinuous growth or proliferation.

In the lens, cellular growth and proliferation are extremely well controlled. If it were different, the value of the lens as a refracting medium would be jeopardized.[4] The beautiful rhythmicality of the anatomic pattern, the increasing index of refraction from the cortex toward the nucleus, the high regularity of the intralental refracting surfaces, all these features are incompatible with major irregularities in growth or proliferation of the lens cells. Age, although inducing many changes, does not impair these properties. The lens cells continue to grow and proliferate until death.

If the aforementioned hypothesis be true, the lens gives cancer little chance to exist in its domain.

Physical factors

Pressure. Cancer cells, when proliferating, infiltrate and push aside adjoining tissues, and the total volume of an affected organ tends to increase. The intralental pressure in the nonaccommodating eye is probably high, a conclusion drawn from the strength of contraction of the ciliary muscle required to overcome the pressure exerted by the capsule on the lens substance.[5, 6]

Although one cell may fail to correspond exactly to adjacent cells—due to slight irregularities in arrangement—it must not be assumed that the resulting, easily demonstrable spaces are empty. These spaces are certainly filled with fluid to insure homogeneous distribution of pressure throughout the lens. Other spaces, such as blood and lymph vessels, do not exist in the lens. It would seem that "wedging in" of cancer cells between normal cells would meet with considerable mechanical resistance from the pressure within the lens.

Light. The retina is protected by the refracting media against damage from ultraviolet radiation.[7] The cornea, because of its thinness, absorbs very little; the aqueous, being noncellular, is biologically inactive; the lens, because of its thickness, absorbs a considerable amount. It is known that ultraviolet radiation promotes conditions which are favorable to cancerous growth.

It may not be too farfetched to conclude that the lens cells are thus naturally adapted to a relatively high dose of ultraviolet radiation, another characteristic held in common with cancer cells. As in anaerobic glycolysis, the lens cell thus meets the cancer cell on the same competitive level, while other body cells, under similar conditions, would be at a distinct disadvantage.

Lens constituents

Minerals. The sodium content of the lens is extremely low. In tumors, generally, the sodium content is increased, but nothing definite is known about the influence of sodium on the growth of cancer.[8]

The potassium content of the lens, on the other hand, is extremely high, but decreases rapidly when cataract develops. Potassium promotes glycolysis. Its presence in large amounts, in both the lens and in tumors generally (where it corresponds with their metabolic rate), may thus be referred to the peculiar energy metabolism of the lens and of cancer respectively.

Protein. There is a questionable decrease of glutathione in the protein found in cancerous growths. In the lens, glutathione is present in significant amounts.

Lenticular protein is unique in that it lacks species specificity, possessing organ specificity only, with an amazing degree of similarity, at least in mammals. This feature

may point to a lower grade of specificity (common to both lens and cancerous tissue), another similarity to cancer.

Enzymes. As mentioned before, the lens cells contain neither cytochrome nor cytochrome oxidase. When cytochrome-c activity of normal human tissues and human neoplasms was compared, cytochrome activity was highest in certain normal tissues and lowest in the tumors of greatest malignancy.[9]

In this study cytochrome-c activity was found to be highest in those tissues in which cancer incidence is least frequent. The lens does not seem to fit into this pattern. In our opinon, however, the absence of cytochrome in the lens and the low cytochrome activity in cancer is one more similarity between lens and cancer, all of which taken together make lens tissue the most direct competitor of malignant tissue.

Other factors

Hydrogen-ion concentration. The pH of the lens is approximately 7.4. At this pH the alpha and beta proteases present in the lens are inactive. If the proteins of the lens break down, the resultant increase in acidity activates the proteolytic enzymes, and the way is opened for large scale hydrolysis of these proteins.[10]

Proteolysis induced by cancer is promoted by reduced oxygen pressure. The oxygen pressure in the aqueous corresponds to only 0.8 to 0.12 volume percent. (The actual volume of oxygen in the arterial blood is approximately 19 cc. percent.) Hence, should tumor cells succeed in becoming established in the lens, it can be assumed that they would exhibit considerable proteolytic activity because of the favorable milieu. The released amino acids would quickly render the reaction within the lens more acid, the mechanism for autolytic decomposition of lens proteins would be released, and swelling and destruction of the lens would result.

Another intereting possibility may be assumed. The lens may not be immune to cancer, but cancer, in its beginnings, may create conditions which tend to destroy the lens before the new growth has advanced to a point where it is demonstrable.

This hypothesis may also be applied to the competition between lens and cancer cells for glycose. If the cells of the lens were deprived of sufficient quantities of glycose for any length of time, the impairment of energy metabolism would soon bring about destruction of the lens.

Summary

Factors of biologic, metabolic, physical, and chemical nature—any or all of which may be responsible for the nonexistence of cancer in the lens—are considered and discussed.

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RECORDING OF VISUAL FIELDS*

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To the busy clinical ophthalmologist, the detailed study of visual fields is frequently an undesirable chore. Too often it turns out to be time consuming and taxes the doctor's patience excessively. Some men even ignore it and others relegate it to the nurse, secretary, or technician. To one who devotes much of his time to this work, it is apparent that the science of perimetry is not to be relegated to a technician. Duggan[1] goes so far as to say that he would condemn such practice as much as that of allowing one's secretary to do the ophthalmoscopic examination.

Some ophthalmologists believe that a very elaborate machine for the study of visual fields does away with the need for the doctor. We must remember, however, that the technique is far more important than the machine. To quote Traquair,[2] "Perimetry is not done by the perimeter, but by the perimetrist, and simple tools properly used are much less productive of wrong conclusions than undue reliance on the dicta of an elaborate instrument." Since the technique of perimetry should be guided by the clinical aspects of the case, one can understand that it would require a clinician to study the visual fields satisfactorily.

TIME-SAVING METHODS

However, since the clinical ophthalmologist may find it too time consuming, it seems pertinent to discuss some of the methods available for time saving and efficiency in recording visual fields.

DICTATE THE FINDINGS

In examining the patient's visual fields on the perimeter, it is best for the examiner to study the successive meridians and dictate the findings to his secretary as he makes them.[3] In this way, the examiner does not waste time looking for the proper place on the field chart, getting a good light to read by in the darkened room, readjusting his own position in relation to the test-object holder, and so forth.

All these distractions are time consuming and tax the subject's patience as well as that of the doctor. Furthermore, taking out time to record interferes with the routine, the patient grows restless and may change his position, and the examiner has to readjust the patient's position for each setting of the perimeter. It is advantageous, therefore, to dictate the findings to the secretary who can insert them on a card previously prepared for this purpose. This card (fig. 1) has the various meridians listed one under the other in the order in which they are examined, and the secretary records the data as the doctor calls them off. There is also provision for object size, distance, and color—all of which are dictated by the perimetrist as he examines.

ROUTINE OF EXAMINATION

For accuracy and uniformity, it is best to start with the 0-degree meridian representing the patient's right horizontal meridian in either eye, and to go up and to the patient's left (that is, clockwise for the examiner as he faces the patient) and, in this order, all the way around the field at 30-degree intervals.

Each meridian is recorded in order, the opposite meridian not being explored at the same time. One finds it less confusing and faster to record each meridian in order, for example 0 degree, 30 degree, 60 degree, and so forth; *not* 0 degree, 180 degree, 30 degree, 210 degree, and so forth.

By following one meridian after the other, the examiner can more easily appreciate the field as it unfolds itself, and thereby adjust

* This work was done under a grant from the William L. Hernstadt Fund. From the Ophthalmological Service of Dr. Samuel Gartner and the Neurosurgical Service of Dr. Leo M. Davidoff, Montefiore Hospital, New York City.

his technique to the conditions found. Single aberrent readings which differ appreciably from the adjacent readings will attract the examiner's attention and will suggest that the same meridian be explored and that the 15-degree readings on either side be explored as well. If the examiner alternates readings between one side of the field and the other while he dictates to the secretary, he may lose track of the general contours of the field and cannot, therefore, guide his technique as accurately.

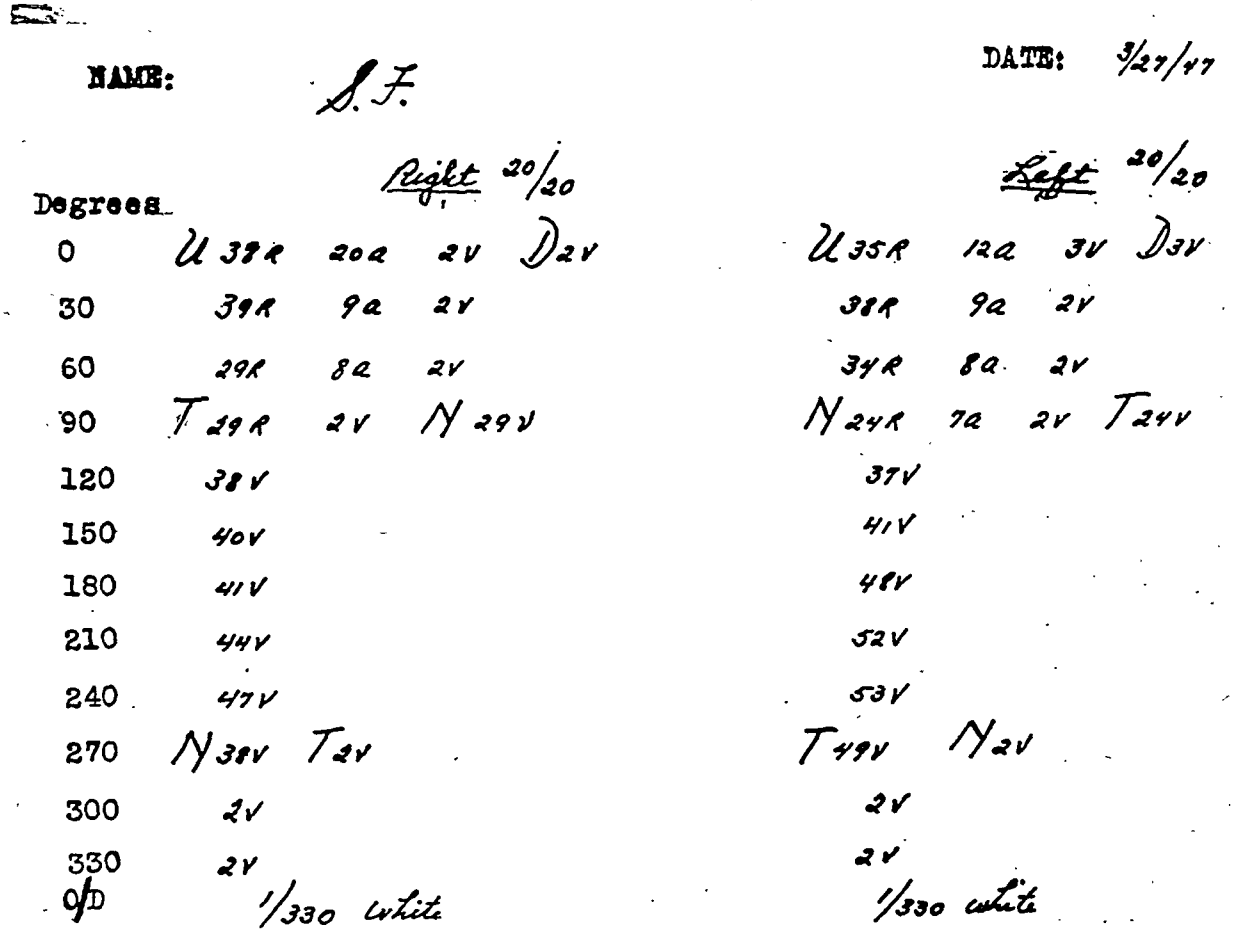


Fig. 1 (Chamlin). Card for recording data for peripheral fields. (The fields in Figure 2 were plotted from the data on this card.)

If all visual findings are definite and the patient is quite sure of his responses, no qualifying remarks are made in the dictation. On the other hand, if the patient gives a definite description of seeing the test object very blurred in certain areas, such as one would see in an area of relative scotoma, the dictation is given so as to indicate that there is some relative defect in this area.

To illustrate this. If we are exploring the 30-degree meridian in the right field of Figure 2 and the patient sees the test object blurred at 39 degrees and continues to see it blurred until it reaches the 9-degree arc, where it suddenly disappears completely and reappears clearly at the 2-degree arc, this 30-degree meridian would be dictated as "39r,9a,3v"—the small letters "r," "a," and "v" standing for "relative," "absolute," and "vision." The last symbol, "v," indicates clear vision for that portion of the field.

Checking relative defects

Of course, in evaluating relative defects, one must be quite sure that it is really a defect and not the normal amount of blurring due to the physiologic diminution in visual acuity in the periphery, corresponding to the

normal "sloping edge" of Traquair. One way of checking the area of relative defect is to use the method of "rapid comparisons"[4] and compare this area with one in another meridian about the same number of arc degrees distant from fixation.

For example, if the patient thinks that the test object is blurred between 10 and 20 degrees in the 60-degree meridian, one should move the test object rapidly to the 120-degree meridian between the 10 and 20 degree arcs, and ask the patient to compare the appearance of the test object in the two different places.

The same test object should be seen approximately equally well in these two areas, unless the defect crosses the vertical meridian. In such a case we may use a point equidistant from fixation in the 240-degree or 300-degree meridians.

It is well to make these comparisons rapidly, holding the test object in each of the comparable areas for only a brief second at a time. One should keep asking the patient "is it clearer here or there" and should accept only very definite and consistent answers.

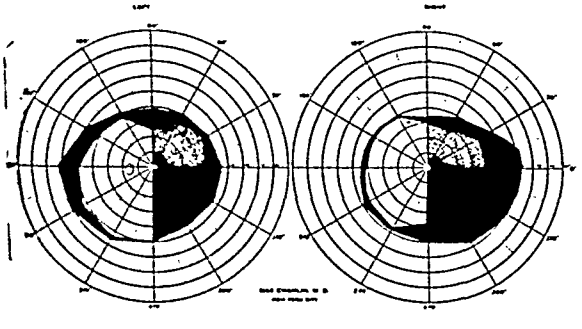


Fig. 2 (Chamlin). These visual fields were filled in from the data recorded on the card shown in Figure 1.

In order to avoid the necessity for moving the arc of the perimeter with each of these rapid changes, it is well to use a paddle type of carrier.[5] With this carrier, which furnishes a large dark background for the test object and simulates the perimeter surface, the examiner merely changes the position of the paddle carrier rapidly from one area to the other, approximating the meridian and arc position rather than actually measuring it on the perimeter. Once the quality of the defect is evaluated in this way, accurate measurements with the perimeter arc in position can be made. In asking the patient to evaluate the test object against the paddle carrier without the perimeter background, it is well for the examiner in his black gown to provide a substitute background.

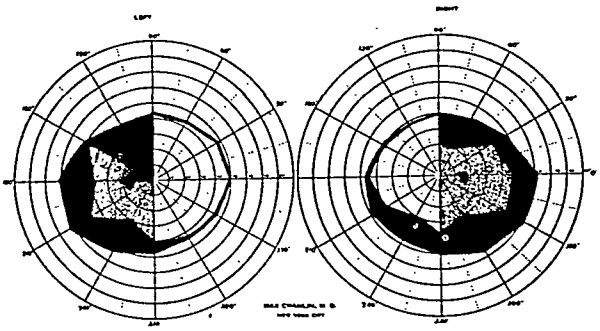


Fig. 3 (Chamlin). Peripheral fields for 1/330 white, showing bitemporal hemianopic defects with varying density.

In the same meridian, one must be careful about labelling a more peripheral arc as relative compared to a more central arc. A pathologic defect is more definite if the test object becomes blurred more centrally after having been seen more clearly peripherally in the same meridian.

Recording of Readings

This method of recording vision, relative defect, and absolute defect, as "v," "r," and "a" may seem a little complicated at first, but actually resolves itself into a very simple method of dictation. As another example, in Figure 2, in the 60-degree meridian of the left eye, if the test object was seen blurred at 34 degrees, disappeared at 8 degrees and returned clearly at 2 degrees, the dictation for the 60-degree meridian of the left eye would be "34r, 8a, 2v." These readings are dictated at the time the patient calls them, as the test object is carried along the meridian being explored.

In those cases in which one suspects a

sharp line of demarcation, such as in the temporal hemianopias of chiasmal lesions where the 90-degree meridian may divide a relative or absolute defect temporally from a zone of good vision nasally, the 90-degree meridian is dictated as "T" and "N," standing for "temporal" and "nasal." The readings are taken separately along the temporal and nasal side of the vertical meridian.

Thus, in Figure 3, the 90-degree meridian in the left eye would be dictated as N43, T0. The same designation of "T" and "N" is used for the 270-degree meridian.

Furthermore, if a sharp horizontal division is found between a zone of good and poor vision in any but the vertical meridians, I use "U" and "D," standing for "up" when reading above the meridian and "down" when reading directly below it. These readings, of course, are made directly above and below the line along the middle of the perimeter surface in the meridian being explored. Thus, in the left field of Figure 3, the sharp change from absolute to relative scotoma in the 150-degree meridian is recorded as U0, D48r, 13a. "T," "N," "U," and "D" are inserted as capitals, while the "v," "r," and "a" are inserted as small letters.

Areas of diminished vision

In those areas where the test object is sighted by the patient, but the patient tells the examiner that it is very blurred, one may indicate the area as being relatively scotomatous. Of course, we are not really giving that portion of the field a definite value in terms of visual angle, color, and illumination. We merely describe it as an area of diminished visual acuity as compared to other areas for the same visual angle and illumination.

These areas of diminished vision can be further analyzed with lesser stimuli into absolute scotomas. However, for most practical purposes, merely indicating a definite blurring as a relative defect is highly satisfactory.

Some patients are very keen in their observations and correspondingly expressive in their descriptions of how they see the test object and thereby give us good data for recording various degrees of density of scotomatous areas. However, one should not attempt to record such gradations on the basis of the patient's evaluation of a single visual-angle stimulus. This would lead to too many complicated factors.

It is safer to accept only one degree of vision as being that of a relative scotoma—that area in which the patient definitely sees the object but where it is definitely not as clear as it is in other areas equidistant from the fixation point.

Recording tangent-screen findings

A similar procedure of dictation may be used in recording findings on the tangent screen. Here the markings are in 22.5-degree meridians and corresponding record cards are used when recording fields such as the 1/2,000 white or the 5/2,000 red.

Here again, one can use the symbols, "U," "D," "T," and "N" to indicate sharp dividing lines as well as the letters, "v," "r," and "a" for indicating varying degrees of density of scotoma or vision. By dictating the findings, we can avoid putting pins into the screen, thus saving time, wear and tear, and the distracting influence of the pins on the tangent screen.

Against this method, one might say that, without the pins, the examiner does not visualize the field as it unfolds itself and thereby fails to take extra readings in areas suggesting a defect. However, if one uses the tangent screen fairly frequently, one will easily learn to visualize and interpret the field as he dictates it.

Verbal dictation and recording by the secretary is not particularly useful in mapping out small scotomas. Here, the usual method of inserting black headed pins or a light dab of chalk is preferable.

Advantages of these methods

There are several advantages to this method of recording perimetric and tangent-screen findings.

1. It gives an accurate, numerical record of the patient's field, not affected by the error in recording hastily and interpolating distance for the various arc degrees on a perimetric chart in a darkened room. For future reference and comparison, these original records are most accurate.

2. The patience of the subject is not taxed with boring delays between readings, and consequently he maintains more constant fixation.

3. The entire procedure becomes much more rapid, thus doing away with one of the reasons that some men do not study visual fields more often. The secretary can be taught to plot the fields from these charts within 3 to 5 minutes after recording all data; or she can plot them after the doctor is through with his work, if the findings are not of an urgent nature. It is preferable to see the plotted field before the patient leaves the office, so that any suspicious recordings which might bear checking can be verified.

Visual field charts

There are many types of charts in use for recording of visual fields. Many of them use some shading of the periphery, leaving unshaded that portion usually subtended by a 5/330-white test. If all perimetry were done with this visual angle, the shading would be adequate as indicating the normal. However, with modern methods of quantitative perimetry, using different visual angles, this shading loses much of its value, and to the inexperienced eye, may often be misleading. While the 5/330-white test is satisfactory for marked peripheral defects, it is not quite sensitive enough for minimal types of peripheral defects. For such minimal types of interference, one should use a minimal stimulus, such as the 3/330 white, or better still, the 1/330 white. The last one mentioned, while not reaching out as far in the periphery of the field as the 3/330 white, is a much more delicate test and more apt to show minimal interference in the field, even when quite peripheral.

Chart for peripheral-field study

Therefore, since 5/330, 3/330, and 1/330 all have their uses, I have devised a chart for use at Montefiore Hospital for peripheral-field study with all these three isopters indicated on it in a light contrasting color (fig. 4).

In order to avoid confusion, the meridional- and arc-degree markings are of an orange color, and the normal isopters are indicated in a very light green—so light, that on casual inspection, the examiner will not notice these isopter lines. However, the recorder has no difficulty in seeing and using the line for the particular test employed. The outermost green line represents the 5/330-white field, the next one the 3/330, and the innermost one the 1/330 field. The visual field tracings are done in the usual black ink.

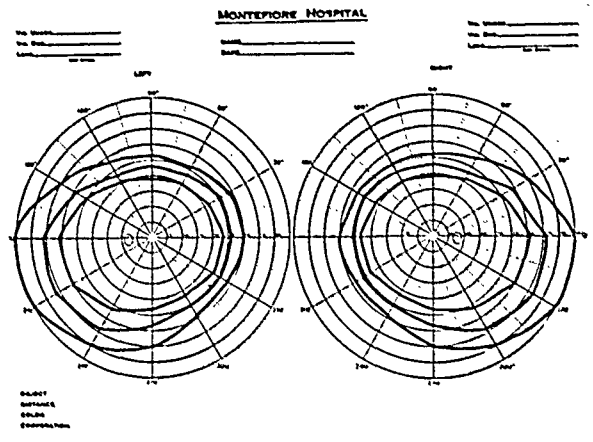


Fig. 4 (Chamlin). Photograph of author's chart for recording peripheral fields. The chart is white and the meridional and arc markings are of a light orange color. All the printing on the chart is also light orange in color. The median normal isopters for the 5/300, 3/330, and 1/300 white are marked off in very light green, hardly perceptible on casual inspection. These isopter lines have been accentuated with heavy black ink so as to show up well in this photograph. The light orange lines have also been changed to black for the purpose of this photograph.

After recording the visual fields, the secretary goes over the isopters for the particular visual angle used in the same black ink. Thus, if we use a 3/330 test, the secretary blackens the middle isopter line, then outlines the field as found for the patient, and

blackens the space between these two lines. Thus, all blackened space indicates lost field.

This method of blackening all the lost field up to the normal isopter is used by many workers for the 5/330 field by blackening up to the shaded area. For smaller visual angles; that is, for the slightly inner isopters, some workers have used the corresponding normals to indicate lost field. Most examiners, however, merely draw the line on the field and do not indicate the normal.

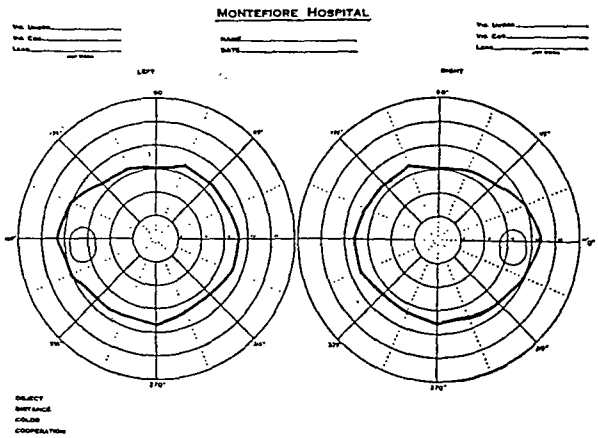


Fig. 5 (Chamlin). Author's chart for central fields. As in Figure 4, all the printing, arc, and meridional markings are in a light orange color. The isopter used for 1/2,000 white, normally a very light green, has been marked with black ink for the purpose of this photograph.

In reading these charts, all the observer has to know is that the outermost blackened line is the normal extent of field for the particular test used. Of course, if the plotted field is larger than the normal one, there is no space to fill in and the normal need not be blackened.

Minimum normal field

To one who has had experience with the various isopters for the various visual angles, this filling in of lost field may not be very important. However, many of the physicians to whom these charts are presented are not acquainted with these normals, and a normal 1/330 field may appear like a generalized peripheral contraction when plotted on a chart whose periphery is shaded for a 5/330 field.

The 5/330 isopter is represented pretty much the same on most perimetry charts and is almost the same as the averages found by Ferree, Rand, and Monroe.[6]

In this same article, the authors studied a large series of normals and worked out what would be a minimum normal field for the 5.8/330 (1-degree stimulus). They conclude with reasonable assurance that a field smaller than this is probably a pathologic contraction.[7]

This minimal normal field takes into consideration even the smaller fields of presbyopes. When considering only myopes and presbyopes, the average field was found to be not more than 10 to 12 degrees narrower than the normal used on the Montefiore chart. Therefore, any contraction beyond 12 degrees on this chart should be considered as probably induced by a pathologic condition.

The 1/330 isopter used on the Montefiore chart is practically the same as the median value given by Ferree, Rand, and Monroe for 150 nonpathologic cases. These authors worked out the lowest normal field for this visual angle (0.17 degrees) including the fields of presbyopes.[8] The greatest difference between the 1/330 isopter on the Montefiore chart and the smallest field for presbyopes is about 10 degrees nasally and 17 degrees temporally. Therefore, any contraction beyond 12 degrees on the 5/330 isopter and beyond 10 degrees nasally and 17 degrees temporally on the 1/330 isopter should be considered suggestive of pathologic conditions.

Interpretation of fields

In general, if the field is uniformly constricted, it is unlikely that one is dealing with a true pathologic contraction. On the other hand, localized indentations and sector defects are much more common in truly contracted fields. Of course, in any doubtful cases, one should expect the emmetropes and hyperopes to have larger fields, and the myopes and presbyopes, smaller ones. A truly technical normal could be established by

working out a long series of fields depending on the refractive error as well as the age. However, if one wants to feel very safe before considering a field contracted, he may do so by using these low normals as worked out by Ferree and Rand.

One may assume other normals than those assumed normals as fairly reliable, especially, as in this case, when the smaller halves of each field are homonymous and the clinical picture warrants a homonymous field defect. However, if the findings do not give a clue, one could well use the median normals on these charts as a guide.

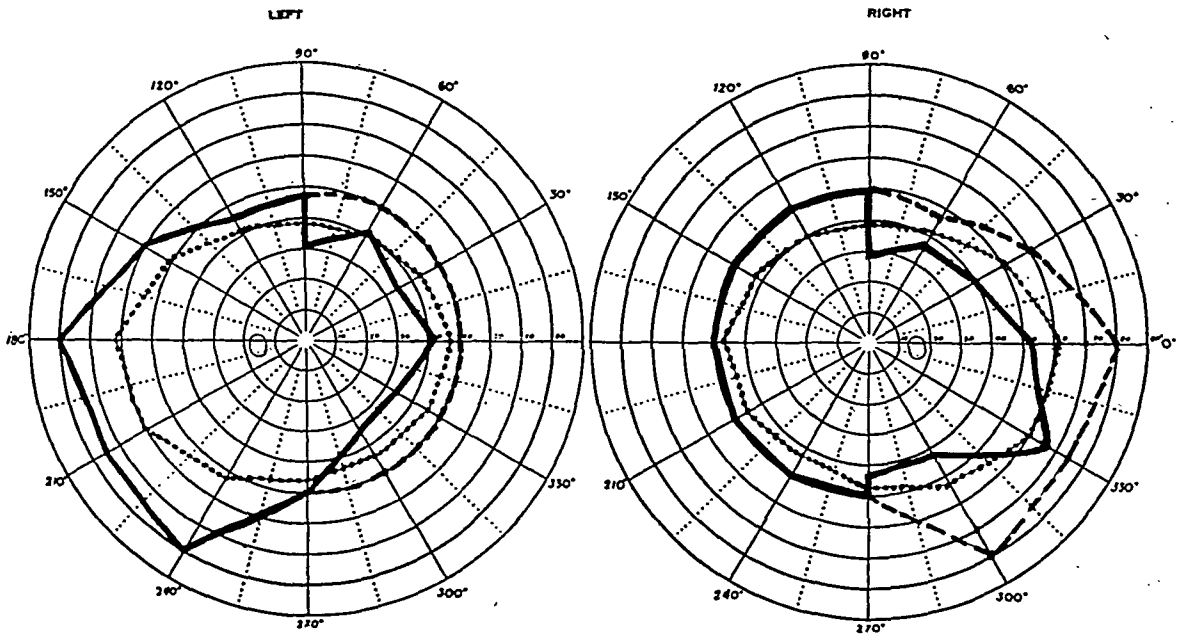


Fig. 6 (Chamlin). The solid heavy black line is the field plotted for A. R. with 1/330 white. The dotted line represents the median normal for this visual angle as used on the author's chart.

In this case, the extent of the normal field in the homonymous defective area of the right eye may be assumed by the broken line which is filled in from the corresponding normal field in the left eye.

That is, the normal for the right temporal field is plotted by a broken line by using the corresponding fuller temporal recordings in the left field. The normal for the left nasal field is plotted by a broken line using the corresponding fuller nasal recordings in the right field.

It is reasonable to assume that the right and left normal fields are equal in size and shape, since both eyes had equal visual acuity and equal refractive error. It will be seen that these assumed right homonymous normals follow the general contour of the fuller, normal, left homonymous recordings.

This is the field study in a case of left temporal lobe lesion with beginning right homonymous field defect.

reported on the charts by the findings in a particular case. For example, in Figure 6 we see that the left half of each field, being unaffected by the interference of the visual pathways, shows an extent of field well beyond the 1/330 isopter shown on my chart. In such cases, we may assume the normal field to be represented by the less affected temporal and nasal halves. One could, in such cases, gauge the normal or the general contour of the fuller size of the field with reasonable accuracy. One may consider such

In similar fashion, the Montefiore chart for central fields has a normal isopter for 1/2000 white indicated on it (fig. 5). Here again, the arc and meridian markings are colored a light orange and the 1/2,000 isopter is a very faint green. The values for this 1/2,000 isopter were made after Hefftner and discussed by me in a previous article.[5]

According to some observers, the normal 1/2,000 field extends for an average of about 19 degrees while, according to others, it may extend to about 26 degrees.[9] The author has

found many patients who do not perceive the 1-mm. test object at two meters beyond the 10- to 12-degree meridian. This is in accordance with the findings of McLean.[10]

If a patient's 1/2,000 field reaches uniformly about 10 degrees all around fixation and no other peripheral or central defect can be found, it is quite likely that this is the

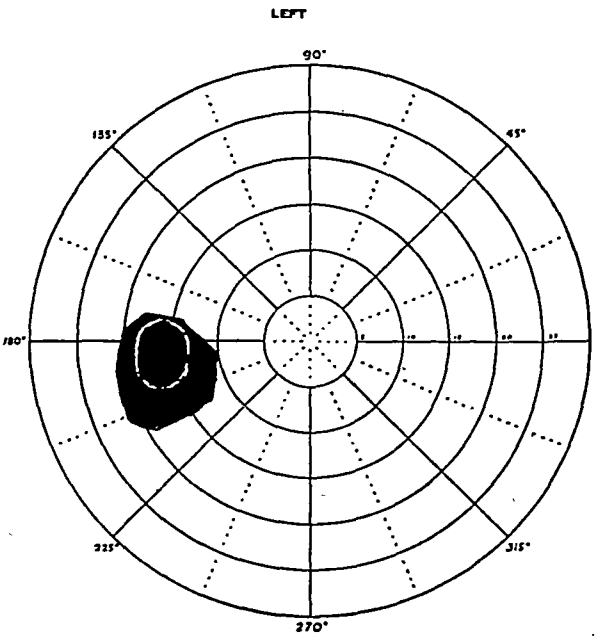


Fig. 7 (Chamlin). Black and white reproduction of an enlarged blind spot. An orange line outlining the normal blind spot on the chart is left unblackened and stands out against the black of the enlarged blind spot to show the normal area.

normal for him. Thus, we must make allowances for a wide range of normals as in the peripheral field. Here, again, localized contractions such as homonymous or bitemporal defects are much more significant than generalized regular contractions.

Show up normal blindspot

The 45-degree meridians are marked off by solid lines to the 5-degree arc and then by dotted lines. The 22.5-degree markings are represented by dotted lines and stop at the 5-degree arc. This allows more space centrally for detailed recordings. The unmarked meridians within the 5-degree arc can be gauged with reasonable accuracy. The blind spots are calculated according to the average of Evans' report on five workers.[11] When filling in the blind spot demonstrated by perimetry, it is well to show up the normal blind spot within it so that the physician can easily gauge the amount of enlargement, if any. This can easily be done by not blacking the outline of the normal blind spot (fig. 7). Here, the orange color outline of the normal blind spot is left intact to stand out, as normal, against the blackened area.

Recommended charts

The charts are printed on white thin paper so that the black ink shows up well and can easily be traced from another field record if necessary. The light orange and green markings become inconspicuous next to the black recordings and the latter stand out well. These charts are useful for hospital and office records, and especially for demonstrations to large groups at clinical conferences. However, for reproducing field studies in medical publications, it is better to use black meridional markings and to trace the normal isopters used from another chart before filling in the space representing lost field. I have used such charts in this article.

Summary

1. A rapid method of recording visual fields is described. This method allows the examiner to work rapidly, uninterruptedly, and accurately while he dictates his findings to his secretary.

2. This method gives a permanent, accurate, numerical record of the visual-field studies, together with a simple method for recording differences in scotometric densities.

3. The Montefiore charts for central and peripheral fields are described. These charts carry the commonly used normal isopters in light colors so the proper ones can be utilized in indicating lost field, thus making the finished chart a schematic picture of the subject's visual field and its deviation from the normal.

1840 Grand Concourse (57).

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THE STEREOPHOTOGRAMMETRIC STUDY OF THE ANTERIOR SEGMENT OF THE EYE*

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Rosario de Santa Fé, Argentina

An historical study of contact lenses and their development from the time of Fick, that is about 1888, to the present, leads to the conclusion that in order to make a perfectly fitting contact lens, a faithful reproduction of the curves of the anterior segment of the eye must be obtained.

The drawbacks to the standard lens, that is, with fixed curves, have been partially solved by using a cast of the eye but this procedure does not fulfill all the necessary requirements and presents unsolved difficulties which will not be discussed in this paper since they are well known to all those who have made a particular study of contact lenses.

The ideal lens is that which would rest on a large surface of the ocular conjunctiva. For this, it is necessary to try to obtain with the maximum exactitude a pattern of all the curves of the anterior segment of the eyeball, covered by the conjunctiva so as to avoid compression of the vessels and subconjunctival capillaries which feed the cornea and perilimbic region.

Dallos, to whom the first results of this study were communicated, is entirely in agreement as to the necessity of obtaining these curves; he maintains these curves should be of such exactitude that the margin of error would not exceed 0.05 mm. (personal communication).

Stereophotogrammetry consists in the calculation of the form, dimensions, and position of a given object from photographs of the same. It is a highly specialized subject in engineering which can only be practiced by skilled technicians. The author is indebted to the collaboration of A. Saralegui, an engineer, whose knowledge has given the solution of many of the problems arising in the course of this work.

It has already been stated that the curves to be obtained are those which form the anterior segment of the eye, covered by the

* Read before the II Pan-American Congress of Ophthalmology, Montevideo, Uruguay, November, 1945.

ocular conjunctiva. The transparency of the conjunctiva, which makes it invisible on a photographic plate, is a great drawback. This was the first difficulty to be solved. Several methods tried gave negative results until the eye was powdered with lamp black. This method gave a satisfactory result; that is a perfect stereoscopic view of the conjunctival and corneal surfaces. The fine film which covers the anterior segment of the eye, the vessels which run under it, and even the sclerotic could all be seen.

The fundamental problem thus solved, it was possible to chart the points of observation necessary for the stereophotogrammetric measurements which enable one to plot the curves made by the conjunctival surface of the anterior segment of the eye millimeter by millimeter throughout the whole of its extent.

The technique was as follows. After the administration of akinesia and local anesthesia, the eye was powdered with lamp black, by means of a strainer; the lids were then separated and a snapshot was taken with a Zeiss stereoscopic camera of the anterior segment of the eye. This camera has orthoscopic objectives, its own illumination, and a focusing eyepiece. The photographic plates gave negatives which permitted the eyeball to be measured within the preëstablished limits of error.

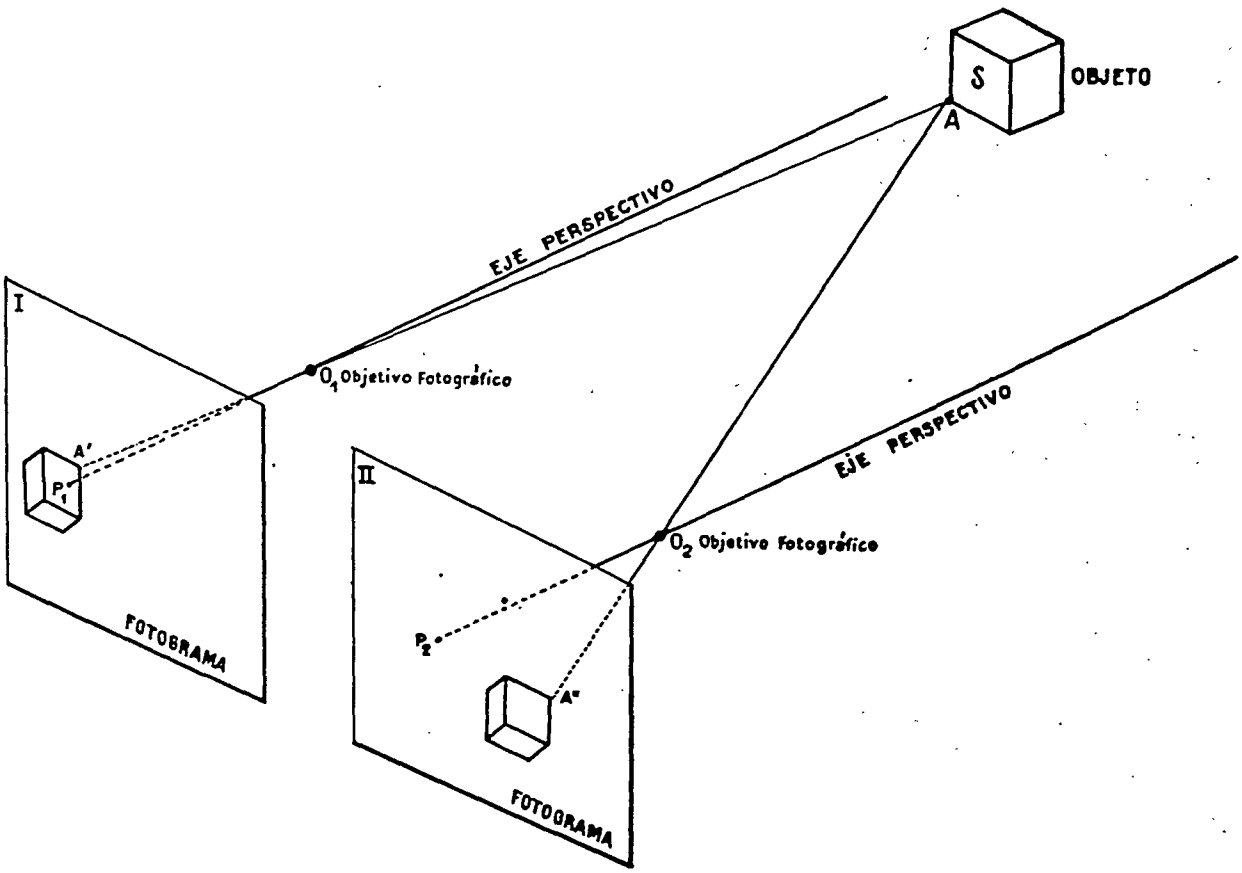


Fig. 1 (Bertotto). A diagram of the simplest way in which two photograms can be taken.

These stereoscopic photographs, from now on referred to as photograms, provide exact and different views of an object. In stereophotogrammetry, two photograms of an object are needed to reconstruct the object in three dimensions. It should be noted that the two photograms must be different; that is, taken from two different points in space, of which the relative position as well as that of the main axes of the perspectives must be accurately known; the greater this accuracy the more exact will be the reconstruction.

Figure 1 is a diagram of the simplest

way in which two photograms can be taken. These have been marked I and II. Their principal points are P_1 and P_2. The positions in space from which they are taken are O_1 and O_2 and the main axes of the perspectives are $O_1 P_1$ and $O_2 P_2$.

Figure 2 illustrates how any point, A, of the object, S, is reconstructed in space A_1, by placing the two photograms, I and II, exactly in the relative position they held at the moment of being taken, and materializing in any way (either optically or mechanically) the beams AO_1 and AO_2, which produce A_1 at their intersection.

It is obvious that in solving the problem by mechanicoptical method or by calculation, the accuracy of the reconstruction of A_1 corresponding to A will depend on the delicacy with which $A'O_1$ and $A''O_2$ have been materialized or in what way the segments P_1A' and P_2A'' have been measured. This last also necessitates the knowledge with the utmost precision of the distances of d_1 and d_2 of the photographic objectives as well as the separation of their posterior nodal points.

Having obtained the foregoing data, the numerical solution of the problem is obtained by a simple equation of proportion. The figures which are known in order to find the unknown; that is, the reconstruction of point A in space (D_A) are the following:

$$d_1 = d_2 = d$$
$$O_1 O_2 = b$$
$$P_1 A' - P_2 A'' = P_A$$

with these data, the following equation can be made:

$$\frac{D_A}{b} = \frac{d}{P_A} \text{ which gives } D_A = \frac{b \times d}{P_A}$$

Dispensing with the numerical calculation, these photograms were later made by the most perfect stereophotogrammetric instrument known up to the present—the Wild A5 Autograph. The exceptional scope of this instrument has made it possible to draw with extraordinary rapidity transverse and frontal (annular) sections of the anterior segment of the eyeball traced automatically millimeter by millimeter.

The mathematical study of the condition under which the photograms were made and the automatic reconstruction as well as the measured proofs made by the automatic counters of the wild A5 Autograph, make it possible to be certain that the alteration

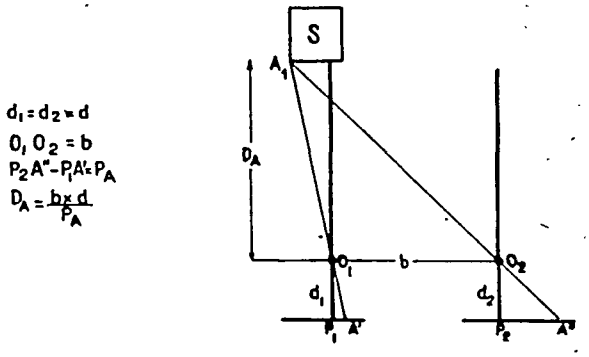


Fig. 2 (Bertotto). This illustrates how any point, A, of the object, S, is reconstructed in space at A_1, by placing the two photograms, I and II, exactly in the relative position they held at the moment of being taken.

in the reconstructed points is less than 0.02 mm. or to be even more exact 0.017 mm. This degree of accuracy will certainly be improved upon in further studies.

Study of the curves obtained by stereophotogrammetry

The camera used takes a stereoscopic photograph with an approximate ratio of 2 to 1, or double the natural size of the eye. Figure 3 is a photograph showing the conjunctiva and cornea powdered with lamp black. The position where the section must be made by the Wild A5 Autograph has been marked by a white line. Underneath the stereoscopic photograph there is a drawing showing the natural size and another three times larger (3 : 1).

In Figure 4, the distance of the different points which make up a curve are related to a plane parallel to the photograms. The measurements can be obtained in thousandths of a millimeter and at any point desired on the curve. Only a few measure-

ments taken at haphazard were established in this diagram.

Figure 5 shows an annular graph; that is, the sections were made in the frontal plane. The circular curves correspond to a center. At the side in the same figure is a diagram of its projection on a plane, with the object of making the explanation simpler. The curve obtained by joining the several projected points will correspond to

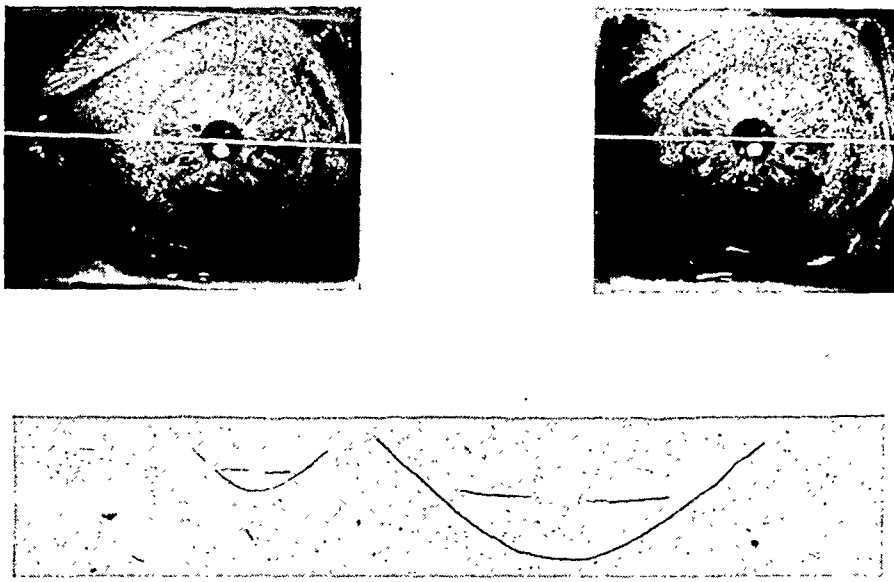


Fig. 3 (Bertotto). This shows the conjunctiva and cornea powdered with lamp black. The position where the section must be made by the Wild A5 Autograph has been marked by a white line. Underneath the stereoscopic photograph there is a drawing showing the natural size and another three times larger (3:1).

section made at a determined distance from a plane similar to that which was referred to in the previous figure, and each line corresponds to a millimeter of the photographed object going from the periphery to the

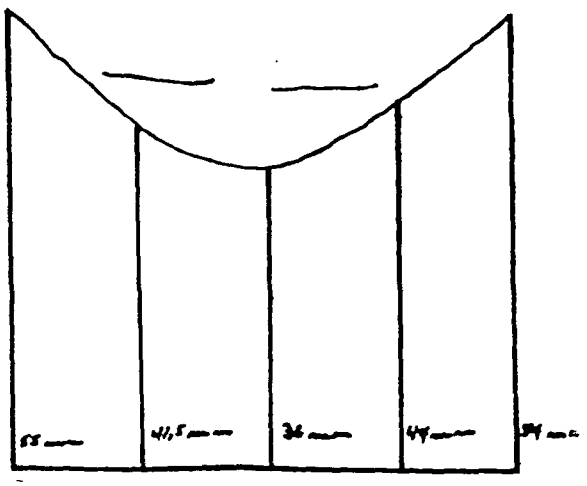


Fig. 4 (Bertotto). The distance of the different points which make up a curve are related to a plane parallel to the photograms.

a section of the eye which passes through the center of the pupil.

Figures 6 and 7 are important as they emphasize the number of serial sections of an eye, which can be made and which can be increased if necessary; they also demonstrate the need of powdering the eye. This series of curves corresponds to transverse sections through the eye from the upper part; namely, that which covers the superior segment of the eye, to the lower part of the same, passing through the center of the pupillary area; the distance between each line corresponds to one millimeter in height.

In Figure 6, the eye had been well powdered, so the necessary points for the stereophotogrammetry were obtained both in the conjunctiva and the cornea. A study of the graph shows that the curve passes from the conjunctival surface to the cornea without apparent signs of transition. In Figure 7, the cornea had not been powdered

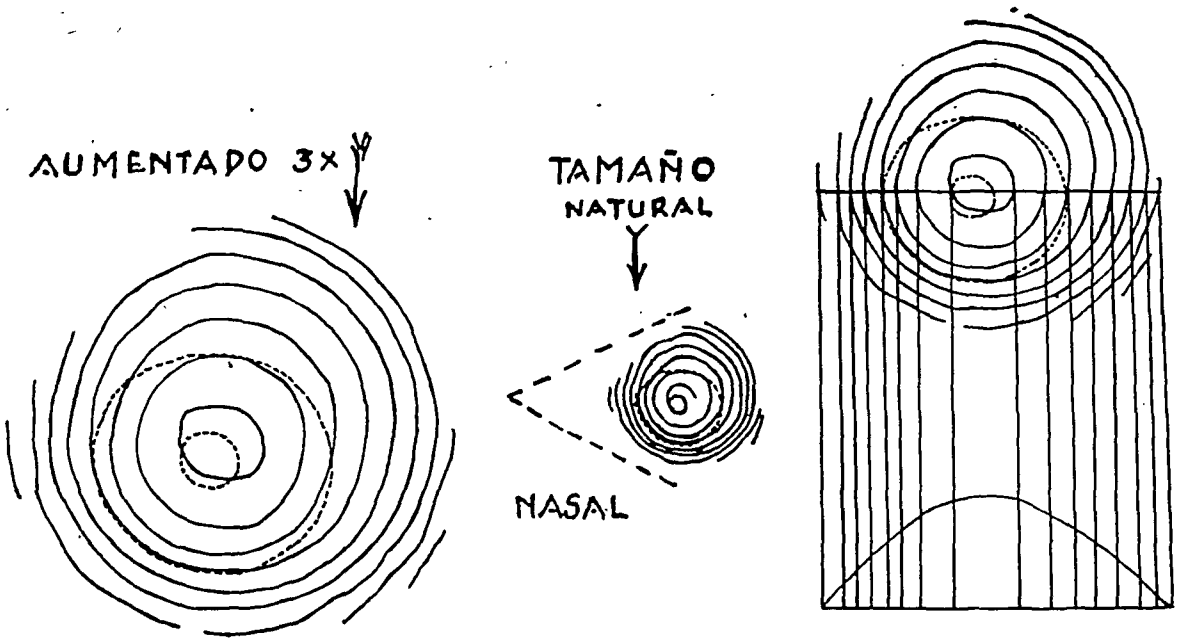


Fig. 5 (Bertotto). An annular graph with the sections made in the frontal plane.

and, therefore, since it is transparent, it has not appeared in the autographic examination. Since the distance between each section is 1 mm., it is easy to deduce that the vertical diameter of the cornea is 12 mm.

The object of Figure 8, is to demonstrate the various planes which can be obtained from a section with the Wild A5 Autograph. It represents three sections of the eye, amplified six times, and with a difference of 3 mm. in height between each section. The middle section is the one which passes approximately through the center of the pupillary area.

Examining this figure, one sees in the first place the bulbar conjunctiva and the anterior aspect of the cornea as obtained by the method under discussion. Immediately behind the curve made by the conjunctiva, there is a second curve which corresponds to the surface of the sclera; its central part, well separated from the curve of the cornea, represents the surface of the iris. In the central section, the posterior line is interrupted in its middle part where it corresponds to the pupil.

At this point attention must be drawn to the fact that the values given to the scleral

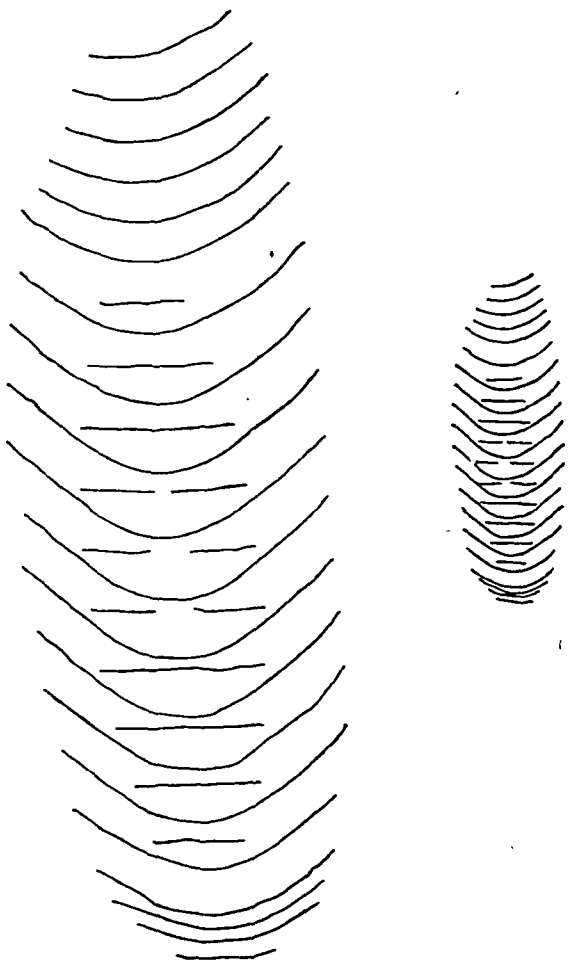


Fig. 6 (Bertotto). A study of the graph shows that the curve passes from the conjunctival surface to the cornea without apparent signs of transition.

curve and those of the surface of the iris are not accurate as no study has been made of the parallex or corneal refraction.

Figure 8 corroborates the importance of powdering the eye with lamp black, since

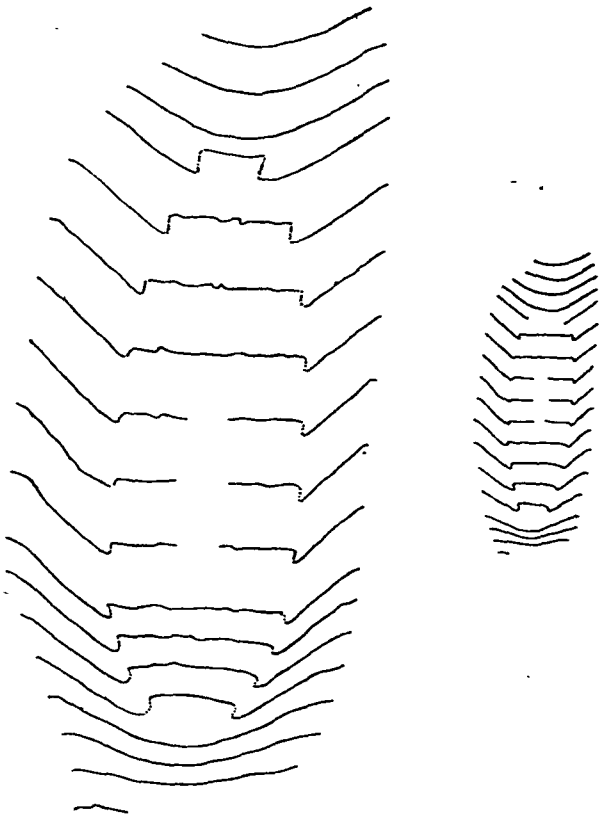


Fig. 7 (Bertotto). Since the distance between each section is 1 mm., it is easy to deduce that the vertical diameter of the cornea is 12 mm.

it demonstrates the separation between the surfaces of the conjunctiva and sclera. It also shows the importance of the surface taken as the base in making a contact lens because, if the sclera is taken, there will certainly be pressure on the vessels and subconjunctival capillaries with subsequent disturbances due to the resulting anemia.

Discussion

The majority of ophthalmologists specializing in contact lenses have abandoned the use of standard lenses, having found that a lens made on a cast of the eye affords greater probabilities of success. There is no doubt, however, that the problem is far from being solved owing to the difficulty of obtaining a perfect pattern or negative of the eyeball which if successful makes the manufacture of the contact lens relatively easy.

Without lessening the importance that casts of the eye have had in the development of the study of contact lenses, Town's opinion on their value can still be fully endorsed: "In the best of cases it is only possible to obtain a defective approximation of the eye." (*Archives of Ophthalmology,* 1940, volume 22, page 822.)

The truth is that a cast of the eye presents certain difficulties among which can be

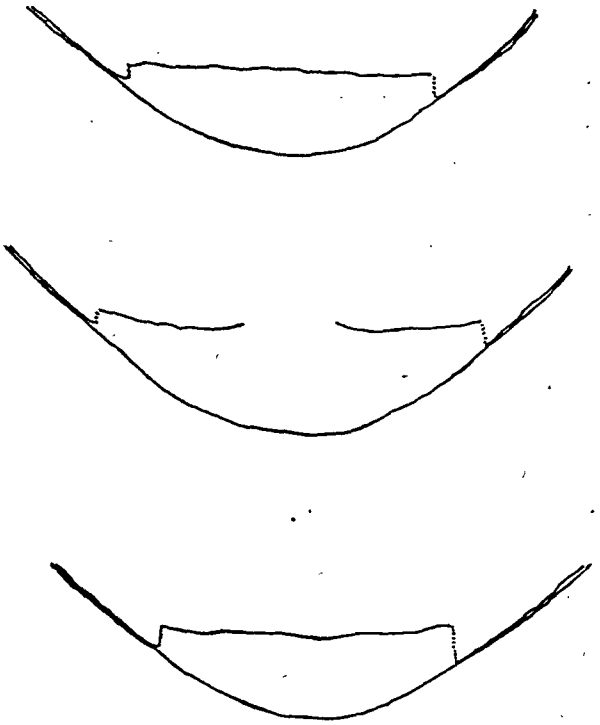


Fig. 8 (Bertotto). The object of this illustration is to demonstrate the various planes which can be obtained from a section with the Wild A5 Autograph.

mentioned: (1) Movements of the eyeball during the taking of the impression; and (2) conjunctival folds and pressure exerted on the ocular tissues.

These inconveniences are eliminated by stereophotogrammetry because there are no movements of the eyeball since the photograph is taken instantaneously, the time employed being 1/25 to 1/50 of a second. It is believed that even more rapid snapshots might be obtained if fresher plates of

greater sensitivity than those used in this study could be employed.

The conjunctival folds and pressure on the eyeball are also eliminated by this method as the only direct manipulation of the eye is the separation of the lids, the facial nerve having been previously paralyzed so as to avoid the defensive contraction of the orbicular muscle of the lids.

Apart from the great advantages which have been mentioned, the method assures that the resulting measurements will have a maximum error of only 0.02 mm. which will be improved upon as the technique is perfected, and which it is believed can be considered negligible in the manufacture of the lens, as it must rest completely on the whole surface in a uniform manner. When the contact lens follows the curves of the eyeball in their slightest detail, it will not easily become laterally displaced or rotate on its interoposterior axis. Also by this method the diameter and exact height of the cornea can be faithfully determined in any meridian desired. With all these exact data, it should be possible to obtain in all contact lenses uniform application over the perilimbic area and a perfect adaptation between the posterior surface of the lens and the vertex of the cornea.

The small number of experiments it has been possible to perform do not allow more definite conclusions as to the advantages of stereophotogrammetry applied to the anterior segment of the eyeball. When the plan of study was sketched out, it was divided into three parts as follows:

1. The obtaining of the curves which made up the anterior segment of the eye—a problem which can be considered as solved, even though it is necessary to perfect the photographic technique.

2. The transference of the curves into three dimensions; that is, the making of the cast of the eye is still being studied. The practical problem has been solved, the photocast having been obtained, but the optic part must be confirmed.

3. Having obtained the cast of the eye, a perfect fitting contact lens must be made. This last phase of the problem has not yet been approached but it should be the easiest, because of the advances which have been made both in plastics and in the manufacture of lenses.

Conclusions

1. A new method of obtaining all the curves which make up the anterior segment of the eye based on the application of stereophotogrammetry to ophthalmology is presented.

2. It is absolutely necessary to powder the eye with a contrasting medium because of the transparency of the conjunctiva and cornea.

3. The results obtained have been better than were expected since the margin of error is only 0.017 mm.

4. This method should be of great value in the manufacture of contact lenses.

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THE OCULAR SYNDROME OF CATARACT AND PAPILLEDEMA IN THE MANIFEST FORM OF PARATHYROID DEFICIENCY*

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A white woman, aged 53 years, was referred because of failing vision. Her medical history previous to her 49th year was irrelevant. At that time she had undergone a thyroidectomy. Since the operation she had lost her hair, her skin was dry, and her nails were brittle. Her chief concern was her dimming vision. She said that she had been given calcium following the operation but she had not taken any for the past year.

Eye examination revealed vision to be: R.E., 20/200, corrected to 20/100; L.E., 20/50, corrected to 20/40. Diffuse posterior subcortical opacities were found in both lenses. The fundi were still discernible and appeared normal. The pupils were equal and reacted normally to light and accommodation. The extraocular muscle balance was normal. The visual fields were normal. There was a slight elevation of the intraocular pressure above the upper limit of normal.

Diagnosis. Because of the history and the presence of a cortical type of cataract, a tentative diagnosis of postoperative parathyroid deficiency was made. A calcium test showed 8.1 mg. per 100 cc. of blood. Miotics were prescribed, and the patient was returned to her physician, who was asked to make further tests to substantiate the diagnosis. In addition to the low calcium, positive Chvostek and Trousseau signs established the diagnosis of latent parathyroid deficiency.

During the three-year interval between the first examination and the cataract extraction, the lens opacities increased to maturity with loss of useful vision. The intraocular pressure fluctuated, apparently rising with the reduction of calcium and falling when the calcium returned to a normal level. At first, the impression was that the increased intraocular pressure was induced by a primary noninflammatory glaucoma. Later, a secondary type of glaucoma, the result of disturbances from the same causes which led to the development of the lenticular opacities, was thought most likely, due to the fact that the pressure fluctuated with the calcium-blood balance.

Cataract operations. The cataract was removed from the right eye by an intracapsular operation with no complications. The immediate convalescence was uneventful and a corrected vision of 20/30 was obtained within six weeks. After this time, the intraocular pressure began to cause steaming of the cornea. The tension was controlled by a cyclodialysis operation. Later, a keratoconjunctivitis produced a permanent opacity in the center of the cornea. This may have been a type of parathyroid lesion described by Leonard[9] or may have been the result of the corneal damage from the glaucoma or from the frequent tonometric instrumentation. The corrected vision was reduced to about 20/70 as a result of the complications. Throughout the postoperative period, the fundus appeared normal.

Four months later, the cataract was removed from the left eye. Just prior to this operation, the calcium level was determined and found at 8.6 mg. and raised to between 9 and 10 mg. per 100 cc. of blood. Again the operation, as with the right eye, was uncomplicated, and the hospital convalescence was uneventful until the ninth day, when the following episode occurred.

Complications. The patient, lying in bed, was heard to emit a loud, piercing scream and was found in a generalized convulsion lasting approximately four minutes. Dyspnea and cyanosis followed but disappeared within the hour, leaving the patient in a

* Presented at the 83rd annual meeting of the American Ophthalmological Association, Hot Springs, Virginia, June, 1947.

mentally confused state for the balance of the day.

This was the first that was known of any generalized or local spasm or convulsion. However, inquiry of the husband revealed the fact that there had been about six apparently similar seizures during the past five months but he had made light of them with his wife, as she was "too nervous as it was." He had not told his doctor. The family physician was aware of the attacks for the first time when told of the hospital convulsion. Shortly after returning home, the patient had several seizures, one of which was witnessed by the family doctor who likened it to that of idiopathic epilepsy.

Postoperative examination. Upon returning for the postoperative examination, the patient seemed quite confused, disturbed, and blind, save for poor light projection. Ophthalmoscopic examination revealed clear media but a papilledema of considerable amount with parapapillary venous engorgement without hemorrhages. Visual fields were markedly constricted, a small central area remaining. At first it was believed, because of the mental state of the patient, that the poor vision and constricted visual fields were exaggerated. But repeated examinations during the course of the ensuing week gave the same results. Papilledema was also found, although seen indistinctly in the right eye, with loss of sight and constricted fields. X-rays of the skull, orbit, and intracranial contents were normal.

Neurologic examination. The patient was referred to a neurologist. His first office examination was not conclusive enough for diagnosis and the patient was hospitalized for further study.

During the three weeks after the last cataract operation, the patient's behavior changed. Mental symptoms appeared, with nervousness, change of temperament, irritability, and irrational periods. During this time, several attacks of generalized convulsions were reported. During the 24 hours prior to hospital admission, there was continuous twitching of the entire body with spasms of fingers and toes, and generalized convulsions and involuntary defecation were reported. On the day of admission, the calcium was at 6.5 mg. and the phosphorus at 2.35 per 100 cc. of blood. The white blood count was 15,700, the red 4,220,000. All other laboratory tests were negative.

Outcome. Immediate improvement began with the administration of dihydrotachysterol and calcium lactate. Convulsions and twitching ceased after the first day. The mentality cleared. The visual fields improved and the papilledema, though still present, seemed at the end of the first week to be reduced. Vision in the left eye, at the end of the first week, had improved somewhat. There may still be further improvement, although some pallor of the disc has appeared.

Cataract of parathyroid deficiency

The cataract produced by parathyroid deficiency is of relative frequent occurrence and has been reported extensively and in detail by ophthalmologists who specifically have recorded normal fundi in many instances. The ocular syndrome of cataract and papilledema is rare, having been reported in the literature infrequently. Albrecht collected eight cases and added one of his own.[1] Barr and his co-workers reported two cases.[2] Leonard reported one case and referred to seven others.[9] Lillie reported a case having "optic neuritis and cataracts."[10] The patient whose history is herewith presented brings the total to 21 cases.

The probable reason for the rarity of papilledema in parathyroid deficiency is the fact that the severity required to produce this condition is seldom encountered. Perhaps it is occasionally overlooked.

Causes of parathyroid deficiency

There are several causes of parathyroid deficiency. Sufficient for the purpose of this presentation is the classification into idio-

pathic and postoperative types. The idiopathic type may be the result of lack of growth or degeneration of the glands. Intoxication may play an uncertain role. Infections, local or general, hemorrhage, and factors which may cause an inactivation of the products of the parathyroid glands may result in parathyroid priva.[15]

The exact action of the reduced functioning of the parathyroid glands upon the body structure, resulting in the varied symptoms, is unknown. There is an increase in the neuromuscular irritability which is reflected in both the somatic and visceral systems. The ectoderm, both somatic and neural, is affected. The condition exists in the latent and in the manifest stage and may occur in an acute, subacute, or chronic form.

Symptoms of latent stage

The latent stage shows symptoms of excitability only upon local nervous stimulation or irritation and is usually restricted to the muscle or muscles innervated by the nerve stimulated. This stimulation may be artificially induced, as is seen in the tests used for the purpose of diagnosis. It may also be the result of local irritation or inflammation, as is seen in the spasm of the eyelids and face and probable ciliary spasm following eye operations. The most common reaction is the spasm of the striated somatic musculature. Usually, with the latent stage, there is an involvement of the surface ectodermal structures.

Symptoms of manifest stage

The manifest stage is characterized by generalized spontaneous convulsions, possibly of central origin, in addition to the ectodermal changes and the symptoms of neuromuscular irritability which may appear spontaneously. The manifest stage also introduces the neuroectodermal symptoms: mental disturbances, increased intracranial pressure with papilledema, and increased cerebrospinal fluid pressure. The few autopsies performed upon these patients revealed the presence of generalized cerebral edema.[1, 11]

Diagnosis of parathyroid deficiency

The diagnosis of parathyroid deficiency in either latent or manifest forms is made through laboratory tests of the blood calcium and phosphorus and through signs of excessive neuromuscular irritability elicited through clinical tests and symptoms of ectodermal (both surface and neural) involvement.

The normal calcium content of the blood varies within the limits of 9 and 11 mg. per 100 cc. Usually, in latent tetany or parathyroid deficiency, the level is about 7 to 8; in manifest tetany from 4 to 6. The phosphorus content, which normally is between 2 to 4 mg. per 100 cc. of blood, is relatively or absolutely increased in proportion to the calcium content.

Clinical symptoms and tests

The usual tests made to determine the hyperneuromuscular excitability are:

1. Chvostek's sign, which shows the hyperexcitability of the muscles innervated by the facial nerve when it is tapped just anterior to the tragus of the ear above the condyloid process of the mandible (the point of injection for O'Brien's akinesia). The response is a momentary contraction of the facial muscles, including those of the eyelids.

2. Trousseau's sign (or phenomenon) is produced by pressure upon the brachial artery at the bend of the elbow, resulting in a contraction of the hand and fingers.

3. Erb's phenomenon is the result of neuromuscular response to a weaker galvanic current than is usually required to produce a normal reaction.

There are other tests and signs of lesser importance. The clinical symptoms are:

Ectodermal trophic changes resulting in alopecia, dry skin, brittle nails, ridged teeth, and cataract.[7]

Causes of lens changes

Authors differ as to the causes of lens changes. Some attribute them directly to tetanic convulsions with possible ciliary spasm. However, these lenticular changes have been seen in patients in which there have been no local or general spasms. Others attribute the lens opacities to the result of low calcium or lack of specific parathyroid secretion.[6]

The opacities usually begin as individual points in the cortex beneath the posterior (occasionally the anterior) capsule of the lens which develop into threads and riders, finally coalescing. A few crystal-like opacities of denser appearance may be present. In the idiopathic form, which may be seen in the young, possibly acquired congenitally, opacities may be seen deeper in the cortex, evidence of involvement during the developmental stages of the lens.[12]

These lenticular changes somewhat resemble, and therefore should be differentiated from, those produced in diabetes and other toxic conditions and from types of radiation, myxedema and other dermatogenic cataracts.

Neural symptoms

The neural (neuroectodermal) symptoms are:

1. Spasms which may be local or general. They may be induced for purposes of diagnosis. They may be the result of irritation or inflammation or they may be spontaneous, in which case they are usually found in the manifest stage.*
2. Sensory affections of tingling, boring, or numbness may be complained of.
3. Symptoms of irritability, headache, and dizziness may be present.
4. Convulsive seizures or epileptiform attacks occur.
5. Mental disturbances may be present with depression, dullness, and personality changes.
6. Symptoms pointing to hypothalamic affection have been reported.[16, 17]

Accompanying these symptoms indicative of cerebral involvement, increased intracranial pressure, as is evidenced by brain edema, papilledema, and increased cerebrospinal fluid pressure, is found.[1, 11]

X-ray films frequently show symmetrical shadows in the area of the basal ganglia. Blood vessels in the vicinity may at first be surrounded by colloid deposits which undergo calcification.[6]

Other symptoms of apparently lesser diagnostic importance, including extrinsic ocular muscular weakness and eyestrain, strabismus, nystagmus, and anisocoria, have been reported. Spasm of the ciliary muscle and iris is found. The smooth muscles innervated by the autonomic nerves are probably more frequently involved in tetany than is commonly appreciated.

Differential diagnosis

Differential diagnosis must be made from idiopathic epilepsy and brain tumor. The former may be the tentative diagnosis of the general practitioner who first sees the patient in convulsions. The latter may be the diagnosis of the neurologist who sees the patient's confused mental state, with convulsions and increased intracranial pressure as evidenced by papilledema and increased cerebrospinal fluid pressure.[1, 11] Perhaps, as there is rapid loss of vision along with swelling of the optic-nerve head, the ophthalmologist may consider optic neuritis along with papilledema in the ophthalmologic diagnosis.[10]

Conclusion

The reason for this presentation lies in my desire to recite my clinical experience and to review the pertinent literature of this con-

* A patient is recalled who, about two hours after cataract extraction, suffered extreme local pain with spasm of the facial muscles and of the eyelids and probable ciliary spasm with redness and profuse lacrimation, evidently as a result of irritation induced by the operation. She had undergone thyroid operation several years before and had developed tetany cataracts.

dition. If there is anything of worth to be gained from the report of this case, I believe it is revealed in the necessity of keeping all patients with parathyroid deficiency under constant surveillance in order to prevent the latent affection from becoming manifest.

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THE EXTRACTION OF CATARACT IN THE PRESENCE OF FLUID VITREOUS*

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Nearly all cataract surgeons have had experiences with the complication of fluid vitreous which has replaced the normal gel vitreous, but very few have recorded them. In some cases, the fluid vitreous remains behind the capsulozonular hyaloid barrier, while in others it is in free communication with the anterior chamber. There are means of recognizing both, although not in every case the latter, and the surgeon may be surprised to see fluid vitreous flow immediately after the section has been made. The profession in general is not aware of the possibilities of recognizing the condition before operation. I have had some gratifying and interesting experiences with such cases and have made some observations and speculation on the nature and cause of the condition and the method of handling the extraction of the cataract.

"When a dissolved state of the vitreous body exists, as it often does in old persons, the section of the cornea is perhaps no sooner made than the cataract, along with a greater or less quantity of the vitreous humor, bursts from the eye; or, the cataract sinking down behind the iris, a large quantity of vitreous humor alone bursts out. If the dissolution of the vitreous body be great, it will be evacuated wholly or in large quantity, and the eyeball may thus be destroyed, notwithstanding the utmost dexterity, delicacy, coolness, and circumspection on the part of the operator."[1]

Weeks[2] said that "in case of fluidity of the vitreous the tension of the eye may be reduced but it is not always so nor can we say that it is the rule. Such cases present complications when operative procedures necessitating the opening of the globe are undertaken."

Hundt[3] said that Peters had had a favorable outcome in a case of fluid vitreous from which he had removed a cataract. Peters assigned him to investigate the subject. I will quote Hundt at length. "The first information available on synchysis of the vitreous is the writings of the anatomists, Rosinius and Morgagni. The latter frequently found in post-mortem examinations that the vitreous had been completely replaced with a transparent fluid.

"Ophthalmologists such as Ammon, Himly and Wardrop added nothing new to this. An investigation of the subject was made by von Graefe who said that it was important to distinguish between a simple liquefaction of the vitreous and flocculent dissolution.

"Arlt, in his book (1856), divided fluid vitreous into five groups, the first in which the liquefaction followed mechanical injury to the vitreous, the second due to a drop in the pressure in the vessels of the interior of the eye. This he named *hydrops ex vacuo.* A third group of cases of fluid vitreous were observed associated with iritis, especially in the chronic cases. He noted that the vitreous liquefied more often in older people, whose lenses were either opaque or on the way to becoming so. He finally stressed especially the fact that eyes with high myopia and stretching of the posterior pole of the eye often had a fluid vitreous.

"In like manner do other older writers express themselves on fluid vitreous. Stellwag (1867) mentioned the occurrence of liquefaction following massive loss of vitreous. He divided fluid vitreous into (1) simple liquefaction without any solid particles and (2) a flocculent type in which the

* Presented at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947.

fluid contains degenerated products of inflammatory lesions, groups of cells, clots, pigment clumps, single or clumped cholesterol crystals, fat droplets, and so forth. Simple synchysis without preceding inflammatory processes is represented as a separate entity. He differentiated between liquefaction of the vitreous and separation of shrunken vitreous from the retina by serous exudate."

Hundt goes on to quote de Wecker, telling how he stressed "(1) chronic uveitis as a forerunner of fluid vitreous, (2) the liquefaction of the vitreous which follows direct injury to the vitreous by introduction of a foreign body and especially by *couching* of the lens, (3) senile degenerative changes accompanied by opacities in the vitreous, (4) poor nourishment of the tissues as related to diseased vitreous."

Fuchs was quoted as stating that the fluid which runs out in cataract surgery in such cases isn't always liquefied vitreous but may well be serous exudate which has accumulated between the retina and the vitreous. Fuchs also brings out the fact that operations in the latter cases may be followed by detachment of the retina and atrophy of the globe.

Von Michel is mentioned as having ascribed the cause of some cases to previous hemorrhage. Elschnig's study of fluid vitreous in myopes is mentioned with his conclusion that myopia can cause it but that the vitreous does not always liquefy in myopia. Behse studied 10 myopic eyes (up to 20D.) and found that in none of them was the vitreous normal. Seefelder found fluid vitreous in congenital hydrophthalmos. Naumoff stated that when the vitreous is fluid only in the center part one is suspicious that the change in consistency is recent. Hundt adds that the peripheral vitreous is normally firmer and would be the last to yield to liquefaction.

Hundt enumerates the significant sequels to fluid vitreous as follows: "(1) No effect on vision from fluid vitreous unless there are also floating particles which may be disturbing to the patient, (2) probably no effect on refractive index, (3) lens nutrition may suffer from chemical changes in the vitreous and a posterior cortical lens opacity may develop and this may or may not spread to the rest of the lens, (4) predisposes to dislocation of the lens, (5) fluid vitreous is of greatest significance when surgery is required, especially in cataract extraction."

Arlt is quoted as saying that you can expect a restoration of vision only if the loss of fluid vitreous is not more than one third of the total. Other authors, especially Czermak, are less conservative. Czermak attaches little significance to fluid vitreous. According to his experience the wound closes well and the globe soon resumes its normal volume. Also, according to Zehender, the eye from which fluid vitreous has been lost is less likely to have an inflammatory reaction after cataract extraction than eyes from which normal viscid vitreous has been lost.

Arlt is quoted as recommending that "In order to avoid loss of vitreous in patients with fluid vitreous they should be in bed when operated instead of sitting up. He added, however, that unfortunately it is seldom possible to establish in cataract patients a diagnosis of fluid vitreous. And, therefore, one will occasionally be surprised, at operation, by a total loss of the fluid vitreous which so radically alters the eye that restoration to its former shape seems doubtful, yet this is often very easy to achieve by filling the empty space with normal saline.

"The credit for the use of saline goes to Hermann Knapp who, in 1899, during a cataract extraction, noticing an unusually deep indentation of the cornea and subsequent infection, made the proposal that in such cases the anterior chamber be filled with physiologic saline in order to prevent infection while the anterior chamber was reforming. Since this method proved utterly harmless in another case of deeply indented

cornea after extraction, Knapp extended the recommendation for its use in cases where the globe collapsed completely after the corneal incision."

Hundt goes on: "It is noteworthy that this very worthwhile suggestion of Knapp's had very little attention; at least I found only two cases in the literature in which this method was used. Thus, Andrews reports that he succeeded in getting uneventful healing and good vision by injecting saline into an eye which had undergone severe loss of vitreous during the extraction of a traumatic cataract.

"Elschnig brought out this point again at a meeting in Heidelberg with a paper recommending in cases with vitreous opacities or hemorrhages treatment of partial withdrawal of the vitreous and replacement with physiologic saline.

"After Axenfeld had remembered that Knapp had recommended this procedure 10 years earlier, Elschnig reported that he, too, had had occasion to replace escaped vitreous with physiologic saline in a case of traumatic perforation of the globe with extensive loss of vitreous and retinal detachment. He reported that he obtained an excellent result."

Hundt goes on to report Peters' case: "It concerned a 65-year-old patient who, in addition to high myopia and a beginning cataract in one eye and a fully developed one in the other, also showed fluid vitreous. When the cataract incision was made, a large amount of entirely fluid vitreous flowed out, so that the sclera above showed a deep depression and the iris dropped back in a funnel-shaped position. The lens disappeared entirely so that the cornea's upper margin was dipping down perpendicularly. It was attempted to fill the globe with this saline. It was, however, impossible to overcome the deep groove in the sclera. The next day the shape of the globe was entirely normal and the anterior chamber was closed. Peters obtained a good result."

Elschnig[4] has reported that in 85 cases of highly myopic eyes intracapsular extraction was successful, 11 capsules ruptured but were extracted, that he was unable to grasp the capsule or that it had already ruptured in the anterior chamber in 18 cases. One eye was lost. "A comparison shows that in highly myopic eyes intracapsular extraction is much superior to extracapsular extraction in respect to all complications. In comparison with extraction in nonmyopic eyes, the danger of prolapse of the vitreous body is a little greater."

Meller[5] states that "Quite unavoidable is the prolapse of vitreous in the presence of complicated cataracts, when the zonule is ruptured or when the vitreous has lost its normal consistency."

Schoenberg[6] said that detachment of the vitreous is recognizable with the ophthalmoscope by the bright reflex in front of the retina. In some cases the vitreous shrinks and becomes detached, ordinarily at its posterior portion, while that part in contact with the ora serrata and ciliary body remains adherent.

Troncoso[7] said "Synchysis can be recognized more easily when the eye is rotated. There may be liquefaction of the vitreous with more or less complete destruction of the framework of fibers, and the appearance of adhering to the fibers or floating in the spaces between." Troncoso agrees with the classification of Bachstez of the lipid and nonlipid bodies moving in the vitreous as follows:

"(1) Bodies in the fluid vitreous: synchysis. (a) synchysis scintillans, (b) synchysis nivea or albescens; (2) Bodies in nonfluid vitreous: (a) asteroid hyalitis, (b) poorly defined flakes of unknown chemical nature."

Troncoso goes on: "*Synchysis scintillans.* This is a special degeneration of the vitreous which appears with the ophthalmoscope as a beautiful shower of sparkling gold particles rising with movement of the eye but sinking rapidly to the bottom. These glistening crystals consist of cholesterol (Clapp), and

appear sometimes in otherwise healthy eyes, especially in aged persons, without deterioration of the central vision. More frequently, however, they are signs of choroiditis occurring as the result of syphilis, arteriosclerosis, metabolic diseases, or trauma. The disease may appear in one or both eyes.

"*Synchysis niva or albescens.* The floating bodies appear as small, white, spherical opacities of a dull white color (Bachstez). They are probably leucine needles, tyrosine or phosphates.

"*Asteroid Opacities.* This is also a degenerative condition with deposits in the vitreous or numerous particles which, instead of being brilliant like the crystals, appear as small, spherical, isolated, white globules resembling snowballs (Holloway). Sometimes clusters of these balls may appear in the periphery. The white opacities are fixed, or move very slightly when the eyeball is rotated, as the vitreous is not liquefied. Benson gave this condition the name of *Asteroid hyalitis,* comparing the fundus picture to the sky studded with numerous stars. Verhoeff had the opportunity, in 1921, to examine chemically the snowball opacities and concluded that they consist chiefly of calcium soaps, calcium carbonate, and a certain amount of fatty or lipid substances. The source of the lipids seems to be, in part, the vitreous lipid. According to Krause, the lipid particles enter the vitreous from other tissues; it is probable that migratory leukocytes pass into the vitreous and die there, disintegrate and leave the lipids as inert particles floating in the vitreous."

Duke-Elder[8] said that "liquefaction of the vitreous body (Synchysis. Syn, together; Cheo, to pour) is the most common feature of degeneration, occurring in senile and myopic conditions and after contusions as well as in most degenerative and inflammatory states of the eye. It is due to a conversion of the colloid gel into a sol and is usually associated with the development of ophthalmoscopically visible opacities formed by the colloidal micellae which aggregate together in dustlike particles, strands or membranes. In a sense it is probably a dehydration rather than a hydration in so far as it represents the loss by the micellae of their water of absorption which becomes free intraocular fluid, leaving the protein residue shrunken and agglutinated. Such a breakdown may be due to purely physicochemical factors but may also be conditioned by enzymic digestion of the protein basis of the gel.

"Fluidity of the vitreous calls for no treatment; its clinical significance lies in the demonstration of degenerative changes in the eye, and in the possibility of serious complications occurring in intraocular operations, for in these eyes the zonule also is usually weak, and a dislocation of the lens and prolapse of the vitreous may easily occur."

The natural conclusion to be drawn from the last paragraph of Duke-Elder's statement is that there should be prophylaxis against luxation of a cataract when fluid vitreous is known to be present. It will be best judgment not to permit a cataract to become hypermature and risk luxation when it may be easily removed at a convenient time.

Arnold Knapp[9] said, "The question whether fluid vitreous is a contraindication is often raised. I am not convinced that this is a contraindication, if it is assumed that its presence can always be recognized beforehand."

Cataract in the presence of fluid vitreous

The presence of fluid vitreous (synchysis) in a case of cataract may therefore indicate the need for a special handling of the eye and use of a special operative technique for extraction of the cataract. The preliminary examination of the eyes before cataract surgery may disclose whether or not the vitreous is fluid instead of being in its normal gel or viscid state. It may be discovered that it is well contained behind the capsulo-

zonular hyaloid barrier or on the other hand it may be in communication with the anterior chamber.

Viscid and semiviscid vitreous

If, directly after the section has been made and the aqueous evacuated, it is observed that the anterior chamber has reformed, it is an indication that a rupture of the hyaloid capsulozonular barrier had preëxisted or had developed during the section and the viscid or semiviscid vitreous had moved forward into the anterior chamber. Even the normal cornea with normal elasticity will collapse somewhat upon evacuation of aqueous. Therefore, if the chamber has deepened and the corneal shape has been restored, the only inference is that as given above. A loop or spoon extraction of the cataract is probably the only resort, as the viscid or semiviscid vitreous will interfere with the grasp of the interior lens capsule by forceps or other device. In some cases of semiviscid vitreous approaching the semifluid stage it may be possible to clear it from the capsule with a suitable applicator but not so in cases of viscid vitreous.

The escape of fluid vitreous

The effect of loss or evacuation of the normal amount of aqueous humor upon cataract section is well known. There is no rapid reformation of aqueous and no continued loss evident in the average case. Therefore, if a continued loss occurs, if fluid seeps away and continues to seep away, flowing out in a thin stream from part or all of the incision, the only inference is that it is fluid vitreous that is escaping. The fluid may be colorless or it may be slightly straw-tinged.

Intracapsular extraction indicated

A condition of hypotony will exist which will make ineffective any manipulation requiring pressure over the globe. Intracapsular rather than capsulotomy extraction will be indicated and necessitate the use of traction, rotation, and under certain conditions direct rupture of the zonule by separating or stripping it from its attachment to the capsule of the lens for the removal of the cataract with the least effort, trauma, and danger.

In the latter group of cases of fluid vitreous it must be inferred that a dehiscence or hole or tear in the hyaloid capsulozonular barrier was present before the section was made or that the zonule being fragile it developed because of the relatively minor trauma of the fixation or of the section or because of the change of hydrostatic pressure inside the eye.

The normal hyaloid capsulozonular barrier

Embryology. The lens plaque arises in the embryo as a result of contact between optic vesicle and surface ectoderm. There develop protoplasmic adhesions between the cells of the primordial lens and the optic vesicle, later the optic cup. As the lens develops, these adhesions are stretched out to form the zonular fibers. The latter in the adult extend between the ora serrata, accounting for its serrated form, and the equatorial portion of the lens capsule, running in and forming the ciliary valleys with secondary fibrillar attachments to the ciliary processes. Mann[10] said, "The primary vitreous is added from retinal ectoderm. The fibrils of the zonule, or tertiary vitreous, arise later from the ciliary epithelium." I have found by microdissection of living chick embryos that strong adhesions which may well be the anlage of the zonular fibers exist at all times after the contact of optic vesicle and lens ectoderm. Further observations should be made on fresh human embryos by microdissection. I believe that as revealing differences will be found between fresh and fixed specimens of the zonule at the different stages of development as are evident in the examination of fresh and fixed preparations of the adult zonule and its lamella. At the time of development of the tertiary vitreous the zonular lamella may be added to the zonular fibers.

Anatomy. In the fresh normal human eye, the zonule consists of (a) an orderly array of fibers and (b) a thin interfibrillar lamella which in clinical surgery gives the zonule the appearance of a membrane. It is not a true membrane like Descemet's but it may well act, when normal, to prevent the passage of particulate bodies from the vitreous to the posterior aqueous chamber. It may have some semipermeable quality, although this is very dubious. It is probably like the vitreous and is a condensation between the zonular fibers. The lamella is of the same index of refraction as the aqueous and is not visible in the living human eye when surrounded by the normal fluids of the eye, as, for example, in colobomas, either congenital, traumatic, or surgical. The zonular fibers are visible under these conditions. The lamella becomes visible when magnified and exposed to the air as, for example, in the surgery for removal of cataract. It disappears during the preparation of stained microscopic specimens, thus leading to the confusion of descriptions of fresh and fixed specimens. The normal hyaloid, zonule, and the lens in its capsule constitute in effect a barrier between the vitreous and the aqueous chambers. The hyaloid enclosing the vitreous anteriorly is separated from the posterior lens capsule by a thin film of aqueous, while in the periphery there is a greater depth of aqueous between the hyaloid and the zonule. The normal vitreous is fluid in the small central region of the canal of Cloquet. The greater portion is normally viscid.

Pathology. In pathologic conditions of the eye, there may be (a) absence or disinsertion of the fibers of the zonule, resulting in luxation or subluxation of the lens. This picture is familiar in congenital, degenerative, and traumatic conditions. In such cases there may be viscid or fluid vitreous in the anterior chamber. In congenital conditions, disinsertion is at the ora and ciliary body, whereas in traumatic, degenerative, and surgical conditions it is at the insertion into the capsule. There may be degeneration and perforation of the zonular lamella and hyaloid but intact zonular fibers. In all of these conditions, particulate bodies from the degenerated vitreous may enter the anterior chamber. When, in addition to the fact that the vitreous is fluid in a case of cataract, there are signs that the hyaloid capsulozonular barrier is missing, perforated, or ruptured, the surgeon is forewarned and may well be prepared for escape of the fluid vitreous immediately after the section has been made. I have observed such cases before and after surgery.

Fluid vitreous well contained behind an intact hyaloid capsulozonular barrier. There are relatively more cases of fluid vitreous well contained behind the hyaloid capsulozonular barrier than those in which a communication of the fluid vitreous exists with the anterior chamber through dehiscences in the barrier. The latter may appear to be a form of low-grade uveitis, in which there is no congestion but in which pigmented and nonpigmented particulate matter circulates in the aqueous and is deposited on the endothelium. I had in such cases considered this material evidence of degeneration rather than of inflammation, but I had not linked up with the possibility of this particulate material coming from the region posterior to the capsulozonular barrier. There is need for the recognition and differentiation of such cases from uveitis due to infection and inflammation. In the group in which the hyaloid capsulozonular barrier is intact, one may find signs of degeneration the same as in the lesser group but there may be no floating debris in the aqueous.

Preoperative examination of the eyes. Preparation for any cataract surgery should include details of examination with the ophthalmoscope, slitlamp, microscope, and tonometer. In cases in which the lens opacity is sufficiently dense to preclude the possibility of direct examination of the vitreous, its condition may be inferred, although not always correctly, by examination of the pa-

tient's fellow eye. One particular lead is to look for signs of degeneration of tissue in all cases of cataract before surgery.

THE SIGNS OF OCULAR DEGENERATION

The absence of congestion. In cases of degeneration alone there will be no congestion of the vessels unless there is consequent inflammation. It is well known that necrosis of degeneration may set up an aseptic inflammation. Congestion of the eye from any cause is an important sign of bad omen in relation to cataract surgery.

Tonometry. The intraocular pressure as indicated with the aid of a reliable tonometer may, if low, and particularly if there is hypotony, indicate that degeneration and fluidity of the vitreous may be expected. The prognosis for successful healing of a very low-pressure eye after cataract extraction when the tension with the Schiøtz tonometer is less than 8 mm. Hg is not good, and surgery, therefore, may well be avoided if possible in such cases. If the hypotony is of lesser degree, between 8 and 12 mm., the condition is less grave but there is a definite indication for particular care in the avoidance of trauma as in all ocular surgery. It has been said that in such eyes the extracapsular operation is indicated, but comparative results show that these eyes do not heal gracefully in the presence of retained cortex which is slow in absorption and productive of irritation, inflammation, and after-cataract; whereas, in my experience, intracapsular extraction has produced gratifying results.

Ophthalmoscopy. Sufficiently strong light should be used with the ophthalmoscope to pierce the lens opacity, if at all possible, and various dioptric values used to detect movement of the vitreous on rotation of the globe, its rate, and the presence of vitreous opacities. The rate and degree of disorderly movement of particulate bodies or opacities in the vitreous indicates the degree of fluidity of the vitreous. It may be possible to demonstrate increased fluidity of the anterior or central vitreous while the posterior or peripheral vitreous remains viscid. The binocular ophthalmoscope is particularly useful in examination of the vitreous.

Biomicroscopy. 1. The vitreous and zonule. Monocular and binocular loupes and the slit-lamp microscope are useful in the examination of the anterior vitreous. The appearance of the magnified normal vitreous with its beautiful transparent curtains and folds, with its undulatory controlled movement on rotation of the globe is a familiar picture. In cases of degeneration, the normal structure will be absent, and in its place there will be observed opacities of various pigmented and nonpigmented forms, dots, strings, conglomerate nebulae, or constellations which the patient may perceive as certain figures or as a jumble of moving clouds which disturb the clarity of his vision. These the ophthalmologist may see moving and swirling in disorganized fashion much more rapidly than any single opacity or group of opacities in the gel state of the normal vitreous, the rapidity of movement being an index of and in proportion to the fluidification of the vitreous. The vitreous may be found to have degenerated from the normal viscid gel to a semiviscid, semifluid, or completely fluid state. Particular examination for the presence of degenerated vitreous mixed with the aqueous or in the anterior chamber should be made in all cases of iridodonesis and inequality of depth of the anterior chamber as indicative of subluxation of the lens. In such cases it is known that there is a dehiscence or break in the zonule. It is a familiar phenomenon in congenital and traumatic luxation or subluxation of the lens to see viscid gel vitreous in the anterior chamber or at the side of the lens. In cases of senile deterioration or degeneration of structure, a minor trauma may cause a break in the zonule and evidence of fluid vitreous mixed with the aqueous may be present. The zonule is known to be fragile in such cases, and it is inferred to be fragile in cases of fluid vitreous because of coinci-

dent degeneration of structure of somewhat similiar origin and nature.

2. The deposits on the endothelium of the cornea. Differentiation should be made between the deposits of inflammation and those of degeneration in cases in which dehiscences in the hyaloid and zonule permit continuity between the aqueous and the fluid vitreous. The typical mutton-fat deposits of inflammatory uveitis have been well described elsewhere and are well known. They bear no resemblance to the deposits found in cases of degeneration. These are fewer in number, are not greasy, are not in clumps, and they do not assume the typical triangular pattern of those of inflammatory origin. They apparently have less cohesive and adhesive equality and appear to be resting on the endothelium, not adherent to it.

3. Particulate bodies in the aqueous. Opacities resulting from degeneration found floating in the convection currents of the aqueous are similiar to the deposits on the endothelium. The plasma clot of acute uveitis is never found in the cases of moderate degrees of degeneration, but one should not mistake the particulate floating bodies of inflammatory uveitis for those of degeneration.

4. The aqueous beam. The aqueous beam exhibits slightly more relucency than normal in case of fluid vitreous in the anterior chamber indicating the slightly greater protein content of the aqueous because of the admixture of the fluid vitreous. In cases, however, in which the beam is in excess of slightly more relucent than normal there should be a grave suspicion that the case is more complicated than can be explained by the presence of fluid vitreous mixed with the aqueous. A moderately to greatly increased protein content of aqueous may point to important complications of serious detachment of the vitreous, uveitis, serous exudate, and detachment of the retina. The sign of increased relucency of the aqueous combined with hypotony with faulty light projection and color perception is of serious omen in establishing the prognosis of complicated cataract.

The form of the cataract. The form of complicated cataract, not always however associated with fluid vitreous, may be that of (a) the postcortical or saucer-shaped variety. It may have the iridescence described by Vogt and this may be a sign of a particular degeneration but the use of the term "complicated cataract" in this connection does not necessarily mean that useful vision cannot be obtained after removal of the cataract. The complication may be only in the lens, zonule, or vitreous and not particularly in the uvea, retina, or nerve. (b) The anterior and posterior subcapsular form, which may be regarded as a variety of the posterior-cortical. In some cases the number of lens globules and the pattern of the anterior opacity may be as great as that of the posterior. Cortical and nuclear haze develop sooner, the onset of intumescence is earlier, and the progress of development of the complete opalescent or dull gray white opacity of the lens is more rapid in the second form. Not all cataracts which develop rapid intumescence are complicated. During surgery the taut capsule of a swollen lens may be found to be rubbery, thick, and tough, or it may be very thin and fragile. The zonule may be resistant or fragile. The well-known forms of presenile and senile cataract, nuclear, corticonuclear, and cortical, immature, mature, and hypermature may all be associated with fluid vitreous and fragile zonules.

Other signs of degeneration. Other signs of coincident ocular degeneration should be looked for and evaluated as, for example, fragility of the conjunctiva, atrophy of the sclera, arcus senilis, dystrophy of the endothelium of the cornea, atrophy of the iris, and exfoliation of the most superficial lamella of the anterior lens capsule. An inference that may well be drawn in the presence of any sign of degeneration is that other structures of the eye may be degenerated. There may be in the presence of cataract, and any or all of the signs enumerated, sclerosis of the cells of the iridocorneal angle, fragility of the zonule, and fluid vitreous.

The recognition of fluid vitreous in communication with the aqueous before operation. The determination of fluid vitreous by ophthalmoscopy and biomicroscopy when the lens is sufficiently clear is relatively easy. It is also possible to recognize the condition of communication of fluid vitreous with the anterior chamber without evident subluxation of the lens and to differentiate it from uveitis due to inflammation. It must again be asserted that the process of degeneration may in itself produce inflammation, although this will usually be different than that engendered by infection, and it must be repeated that signs of severe or extensive degeneration with fluid vitreous, particularly with hypotony and increased aqueous flare, even though the light perception and projection are fairly accurate, must give a poor prognosis.

The Cause of Cataract, Fragility of Zonule, and Fluid Vitreous

The coincidence of cataract, fragility of zonule, and fluid vitreous connotes deterioration of the substance of the crystalline lens, zonule, and of the vitreous humor, and may be regarded as a dystrophy or degeneration dependent on faulty nutrition, abiotrophy and senescence of ocular tissues which may be local or part of a general condition, hemorrhage into the vitreous, myopia, trauma, inflammation, and detachment of the retina.

1. Faulty nutrition. The lens, zonule, and vitreous may suffer from faulty nutrition because of degeneration of ciliary body and the production of poor-quality aqueous. The proper utilization of vitamins, proteins, fats, carbohydrates, and minerals is important in the maintenance of nutrition, health, and transparency of the lens, zonule, and vitreous. Faulty blood supply to the eye, particularly to the ciliary body, may produce faulty nutrition of the lens, zonule, and vitreous and consequent cataract, fragility of zonule, and fluidification of the vitreous.

2. Abiotrophy and senescence. Abiotrophy and local senescence of tissue may be a factor in the development of cataract, fragility of zonule, and fluid vitreous. The span of life and function of these tissues of ectodermal origin may be less than that of the rest of the eye or body and thus be the reason for their earlier deterioration. Other examples of abiotrophy in the eye, such as the degeneration of the pigmented and nonpigmented cells of the posterior surface of the iris and of the ciliary body in certain cases of glaucoma, of the pigment epithelium of the retina and of the choroidal blood vessels in retinitis pigmentosa, may be cited. The eye and its tissues share in the process of general senescence. A large percentage of all elderly persons have some signs of cataract and degeneration of lens capsule and zonule, but relatively few develop fluid vitreous.

3. Hemorrhage. Hemorrhage into the vitreous may be a cause or an accompaniment of the degeneration of the vitreous.

4. High myopia. Progressive myopia leading to the higher degrees of myopia, although it may be caused by a number of factors, may in some instances be regarded as a dystrophy or degeneration in which the lens, zonule, and vitreous suffer. From the mechanical viewpoint, the self-limited vitreous gel sufficient to fill a normal eye is incapable of expanding to the size of the highly myopic eye. The balance of the space is filled with fluid. The remaining gel may tend to liquefy so that the whole may eventually become fluid. Fluid vitreous may well be expected in all cases of high myopia, although as shown in Elschnig's and in my series of cases the vitreous may be retained behind an intact hyaloid and be no contraindication to intracapsular extraction.

5. Trauma. Contusion trauma sufficient to rupture the normal zonule from its attachment to the lens capsule must be relatively great. It is remarkable that the eye as a whole can stand such injury. If the lens is luxated into the vitreous by trauma it may act either with its capsule ruptured or intact as a foreign body and, in addition to its potentialties of exciting aseptic inflammation, may cause degeneration of tissue and fluidification of the vitreous. Even without

gross rupture of the globe, contusion trauma may produce degeneration of the ciliary body, hypotony, cataract, and fluid vitreous.

6. Inflammation—Uveitis due to infection. Any case of uveitis, particularly of cyclitis and choroiditis, may develop cataract and fluid vitreous as a complication or consequence of the inflammation. All cases of cataract should be examined with magnification to determine whether or not there are signs of causative or complicating uveitis. Excluding the active congestive states of acute uveitis, one should look for the insidious quiet cases which may show (1) a few typical mutton-fat deposits on the endothelium of the cornea, (2) particulate bodies either floating in the aqueous or fixed in a plasma clot in the anterior chamber, (3) increased relucency of the aqueous, (4) ciliary congestion, (5) posterior-cortical form of cataract, (6) opacities in the vitreous, and (7) signs of coincident or consequent degeneration.

If degeneration of the lens, vitreous, and uvea develops rapidly or extensively, there may be engendered an inflammatory reaction because of the nature of the toxic necrotic material which must be absorbed and in the process proves irritating to the uvea. Such a reaction may be entirely similar to that produced by an infection to which the uveal tissues may have become sensitized.

7. Detachment of the retina. When detachment of the retina first develops, the vitreous may be quite normal and viscid. If the detachment exists for a length of time or becomes extensive, degeneration and liquefaction of the vitreous will ensue. Hence, it is of particular importance in each case of cataract and fluid vitreous to exclude detachment of the retina by objective examination and by subjective tests before surgery. On the other hand, if detachment of the retina does not exist at the time of surgery it has been my experience in this series, except in one case, that it has not developed after the extraction of the cataract even when the fluid vitreous has escaped and later been replaced by normal saline or by natural restoration of intraocular fluid.

Indications and prognosis in cases of cataract and fluid vitreous. Degeneration of the normal gel viscid vitreous at the time of cataract surgery may have caused it to become semiviscid, semifluid, or completely fluid. Degeneration of the lens, zonule, and vitreous does not necessarily indicate an accompanying degeneration of the retina, nerve, and uvea. Eyes in which the latter is not present and from which the cataract has been removed may heal well after surgery and maintain good function, central form and color and peripheral field vision for years afterward. They seem to do so well after the indicated nontraumatic intracapsular cataract extraction that it may be judged that the cataract had been liberating toxic bodies, freedom from which has a salutary influence.

I believe that extracapsular extraction is contraindicated in such cases because it has been common experience that cortical remnants do not absorb gracefully when mixed with vitreous, normal or in any stage of degeneration. The cataract may be removed fairly easily in the capsule because of the fragility of the zonule. Minor subluxations do not alter the prognosis. Complete luxation into the anterior chamber or into the fluid vitreous complicates the condition. When fluid vitreous is recognized, the cataract should be removed before hypermaturity makes probable the development of complete luxation. One should not be deceived in the interpretation of signs of degeneration or inflammation and give a good prognosis when other serious complications are present.

The disaster of the loss of viscid vitreous. Nothing that is said in this paper should be taken to minify the bad effects of the loss of normal viscid vitreous in cataract surgery. Eyes in which normal viscid vitreous is extruded may be lost through infection, uveitis, through faulty healing, or by detachment of the retina. More such eyes are lost when the

hyaloid ruptures inside the eye than when the hyaloid remains intact but incarcerated in the healed incision. Disaster usually attends the rupture of the hyaloid and extrusion of viscid gel vitreous into the anterior chamber or actual loss and incarceration of the fibrillae. The methods of prevention or of successfully dealing with this complication when it is imminent or when it has actually happened have not been developed. This is one of the real problems of the future in cataract surgery.

The removal of cataract in the presence of fluid vitreous

The recognition of fluid vitreous before operation, whether apparently well contained behind the hyaloid capsulozonular barrier or in communication with the anterior chamber, need not deter the surgeon from removing the cataract whether it be completely luxated, partially subluxated, or with the lens in proper position. I have several private communications from surgeons who abandoned the operation after the section had been completed and fluid vitreous found. It is technically possible to remove such lenses best in their capsules without undue trauma and to have good visual results, provided the functional tests of the eyes are good before the operation and there are no other insurmountable local or general complications.

1. The removal of cataract luxated into the anterior chamber in the presence of fluid vitreous. If the cataract is found in the anterior chamber, preplaced sutures and a small limbus incision enlarged by scissors, avoiding injury to the lens capsule, may allow the lens to escape. If not, a loop or forceps may be used to remove it. If the cataract has been in the anterior chamber for some time and adhesions have formed with development of increased intraocular pressure, the problem is greater and more unsatisfactory in its solution.

2. The removal of cataract completely luxated into fluid vitreous. In the presence of fluid vitreous a completely luxated cataract may be found floating about with the motion of the eye, settling down when the eye is quiet, and tending to become adherent to the retina or ciliary body. A cataract completely luxated into the vitreous may or may not be readily detected and localized. Ophthalmoscopy and direct observation with the aid of the Hildreth or Hague ultraviolet lamps, which with a filter utilize the natural fluorescence of the lens tissue for its visual demonstration, may help. If the cataract is adherent to the ciliary body, it may not be visible.

Luxated lenses are said to float up and forward directly after the incision has been made, thus obviating any necessity of fishing for them, but this behavior only applies to cases in which viscid or gel vitreous is back of the subluxated lens. As soon as the section is made, such viscid vitreous itself moves forward, bringing the lens with it. If the lens is freely movable in fluid vitreous, the effect of having the patient lie prone on the abdomen and with dilatation of the pupil, trying to coax the cataract into the anterior chamber, imprison it there by the use of miotics contracting the pupil, from which it may be more easily removed. By experience, however, it is known that it is difficult to keep the lens in the anterior chamber during the steps preceding the extraction.

If the luxated cataract cannot be gotten into the anterior chamber, I would recommend that the surgeon should not fish around blindly with a spoon or loop for the cataract or lift it off the retina, on which it may have settled. This may be productive of severe reaction and probable loss of the eye. A floating lens may be carefully picked up on a loop and removed.

There are two very ingenious methods which have been described in which success has been achieved in the removal of luxated cataracts from fluid vitreous: (1) the technique reported by Verhoeff,[11] who described how he made the incision, lifted the corneal flap, directed a stream of saline into the fluid

vitreous, causing the loose lens to float up from the retina into a position from which it could be removed and (2) the method of Bracken,[12] who inserted corneoscleral sutures, made the incision, then had the table elevated, the specially robed and draped patient turned over from the supine to the prone position, so that the lens dropped into the anterior chamber from which it was easily removed with a loop. It need not be assumed that all of the fluid vitreous would run out under such conditions. Saline may be used to replace some of the fluid vitreous which escapes after the patient has been returned to the supine position. Then the toilet of the operation may be completed.

3. The removal of subluxated cataract in the presence of fluid vitreous. If it is known beforehand that the lens is partially subluxated and that fluid vitreous is in communication with the anterior chamber, then sutures may be placed before or after the section has been made, a loop passed through the opening in the zonule behind the lens to support it, bringing it forward and removing it if the zonule is very fragile. If the remainder of the zonule displays any resistance, I believe it best not to use traction alone with the loop to remove the cataract, but, having lifted it up into position, to grasp the anterior capsule with forceps and then slip the loop around the zonule to rupture it directly by separating or stripping it from the capsule, thus freeing the lens for nontraumatic delivery.

4. The removal of cataract in the presence of fluid vitreous when the zonule is intact and the lens is in normal position. Preparation for surgery. The usual preoperative preparations of sedatives, cultures, atraumatic cleansing of the field, asepsis, and so forth, are all indicated. Local anesthesia is employed by instillation, and by injection, avoiding retrobulbar injection except in patients who have good blood vessels. Intravenous anesthesia in the hands of some, and with selected patients, may have very desirable features, but it is not without complications and dangers. Complete akinesia is desirable and if the patient is not confident and relaxed, various delays or changes with the addition of more sedatives may be resorted to until he is quiet.

Incision. A speculum, such as the Lancaster smooth, solid blade properly supported by an assistant, is preferred to lid sutures or metal retractors. Lateral canthotomy is done if there is any lid pressure upon the globe. Fixation is taken lightly on the medial rectus tendon. A narrow point of fixation is preferred to a broad one. The conjunctiva may be severed from the upper limbus by peritomy so that there will be no flap to interfere with the manipulations of extraction or the firm closure of the corneoscleral incision. A beveled corneoscleral section with a narrow conjunctival flap is made with the Graefe knife from about one quarter to one third of the circumference of the limbus. It is enlarged with the scissors on each side to two fifths, usually to one half, of the limbus circumference according to the size of the cataract, care being taken not to buckle the tissues or to cause pressure during any maneuver.

Sutures. If preplaced sutures are indicated, I prefer the Suarez de Mendoza[13] or the McLean[14] type. I have found by experience that corneoscleral sutures may be efficiently placed after the section, except in cases of presentation, prolapse, or loss of viscid vitreous. As previously described, three accurately placed radial appositional atraumatic 5-0 black silk sutures are inserted with a small, sharp-cutting 3/8 curve needle, using a standard Kalt needle holder and special forceps designed for the purpose. The central of the three sutures is at first passed through only the outer half of the corneal edge and is used for traction and direct exposure of the iris and lens. It is completed and passed through the outer half of the scleral edge after the extraction of the lens. The ease of insertion of such sutures with proper instruments, the airtight or watertight quality of the anterior chamber

produced by the proper apposition of incision edges after such suturing, the retention of saline or air which may be injected into the anterior chamber after the extraction have made the use of radial appositional sutures valuable in the presence of fluid vitreous. The loose conjunctiva is sutured separately after the corneoscleral sutures have been tied.

Intraocular pressure after corneoscleral section. Immediately after the corneoscleral section has been made in the average eye for the removal of cataract, the intraocular pressure drops to that of the surrounding atmosphere, unless there is present increased intravitreous, uveal, or retrobulbar pressure. The eye retains its contour, particularly if the sclera and cornea have their normal tissue resiliency, elasticity, and structure. The surgeon may feel assured if he notes a little dimpling or falling in of the cornea, denoting the fact that the cataract, vitreous, and uvea are remaining in their normal positions and that the eye will behave well under the manipulations of cataract extraction.

When, however, after the corneoscleral section, the aqueous has escaped and fluid vitreous seeps out and continues to flow away in a thin stream, and the globe appears to collapse somewhat, the lens and iris falling to a deep posterior position, then the surgeon may well show concern because of the evident hypotony and difficulty of extraction of the cataract, particularly in a case in which the condition was not diagnosed before operation. Such a state is not the dreaded complication of the lens becoming completely luxated and falling deep or out of sight into the vitreous, but it may be possible for this to occur through injudicious handling of the case, as, for example, by an attempted loop extraction, passing the instrument through a portion of the zonule which is intact. Certainly pressure upon the exterior of the globe for intra- or extracapsular extraction in this predicament is inadvisable, inefficient, and contraindicated for removal of the cataract because of the evident hypotony, the impossibility of rupturing the zonule by pressure, or of expressing the lens nucleus if the capsule has been opened, and the evident escape of more fluid vitreous with each pressure manipulation.

The handling of the iris. The criteria used previously for the handling of the iris apply to cases of cataract with fluid vitreous. If the pupil will dilate to but 4 mm., a complete iridectomy is necessary. If it will dilate to 5 mm., a small cataract may be removed through the round pupil. If to 6 mm., the removal of any size cataract through the round pupil is feasible. Peripheral iridotomies, two in number and placed between the central and lateral sutures, are desirable.

The experience of distortion of the pupil, drawing up of the iris and ciliary body by a mass of viscid vitreous or by strands of semiviscid vitreous does not apply to cases of fluid vitreous. The pupil and iris may be as free and perfect as after an uncomplicated case in which the hyaloid remained intact and in normal position.

The removal of cataract in the presence of fluid vitreous. A redescription of the maneuvers used in my system of intracapsular cataract surgery[15] seems desirable in this paper. If the fluid vitreous is well contained behind an intact hyaloid, all of the procedures may well be applied although one should be cautious of the use of any pressure on the globe. The condition of the eye in which fluid vitreous has seeped away immediately after the section makes it evident that pressure should not be used even for a preliminary test of conditions. The tension is very low and the resistance found in the average case with intact vitreous and hyaloid is not present. The iris and the lens or cataract fall well back into the eye. The lifting or elevation of the corneal flap permits the surgeon to assay the conditions present. My experience has shown that I may reach in with a suitable intracapsular forceps, place it ever so lightly on the capsule, close the forceps to the stop which prevents too firm a closing, get a proper grasp of a sufficient

portion of the capsule, preferably just anterior to the superior equator of the lens, and lift the lens to the level of the open incision where I can manipulate it. I need not fear loss of viscid vitreous for there may be none or, if there is any, it may be well back in the posterior portion of the eye. I can calmly make traction to one side, putting the zonule under tension, and, with a blunt instrument such as the loop or the elbow of the lens expressor hook, separate or strip off a small area of zonule to start the process of direct rupture of the zonule. Further rotation may tear the hole in the zonule larger, or I may use the blunt instrument more to separate the zonule farther. When more than 120 degrees of zonule have been removed, the balance may be torn circumferentially by rotation first to one side, then to the other, and the lens wheeled out to one side or the other. If need be, the grasp of the forceps may be released and reapplied or a second pair of forceps may be applied to provide further rotation.

If subluxation of the lens is present before the incision is made or if it develops because of manipulations in such an eye in which the vitreous is fluid and the zonule fragile, then it may not be safe or feasible to place the forceps on the lens capsule. I have in such cases placed a wire loop behind the lens, introducing it advisedly through the area in which the zonule is already missing or ruptured rather than going through the typical textbook manipulations of the introduction of the loop from above, endangering, in a case in which the upper portion of the zonule is the only intact part, complete luxation and a more difficult task of removal of the lens. When once the loop has been placed behind the lens, it may easily be removed by direct traction with the loop if the zonule is fragile, but if not, the loop should be used first to bring the lens forward and support it, while the corneal flap is elevated and forceps applied to the lens capsule. Then, with the forceps holding the lens, the loop may be used for direct rupture of the zonule by separating or stripping it from the capsule to provide easy delivery.

I would not advise the use of a barbed vectis for direct traction under any conditions. The experience of some in using a flat or shallow concave spoon as a sliding plane, holding it still while pressure through the cornea causes the lens to slide up and out, has met with success except when the zonule is resistant. The use of the suction cup or erisophake does not seem advisable if there would result aspiration of the intervening fluid vitreous before the lens capsule is engaged.

Direct rupture of the zonule by separating or stripping it from the capsule has been previously reported as a feasible, desirable, efficient, and conservative procedure in cases in which the zonule has proved to be more elastic, resilient, and resistant than that found in the average cataract case, and in which an average or safe amount of pressure, traction, and rotation has failed to deliver the cataract. The further application of these principles and maneuvers to cases of cataract in the presence of fluid vitreous was a natural one. It was definitely indicated because of the inadvisability of using pressure, the futility, faulty judgment, inefficiency, and even hazard of pressure or traction alone if they be applied in such a case. Experience with its application in these complicated cases has been gratifying.

Toilet of the incision and completion of the operation. If the iris is not caught between the edges of the incision, the iris repositor need not be used. The lateral sutures are tied with three square reversed loops. Then the central suture is completed and tied.

Transplantation or replacement of vitreous. It has not seemed nor been found necessary to replace the fluid vitreous, which has escaped, by transplantation of vitreous or replacement with fluid other than normal saline, which was used in relatively few of the cases.

A suture is placed between the skin of the

upper and lower eyelids to splint them and to be sure that the eye is kept closed. Physostigmine sulfate (½ to 1 percent) in aqueous solution is instilled. A single or double eye dressing and mask is applied, according to the behavior and coöperation of the patient. Atropine-sulfate solution is used at the first and subsequent dressings as indicated.

The vitreous after intracapsular cataract extraction. After removal of a cataract in the capsule in the otherwise normal case with gel vitreous, the latter may be seen delimited from the aqueous by the hyaloid. It may be on a plane posterior to the iris, protruding slightly through the pupil or prolapsed into the anterior chamber.

The prolapse and loss or incarceration of normal gel vitreous will usually result in an updrawn pupil, even more so when an iridectomy has not been performed, and the incarceration of the hyaloid and of the vitreous fibrillae in the healed incision. The complications attendant upon such an event have been described.

In cases of semiviscid vitreous, there may be found isolated strings of vitreous substance, one or more of which may become incarcerated. After removal of cataract from cases of fluid vitreous, there may be no gel vitreous to be seen, only fluid similar in all respects to that of the anterior chamber.

In addition to the cases in which there are manifest evidences of dehiscences in the hyaloid and zonule before the section is made, there are those of known fluid vitreous often in high myopia in which during and after the procedure of extraction the hyaloid has not been ruptured and has remained intact, still containing the fluid vitreous.

Opinions concerning the handling of such cases vary much. Some say that preliminary iridectomy and capsulotomy and removal of the lens nucleus and cortex by expression are indicated. One illustrative case of recurrence of secondary membranes (Case 4, L. B. in Series 1) after extracapsular extraction is given to illustrate one of the complications. Discission of such membranes as found necessary in many cases of extracapsular extraction produces the communication between the fluid vitreous and the anterior chamber which it was the purpose of the procedure to avoid. My experience has shown that such eyes react well to intracapsular extraction with emphasis on traction and rotation for the delivery rather than pressure in the eye that usually has low tension. If the cataract does not come away easily with traction and rotation then direct rupture by separation or stripping of the exposed zonule has served a very useful purpose.

Case reports

Series 1

Case 1. C. E. A., a white woman, aged 68 years, was an artist. She had been myopic since the age of nine years. Vision was: O.D., with a −17D. sph. = 1/6; O.S., with a −21D. sph. = 1/10. The cataracts were corticonuclear. The vitreous was fluid with opacities. The fundi showed large areas of myopic degeneration and posterior staphyloma, particularly in the left eye. Intraocular pressure measured: O.U., 16 mm. Hg (Schiøtz). On January 10, 1944, an intracapsular extraction with iridectomy was performed on the left eye without any presentation of vitreous. On April 27, 1944, vision was: O.S., +4.25D. sph. ⊂ +1.50D. cyl. ax. 155° = 4/6. The same operation was performed on the right eye on November 14, 1944. On January 23, 1945, vision was: O.D., +3.75D. sph. ⊂ +1.25D. cyl. ax. 25° = 3/6; O.S., +4D. sph. ⊂ +1.25D. cyl. ax. 170° = 4/6. One year later, a macular, retinal hemorrhage developed in the right eye which reduced the central vision to 2/6.

Case 2. C. H., a white woman, aged 70 years, was a nurse. She had been myopic in her right eye and worn glasses since the age of 34 years. On October 16, 1944, vision was: O.D., −6D. sph. = 4/6; O.S., −4D. sph. = 3/100. A partial cataract was present in the right eye. The fundus of the left eye could not be visualized and there was a partially complete cataract. An intracapsular extraction through a round pupil was performed on the left eye. On December 28, 1944, vision was: O.S., +12.5D. sph. ⊂ +3D. cyl. ax. 30° = 4/6. There was further development of the lens opacity in the right eye, and the same operation was performed on this eye on March 12, 1945. On April 12, 1945, vision was: O.D., +8.5D. sph. ⊂ +2D. cyl. ax. = 3/6. On May 21, 1945, vision was: O.D., +7.5D. sph. ⊂ +2D. cyl. ax. 140° = 3/6; O.S., +12D. sph. ⊂ +2.50D. cyl. ax. 32° = 4/6.

Case 3. C. H., an actor, aged 66 years, had, on September 28, 1942, lost the sight of his left eye through inflammation, detached retina, and glau-

TABLE 1

SUMMARY OF REPORT OF CASES OF FLUID VITREOUS WITHOUT ESCAPE AT TIME OF SURGERY FOR REMOVAL OF CATARACT*

Case	Name	Age	Tension	Refraction Before Operation	Eye	Refraction After Operation	Vision	Pupil
1.	C. E. A.	68	16	−17.00	O.D.	+3.75 +1.25 ax. 25	2/6	Coloboma
	C. E. A.	68	16	−21.00	O.S.	+4.25 +1.50 ax. 155	4/6	Coloboma
2.	C. H.	70	14	−6.00	O.D.	+7.50 +2.00 ax. 140	3/6	Round
	C. H.	70	14	−4.00	O.S.	+12.00 +2.50 ax. 32	4/6	Round
3.	C. H.	66	18	−4.50 −2.50 ax. 20	O.D.	+8.00 +1.50 ax. 100	6/6	Anterior synechia superior nasal
4.	L. B.	70	12	−16.00 (Capsulotomy O.U. in 10 yrs.)	O.D.	−1.50 +3.50 ax. 20	3/6	Coloboma
	L. B.	70	12	−21.00 (3 discissions O.U. in 10 yrs.)	O.S.	−3.50 +4.50 ax. 20	3/6	Coloboma
5.	A. L. B.	57	16	Unsatisfactory	O.D.	+10.00	5/6	Coloboma
6.	G. B.	64	—	−10.00	O.D.	+2.50 +2.75 ax. 175	4/6	Round
	G. B.	64	—	−10.00	O.S.	+4.00 +2.50 ax. 150	4/6	Round
7.	G. L. H.	45	12	−14.00 −5.00 ax. 165	O.D.	−1.00 ax. 135	2/6	Round
	G. L. H.	45	12	−13.00 −4.00 ax. 165	O.S.	+1.50 +2.50 ax. 180	4/6	Round
8.	C. F.	60	7	−25.00 −.50 ax. 180	O.D.	−2.25 +3.25° ax. 160	3/6	Round
	C. F.	60	7	−19.00 −1.00 ax. 105	O.S.	+.50 −4.00° ax. 55	1/6	Round
9.	G. B.	71	10	−18.00	O.D.	−1.00 −2.00 ax. 95	1/10	Round
	G. B.	71	10	−20.00	O.S.	−1.50 +3.50 ax. 25	1/10	Round
10.	B. C.	53	18	−13.00 −7.00 ax. 175	O.D.	+2.25 +1.25 ax. 110	4/6	Round
	B. C.	53	18	−8.50 −4.50 ax. 165	O.S.	+2.00 ±4.50 ax. 155	2/6	Round
11.	M. F.	66	14	−19.00 −1.00 ax. 180	O.D.	+3.50 +3.25 ax. 15	3/6	Round
	M. F.	66	14	−20.00 −1.50 ax. 165	O.S.	—	—	—
12.	A. F.	68	8	−14.00	O.S.	−4.00	2/20	Round

* Twelve cases reported, 20 eyes operated upon. Ages 45 to 70 years. Tension from 7 to 18 mm. Hg Schiøtz. Nearly all myopic Postoperative acceptance in proportion to previous axial and lenticular myopia. Vision obtained from 1/10 to 7/6. Three patients had 1/10, 1 had 1/6, 2 had 2/6, 3 had 3/6, 7 had 4/6, 1 had 5/6, and 1 had 6/6. One developed anterior synechia and glaucoma and glaucoma controlled by miotics. Most of the cases had areas of degeneration of choroid and retina. In no instance did detachment of the retina develop.

coma. There was no light perception. Vision in the right eye was: −4.5D. sph. ⊂ −2.5D. cyl. ax. 20° = 1/6. Tension of the right eye measured 18 mm. Hg (Schiøtz). On November 10, 1942, an intracapsular extraction with peripheral iridotomy was performed on the right eye without any presentation of vitreous. During convalescence, due to the strain of vomiting, peripheral anterior synechia developed superior nasally over one sixth of the angle circumference. On December 11, 1942, vision was: O.D., +10D. sph. ⊂ +0.5D. cyl. ax. 95° = 4/6. On December 12, 1942, there was a transient attack of glaucoma with tension measuring 50 mm. Hg (Schiøtz). The attack subsided under treatment with pilocarpine and mecholyl. On December 19, 1942, vision was: O.D., +8D. sph. ⊂ +1.5D. cyl. ax. 100° = 6/6. Tension was normal. Vision was the same on November 20, 1946.

Case 4. L. B., a white woman, aged 70 years, was an artist. Vision was: O.D., −16D. sph. = 2/100; O.S., −21D. sph. = 1/8. Intraocular pressure was: O.U., 12 mm. Hg (Schiøtz). On May 22, 1935, a capsulotomy extraction with iridectomy was performed on the right eye. On November 13, 1935, vision was O.D., +1.0D. sph. ⊂ +4D. cyl. ax. 20° = 1/10. Discission of after-cataract of the right eye was done on November 26, 1935. A capsulotomy extraction with iridectomy was performed on the left eye on December 2, 1935. On March 13, 1936, vision was: O.D., −1.5D. sph. ⊂ +3.5D. cyl. ax. 20° = 3/6. On January 2, 1938, vision was: O.D., with the same acceptance, 1/6; O.S., with the same acceptance, 5/100. Discission was performed on both eyes and, on June 2, 1944, was repeated because of reformation of after-cataract. With the same acceptance, vision in each eye was 4/6. Semifluid vitreous with opacities could be seen through the discission openings.

Case 5. A. L. B., a white man, aged 57 years, a broker, was first seen on October 19, 1944. He had had uveitis in both eyes for years. This condition had been treated with old tuberculin by the oculist who referred him for surgery. Vision in the right eye was hand movements with good light projection and perception of colored light. Vision in the left eye was 1/6 with a +1.5D. sph. ⊂ −3.5D. cyl. ax. 155°. There was a corticonuclear cataract in the right eye, and a partial cataract in the left eye. Intraocular pressure was: R.E., 20 mm. Hg (Schiøtz); L.E., 16 mm. Hg. An intracapsular extraction with peripheral iridectomy and no escape of vitreous was performed on November 20, 1944. On December 21, 1945, vision in the right eye was 1/6 with a +10D. sph. and there were many large opacities in the fluid vitreous. On March 15, 1945, vision in the right eye was 3/6, with a +10.5D. sph. ⊂ +0.75D. cyl. ax. 135°. On June 27, 1945, the vitreous of the right eye was quite clear, and vision with the same acceptance was 3/6+. The vision of the left eye has become quite poor through further development of lens opacities. Intraocular pressure was: O.D., 16 mm. Hg (Schiøtz); O.S., 18 mm. Hg. Late in 1946, vision in the right eye had improved to 5/6, and the same operative procedure was used for the left eye with equally promising results.

Case 6. G. B., a white woman, aged 64 years, was a housewife. When she was first seen on June

12, 1937, she stated that she had always been myopic. Vision was: O.D., —10D. sph. = 1/6; O.S., —10D. sph. = 3/6. Interior fluid vitreous was present, and there was a myopic fundus. An intracapsular extraction with peripheral iridotomy was performed on the right eye on September 14, 1937. On October 5, 1937, vision was: O.D., +3D. sph. ⊂ +2.5D. cyl. ax. 150° = 2/6; and on October 29, 1937, vision in this same eye was 4/6— with a +2.75D. sph. ⊂ +2.75D. cyl. ax. 175°. Vision in the left eye, with acceptance, was 1/6. On November 8, 1937, the same operation was performed on the left eye. On December 16, 1937, vision was: O.D., +2.5D. sph. ⊂ +2.75D. cyl. ax. 175° = 4/6; O.S., +4D. sph. ⊂ +2.5D. cyl. ax. 150° = 4/6.

Case 7. G. L. H., a white woman, aged 45 years, was a secretary who had always been myopic. When first seen on February 3, 1947, there were old, interstitial corneal opacities; cause not determined. There were partial lens opacities in each eye. Vision was: O.D., —14D. sph. ⊂ —5D. cyl. ax. 165° = 1/6; O.S., —13D. sph. ⊂ —4D. cyl. ax. 165° = 2/6. Semifluid vitreous was present. The fundi could not be visualized well, but no areas of degeneration were seen. The fundi were seen with a —24D. sph. Intraocular pressure was: O.U., 12 mm. Hg (Schiøtz). An intracapsular extraction with peripheral iridotomy was performed on the left eye on March 8, 1937. The same operation was performed on the right eye on June 14, 1937. On December 1, 1937, vision was: O.D., —1.0D. cyl. ax. 135° = 1/6+; O.S., —1.5D. cyl. ax. 180° = 1/6. By February 5, 1938, vision was much better. The patient can now see to read and work. On June 13, 1940, vision was: O.D., —1.0D. cyl. ax. 135° = 2/6+; O.S., +1.5D. sph. ⊂ +2.5D. cyl. ax. 180° = 4/6.

Case 8. C. F., a white woman, aged 60 years, a housewife, was first seen on March 6, 1935. She had always been myopic. At this time vision was: O.D., —25D. sph. ⊂ —0.5D. cyl. ax. 180° = 1/6; O.S., —19D. sph. ⊂ —1.0D. cyl. ax. 105° = 1/6. Fluid vitreous with large opacities was present in both eyes. There were partial nuclear cataracts, marked chorioretinopathy, and myopic degeneration. Intraocular pressure was: O.U., 7 mm. Hg (Schiøtz). On May 13, 1937, more lens opacities were seen, particularly in the right eye. At this time, vision was: O.D., —28D. sph. = 1/6—; O.S., —20D. sph. = 1/6. By February 2, 1938, there were more nuclear opacities in both eyes. Intracapsular extraction with complete iridectomy was performed on the right. There was one secondary hemorrhage in the anterior chamber and in the vitreous. On March 5, 1938, vision was: O.D., —3D. sph. ⊂ +4D. cyl. ax. 150° = 1/6. On March 10, 1939, vision was: O.D., —2.25D. sph. ⊂ +3.5D. cyl. ax. 155° = 3/6; O.S., —20D. sph. = H. M. On April 5, 1939, an intracapsular extraction with iridectomy was performed on the left eye, with no vitreous loss. On May 29, 1939, vision in the left eye was 1/6 with a +0.5D. sph. ⊂ —3.5D. cyl. ax. 45°. On December 21, 1941, vision was: O.D., —2.25D. sph. ⊂ +3.25D. cyl. ax. 160° = 3/6; O.S., +0.5D. sph. ⊂ —4D. cyl. ax. 55° = 1/6.

Case 9. Mrs. G. B., a white housewife, aged 71 years, was first seen on August 5, 1943. She had always been myopic. Vision at that time was: O.D., —18D. sph. = 1/100; O.S., —20D. sph. = 5/100. A nuclear cataract was present in each eye, as were fluid vitreous with opacities and myopic chorioretinopathy. Intraocular pressure was: O.U., 10 mm. Hg (Schiøtz). Central scotomas were present in both eyes. An intracapsular extraction with iridectomy was performed on the right eye on September 14, 1943. On October 22, 1943, vision was: O.D., —1.0D. sph. ⊂ —1.0D. cyl. ax. 90° = 1/10+. On January 10, 1944, the capsule ruptured during an attempted intracapsular extraction with iridectomy of the left eye. Operation was followed by uveitis and after-cataract, and there was a slow convalescence. On March 27, 1944, the membrane and capsule were removed with a Tyrell hook through a linear section in the left eye. By June 10, 1944, vision was: O.D., —0.5D. sph. ⊂ —1.5D. cyl. ax. = 1/6; O.S., —2D. sph. ⊂ —1.5D. cyl. ax. 100° = 1/20. On September 10, 1945, vision was: O.D., —1.0D. sph. ⊂ —2.0D. cyl. ax. 95° = 1/10; O.S., —1.5D. sph. ⊂ +3.5D. cyl. ax. 25° = 1/10.

Case 10. B. C., a white mechanic, aged 53 years, was first seen on February 26, 1940. He had always been myopic. Vision at this time was: O.D., —13.5D. sph. ⊂ —7D. cyl. ax. 175° = 1/10; O.S., —8.5D. sph. ⊂ —4.5D. cyl. ax. 165° = 3/6. The interior of the right eye showed a dense nuclear cataract. There was a partial cataract in the left eye. Fluid vitreous with opacities and myopic fundi were also present. The intraocular pressure was: O.U., 18 mm. Hg (Schiøtz). On January 5, 1942, an intracapsular extraction with peripheral iridotomy was performed on the right eye. Vision on January 27, 1942, in the right eye was 3/6— with a +1.0D. sph. ⊂ +3D. cyl. ax. 95°. On August 12, 1943, vision was: O.D., +2.25D. sph. ⊂ +1.25D. cyl. ax. 110° = 4/6; O.S., +2D. sph. ⊂ —4.5D. cyl. ax. 155° = 2/6—. The left eye has not been operated on since the patient is satisfied with the use of the right eye.

Case 11. M. F., a white woman, aged 66 years, had been nearsighted for years. Vision was: O.D., —19D. sph. ⊂ —1.0D. cyl. ax. 180° = 6/100; O.S., —20D. sph. ⊂ —1.5D. cyl. ax. 165° = 6/100. Intraocular pressure was: O.U., 14 mm. Hg (Schiøtz). There were vitreous opacities, the vitreous was fluid, and posterior staphylomas were present. An intracapsular extraction with no escape of vitreous was performed on the right eye on December 10, 1946. Vision was 20/40 in the right eye on March 28, 1947, with a +3.5D. sph. ⊂ +3.25D. cyl. ax. 15°. The left cataract was removed by the same operative procedure in May, 1947.

Case 12. A. F., a white woman, aged 65 years, had always been nearsighted, but now there had been a constant fog before the left eye of 3 to 4 years' duration. The right eye had been blind for

some years due to an old uveitis with degeneration. Tension in the left eye was low, 8 mm. Hg (Schiøtz). The central light and color perception was faulty. Vision was less than 1/100. Projection was good. There was a dense, brownish nuclear opacity in the lens. The vitreous was evidently fluid, for very high myopia and a degenerated uvea were present. Intracapsular extraction with complete iridectomy were performed with no escape of vitreous and with the hyaloid remaining intact. Two months after the extraction, vision was 10/100 with a —4D. sph. The intraocular pressure was still 8 mm. Hg (Schiøtz). There was no detachment nor other untoward development. The patient was pleased with the improvement in her vision.

Case reports

Series 2

Report of surgery of cases of cataract and fluid vitreous and dehiscence of hyaloid capsulozonular-barrier with escape of fluid vitreous at the time of extraction of the cataract.

Case 1. W. B., was a white man, aged 39 years. The vision of the right eye had never been good, while that of the left eye had become poor within the past year. Physical condition showed a typical case of Marfan's syndrome of arachnodactyly with bilateral subluxation of the lenses and recently developed anterior and posterior subcapsular cataracts and recognizable fluid vitreous. Vision was: R.E., 1/100, with a —2D. sph.; L.E., 3/100, with a —10D. sph. ⊂ —2D. cyl. ax. 10°. Intraocular pressure was: O.U., 16 mm. Hg (Schiøtz). On December 19, 1945, an intracapsular extraction with use of forceps and loop was done on the right eye, and on January 3, 1946, the same operation was done on the left eye. Resulting vision was: R.E., +8D. sph. ⊂ +1.0D. cyl. ax. 90° = 2/6; L.E., +9D. sph. ⊂ +1.0D. cyl. ax. 90° = 6/6. The left eye was used alone as it had been previous to the operations. Exotropia of 40 degrees of arc continued.

Case 2. E. C., a white woman, aged 41 years, was first seen on August 6, 1942. She had always been nearsighted, but within the past two years her vision had become so poor that she could hardly get about by herself. History was negative except for a rather severe chronic purulent pansinusitis which every general and local effort had failed to cure. Physical examination showed a well nourished woman of middle age.

Vision was: R.E., 1/16 with a —7D. sph. ⊂ —1.0D. cyl. ax. 180°; L.E., 1/12 with a —12.D. sph. ⊂ —1.0D. cyl. ax. 180°. Corticonuclear cataracts were more dense in left eye. The color perception and peripheral fields for light and form were normal. The pupils measured 3.5 mm., reacting 1 mm. They dilated well with homatropine and paredrine to 8 mm. Tension was 18 mm. Hg (Schiøtz), O.U. Examination with slitlamp microscope was essentially negative. There were no deposits on the endothelium of the cornea except some old fine pigment dots; no floaters; no iridodonesis. Iris structure was normal. There was no heterochromia. Operations: O.S., intracapsular extraction with peripheral iridotomy on November 13, 1942; O.D., May 11, 1943. Then lens capsule was ruptured with the wire loop which was being used to strip off the zonule. Not all of the adherent cortex was removed. It was thought that a great part of the inflammation which developed in the right eye in the postoperative course was due to the toxic effect of the degenerated lens protein. In January, 1945, two months after the extraction, vision in the left eye was 6/6 — 1 with a +6.25D. sph. ⊂ +1.5D. cyl. ax. 53°. In January, 1944, six months after operation, vision in the right eye was 3/6; while one year after the surgery, vision in the right eye was 4/6 with a +8.5D. sph. ⊂ +2D. cyl. ax. 90°. In 1947, she had 6/6 vision in each eye with binocular single vision and stereopsis. The right iris was slightly atrophic, and there were some posterior synechias to a portion of the anterior lens capsule. The left iris appeared normal. The vitreous became quite clear in each eye.

Case 3. A. A., was a white man, aged 44 years, whose left eye had always been weak. For the past six years the vision of each eye had been practically useless. Vision was: R.E., 1/6 not improved by glasses but with good color perception and form field. The left eye had light perception, good light projection, and color perception. An operation on the left eye on March 20, 1945 combined an intracapsular extraction with peripheral iridotomy. The same was done on the right eye, September 11, 1945. The left eye had 6/12 vision in three months, with a +8.25D. sph. ⊂ +1.5D. cyl. ax. 15°. The right eye had 6/12 vision in two months with a +8D. sph. ⊂ +2D. cyl. ax. 175.° The irides appeared normal and in good plane, with no synechia apparent; the fluid vitreous was clear with no opacities.

About fifteen months after the extraction from the left eye and nine months after the extraction from the right eye, the ophthalmologist who had referred him to me and who had been very pleased with the result found that the intraocular pressure was elevated to nearly 60 mm. Hg (Schiøtz). There was very little redness and the vision with correction was reduced to 20/70 in the right eye, and 20/200 in the left eye. My associate in my absence found that medication failed to reduce the tension and performed a cyclodialysis with iridectomy in each eye. The tension in two months was: O.D., 22 mm. Hg, and O.S., 24 mm. Hg. Di-isopropyl-fluoro-phosphate (0.1 percent) was used later when the tension was found nearer 30 mm. Hg, with not very satisfactory results as far as normalizing of the tension was concerned. This has remained about 25 to 28 mm. Hg (Schiøtz), but the vision of the right eye with correction has been 3/6, and that of the left eye 2/6.

Case 4. A. E., a white man, aged 55 years, was first seen on April 30, 1945. His right eye had been normal, while his left eye had had an ulcer of the

cornea following a foreign body 18 years ago. Five years ago, while pounding on pipe, a piece of iron had injured but had not entered the left eye. X-ray films showed no intraocular foreign body. Recently the vision of the left eye had been very poor. Seven months ago he was told that he had a hemorrhage in the eye. He had been disturbed by large clouds before the left eye. The left eye was not congested. The cornea was clear except for minute pigment deposits on the endothelium. The aqueous was clear. There were no floaters; iris was normal; there was a small sized dense brownish cataract. Pupils were equal and both reacted to direct light. Vision was: L.E., good projection, with good light projection and perception of colored lights, R.E., 6/6 with a −0.25D. sph. ⊂ −0.37D. cyl. ax. 70°. Tension was 16 mm. Hg (Schiøtz) in each eye. Intracapsular extraction with peripheral iridotomy was performed on the left eye. The first test of vision was three months after the operation when it was: O.S., +8.5D. sph. ⊂ +3D. cyl. ax. 60°, 4/6+. The plane of the iris was normal. The aqueous was clear. The vitreous opacities were well posterior. The anterior vitreous was clear.

Case 5. L. B., a white man, aged 64 years, had always been quite myopic. Recently vision even with best correction was very poor. Vision was: R.E., 1/16 with a −20D. sph., L.E., 1/100 with a −14D. sph. Pupils were equal and reacted well to light. His general condition was excellent. Corticonuclear cataracts were denser in right eye. There was fluid vitreous with many fine and course floating opacities. Tension was 20 mm. Hg (Schiøtz) in each eye. An operation was done on the right eye, November 14, 1944. The seeping away of fluid vitreous continued until the lens was out, then viscid vitreous presented in the superior temporal portion of the incision. None was lost but the vitreous became incarcerated in the lips of the incision and upon healing the pupil was drawn up and displaced in this area. The vision of the right eye with a +1.0D. sph. ⊂ +2D. cyl. ax. 45° was 2/6 one month after operation. Because of the behavior of the right eye at the time of surgery it was decided to do an inferotemporal, posterior, scleral drainage of the left eye immediately before the extraction of the cataract from the left eye. On March 2, 1945, an operation on left eye was planned as above. Viscid vitreous was found in the posterior scleral drainage area. Fluid vitreous seeped away anteriorly after the incision and during the delivery of the cataract, but no viscid vitreous was lost or incarcerated. In two months the vision of the left eye was 1/5 with a −2.5D. cyl. ax. 175°. The final vision in each eye was very satisfactory. One year after operation vision was: R.E., 4/6 with a +0.75D. cyl. ax. 10°; L.E., 5/6, with a +2.25D. cyl. ax. 180°. The after history of the left eye is very interesting. On May 9, 1947, over two years after the extraction, the patient came to me complaining of loss of vision in his left eye. He had been performing extremely arduous labor, lifting heavy cases and helping to move machinery of great weight. Detachment of the retina was found. This was the only case in which this condition developed. The factor of the creation of an opening in the retina through which an attempt was made to drain the vitreous may well have been the cause. Surgery for reattachment of the retina is to be done. Certainly patients who have had a successful result after cataract surgery should be warned, as was this one, of the bad effects of undue strain upon an aphakic eye.

Case 6. W. J. W., a white man, aged 49 years, was first seen September 28, 1945. He was a clerical worker who had always been myopic. Vision was: O.D., −5.5D. sph. ⊂ −3D. cyl. ax. 10° = 1/12; O.S., −6D. sph. ⊂ −3D. cyl. ax. 180° = 2/6. On November 20, 1945, an intracapsular extraction with peripheral iridotomy was done on the right eye. No gel vitreous was seen. On December 10, 1945, vision was: O.D., +4D. sph. ⊂ +1.75D. cyl. ax. 100° = 4/6; December 21, 1945, O.D. +4D. sph. +2D. cyl. ax. 105° = 6/6.

Case 7. L. B., aged 60 years, rapidly developed cataract in the right eye. The left eye had been blind for 10 years from endophthalmitis, detached retina, secluded pupil, hypotony, cause unknown. The right eye showed no congestion; dystrophy of the endothelium with deposits of degeneration was present, as were floaters and slightly increased relucency. There was complicated cataract. Tension was 12 mm. Hg (Schiøtz). There was partly fluid vitreous with opacity and a tremulous lens. A few months after the first observation the cataract rapidly became complete; there were more floaters and more relucency of the aqueous. Light projection and color perception was not perfect. Due to the nature of the case, operation was decided upon. After cataract extraction which was easily accomplished and in which fluid vitreous seeped away, the eye appeared to heal well anteriorly but a detachment of the retina, which may well have been present at least in part before the extraction, was evident. The aqueous floaters and relucency were in this case significant of the pathologic condition in the posterior segment. The eye did not respond to later efforts to reattach the retina.

Case 8. E. R., a woman, aged 64 years, had a record of having been refused cataract operation for her better right eye by a number of surgeons because of ophthalmoscopic evidence of arteriosclerotic degenerative chorioretinopathy in the left eye. Her vision was: O.D., 10/200 with a −11D. sph., and O.S., faulty light projection. Tension was 13 and 12 mm. Hg (Schiøtz). Diagnosis of fluid vitreous was made. There were tremulous lenses. It was decided to remove the left lens first to learn the reaction of the eye. It healed well with a round pupil, despite escape of much fluid vitreous. Then the cataract was removed from the right eye with a good result of 6/9 vision with correction.

Case 9. E. McE., a white man, aged 62 years, had good functional tests and no remarkable evidence of degeneration before surgery. Tension was: O.U., 16 mm. Hg (Schiøtz). At the time of opera-

tion on each eye, excess fluid came away, apparently from the area anterior to and around the gel vitreous which presented but did not escape in either eye. Healing and vision after surgery were good. He had worn: O.D., —0.75D. sph. ⊂ —1.75D. cyl. ax. 45° = 1/100; O.S., —2D. sph. ⊂ —0.50D. cyl. ax. 20 = 6/100. The acceptance six months after operation was O.D., +7.5D. sph. ⊂ +3D. cyl. ax. 160° = 5/6; O.S., +7D. sph. ⊂ +2D. cyl. ax. 70° = 5/6. In 1946, he had 6/6 vision in each eye.

Case 10. M. R., aged 52 years, had had intumescent cataract of the left eye operated upon unsuccessfully, with loss of viscid vitreous complicated by iridocylitis (not of the sympathetic type) resulting in loss of the eye. Enucleation had been performed. Upon development of a cataract of the same type in the right eye, six months later, extra precautions were taken, including a preliminary iridectomy at the time of which fluid vitreous flowed away through the keratome incision. Tremulousness of the lens had been a constant feature since then. There were fine deposits on the endothelium (none of the mutton-fat type). The aqueous beam was normal. An occasional floater of varied type was seen. The subsidence of the intumescence for an easier intracapsular extraction was awaited and extraction was performed on May 6, 1947. Direct rupture of the zonule was necessary to effect delivery in the capsule because of the low intraocular pressure.

Comment

It is evident from analysis of these two groups of cases that there are points of difference. In the first group, the fluid vitreous was a complication of high myopia except in two cases, in whom the myopia was moderate, and in one, in whom uveitis caused the complicated condition. The second group are younger with an average age of 48 years. If Case 4, in which trauma was a factor, and Case 5, in which high myopia was present in an older individual, are excluded, the average age was 46 years. The visual results after operation in each group were remarkably good considering the complications.

Summary and Conclusions

Fluidification (synchysis) of the vitreous may complicate the formation of cataract. The degeneration of the vitreous may proceed from the normal viscid gel to a semi-

TABLE 2

SUMMARY OF REPORT ON CASES OF FLUID VITREOUS WITH ESCAPE AT TIME OF SURGERY FOR REMOVAL OF CATARACT*

Case	Name	Age	Tension	Refraction Before Operation	Eye	Refraction After Operation	Vision	Pupil
1.	W. B.	39	16	−2.00	O.D.	+8.00 +1.00 ax. 90	2/6	—
	W. B.	39	16	−10.00 −2.00 ax. 10	O.S.	+9.00 +1.00 ax. 90	6/6	—
2.	E. C.	41	18	−7.00 −1.00 ax. 180	O.D.	+8.50 +2.00 ax. 90	4/6	—
	E. C.	41	18	−12.00 −1.00 ax. 180	O.S.	+6.25 +1.50 ax. 53	6/6−1	—
3.	A. A. I.	44	—	—	O.D.	—	3/6 reduced by glaucoma to 3/6−1	
	A. A. I.	44	—	—	O.S.	—	3/6 reduced by glaucoma to 2/6−1	—
4.	A. E.	55	16	Not satisfactory	O.S.	+8.50 +3.00 ax. 60	4/6+	—
5.	L. B.	64	20	−20.00	O.D.	+.75 ax. 10	4/6	Interior synechia
6.	L. B.	64	20	−14.00	O.S.	+2.25 ax. 180	5/6	—
7.	W. J. W.	49	—	−5.50 −3.00 ax. 10	O.D.	+4.00 +2.50 ax. 105	6/6	—
	L. B.	60	12	−7.00	O.D.	Estimated aphakia +10.00	Hand movements	—
	L. B.	60	—	Blind, detached retina	O.S.	—	Complicated detached retina	—
8.	E. R.	64	13	−11.00 worn	O.D.	−4.00 +1.00 ax. 170	6/9	—
	E. R.	64	12	−11.00 worn	O.S.	+4.00	1/100	—
9.	E. McE.	62	16	−.75 −1.75 ax. 45	O.S.	+7.50 +3.00 ax. 160	5/6	Slight distortion of round pupil
	E. McE.	62	16	−2.00 ax. 20	O.D.	+7.00 +2.00 ax. 70	5/6	—
10.	M. R.	52	18	−3.75	O.D.	Operation preliminary iridectomy. Fluid vitreous		—

* 10 cases reported, 16 eyes operated upon. Ages 39 to 64 years. Tension from 8 to 20 mm. Hg (Schiøtz). Refraction from approximately −1.00 to −20D. sph. with cylinders. The average would be that of the lower degrees of myopia. The acceptance after extraction was corresponding. The degree of central vision was good after extraction, considering the type of cases and the complications. After healing, one patient had hand movements, one had 1/100. Both of these cases had known retinal pathology. One other eye had 2/6, 4 had 3/6, 4 had 4/6, 3 had 5/6 and 1 had 6/6. In the case of one patient, secondary glaucoma reduced the vision of one eye from 3/6 to 3/6—1 and of the other to 2/6—1. One eye with fluid vitreous has had only preliminary iridectomy, not having had the extraction of the cataract as yet. One patient evidently had detached retina before the extraction, which seemed indicated because of the complete blindness of the indlvidual. One patient developed detachment of the retina two years after extraction. The factors of excessive strain of heavy lifting and arduous labor may have been at fault, but it is significant that in this case alone was the procedure of posterior drainage of the vitreous resorted to before the extraction.

viscid, semifluid, and fluid state. A portion of the vitreous may remain viscid or semiviscid, surrounded by fluid. The vitreous may be contained behind an intact hyaloid capsulozonular barrier or the latter may also be degenerated and a direct communication exist with the aqueous in the posterior and anterior chambers. The signs for recognition of both of these conditions are described. Particular stress is made of the signs of degeneration of the ocular tissues, hypotony, the type of deposits on the endothelium, the aqueous floaters and relucency, the form of the cataract, the character of the vitreous. The particular lead is to look for signs of degeneration of tissue before surgery for removal of cataract. If they are found, the inference should be drawn that the zonule is fragile and that the vitreous may be fluid. The causes of degeneration and fluidification of the vitreous—faulty nutrition, abiotrophy and senescence, myopia, trauma, inflammation, and detachment of the retina—are discussed in relation to the condition. The literature is cited, particularly in relation to the prognosis, surgical treatment, and results obtained.

The recognition of abnormal fluidity of the vitreous before operation or encountered at the time of surgery is a direct indication, in my experience, for intracapsular extraction. The usual tests of light and color perception and projection should be made and the prognosis based upon them and the objective condition of the eye. Hypotony with intraocular pressure below 8 mm. Hg (Schiøtz) and definitely increased relucency of the aqueous are signs of ill-omen. The cataract should be removed before hypermaturity and complete luxation, because of the attendant fragility of the zonule. The flowing away of the fluid vitreous and the partial collapse of the globe may cause some surgeons to abandon the extraction of the cataract after the section has been made, but in my experience atraumatic intracapsular extraction has given good results. The zonule is uniformly fragile in such cases. Extracapsular extraction is contraindicated in cases of fluid vitreous in communication with the anterior chamber, because of the hypotony which makes useless any maneuver involving pressure and because the eye does not heal as well with retained irritating cortex. If the lens is luxated into the anterior chamber, it can be removed directly. If luxated into fluid vitreous, the maneuvers of coaxing it into the anterior chamber or the methods of Verhoeff or Bracken may be used. If the hyaloid capsulozonular barrier is intact and the vitreous fluid, there is no contraindication to intracapsular extraction, with retention of the intact hyaloid even in cases of high myopia. When there are dehiscences in the barrier, with or without subluxation, intracapsular extraction with traction by forceps and direct rupture of the zonule by separating or stripping it from the capsule with a blunt instrument, such as the elbow of a lens expressor hook, has produced good results. In cases of subluxation, the loop or spoon may be used but it should be passed through an already existing break in the zonule and used to support the lens until the forceps grasp the lens capsule and support it while the loop or spoon is used to separate the zonule from the capsule.

I would not use direct traction with loop or vectis to rupture the zonule nor would I use pressure from without to slide the lens out on a flat spoon, except when the zonule is fragile. The use of the suction cup or erisophake is not indicated in cases of fluid vitreous in communication with the anterior chamber. It may be contraindicated if a direct application of the cup to the capsule is not feasible before the suction is applied. Preplaced sutures are not necessary or even indicated, as shown by experience, in the presence of fluid vitreous. Sufficient time may be taken for a calm, unhurried performance of the surgery, particularly in the toilet of the incision. A complete iridectomy is not necessary in cases of fluid vitreous, as the round pupil may be re-

tained, using two peripheral iridotomies. There need be no drawing up of the iris if there is no incarceration of viscid or semiviscid vitreous. Transplantation of viscid vitreous or replacement with spinal fluid or even with saline is apparently not necessary, although the latter may be used if there has been collapse of the globe. Two cases of detachment of the retina were observed in this series, but the condition in one existed prior to the development of the cataract. In the other, the detachment developed over two years after the extraction. The factors of heavy lifting and the presence of a hole in the retina produced by purposeful drainage of the vitreous prior to the extraction of the cataract from this eye have to be evaluated as the cause of the detachment. One case of bilateral postoperative glaucoma developed. This was only partially controlled by surgery and the use of di-isopropylfluorophosphate (0.1 percent).

A report of 10 case histories with operations on 16 eyes in which fluid vitreous was in communication with the aqueous and of 12 cases with operation on 22 eyes in which the hyaloid was intact is made. The results obtained indicate that in cases of fluidity of the vitreous with cataract in which the degeneration has not progressed too far and in which there is not a preëxisting detachment of the retina or severe hypotony the cataract may be removed by an atraumatic intracapsular technique with gratifying results.

Nothing that is said in this paper on fluid vitreous should be taken to minify the disastrous results of the rupture of the hyaloid and the loss of viscid vitreous.

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NOTES, CASES, INSTRUMENTS

AN UNUSUAL CASE OF LEPTOTHRICOSIS CONJUNCTIVAE*

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A 32-year-old white housewife was first seen at the out-patient department of the Massachusetts Eye and Ear Infirmary on December 25, 1946, complaining of itching of the right eye of two weeks' duration and redness of the eye associated with a painful lump in front of the right ear of three days' duration. She had been treated by her own physician for the past five days with ointment and drops without improvement.

Ocular examination revealed vision to be: O.U. 20/30—. The right eye showed slight redness of the lids with moderate swelling of the lower and marked swelling of the upper lid to the extent that the upper fornix could not be prolapsed. There was a scant, stringy mucoid discharge.

There was marked chemosis and swelling of the fornicial conjunctiva. The palpebral conjunctiva was congested and swollen. In the center of the palpebral conjunctiva of the lower lid was a grayish white, semitranslucent, mushroomlike, nonulcerated nodule measuring 3 by 2 mm. with a collarette of smaller daughterlike grayish deeper excrescences.

Several small follicles were seen near the outer canthus of the lower lid. The cornea was clear and did not stain with fluorescein. Findings in the remainder of the eye were negative. The right preauricular node was tender and swollen, measuring 1 by 1 cm. The left eye was entirely negative. Temperature was 99.2°F. A diagnosis of Parinaud's oculoglandular syndrome was made.

Laboratory findings. Conjunctival smears and scrapings were negative. Culture revealed nonhemolytic streptococci. Urine was negative.

Blood was: W.B.C., 8,300—77-percent polymorphs, 14-percent lymphocytes, 9-percent monocytes. R.B.C., 4,200,000; Hgb., 12.2 gm.

X-ray films of chest, teeth, and sinuses were negative.

Agglutination tests for brucella and tularemia were negative. T.B. skin test (1/20,000) was negative. Serology was negative.

Course. Three days after the initial visit, hemorrhage occurred into the nodule and it was removed for biopsy. The sections were reviewed by Dr. F. H. Verhoeff, who found the typical histologic picture and organisms of Leptothrix infection.

The tributary adenopathy became progressively more marked and diffuse. Thirteen days after first being seen at the clinic, the preauricular node measured 2 by 3 cm., and the whole right cervical chain was visibly enlarged and tender. The overlying skin was reddened. No definite fluctuation could be made out at this time, although the surgical consultants were of the opinion that the patient had a definite and marked cervical adenitis.

The blood at the height of the adenitis revealed a leukocytosis of 12,400 with 77-percent polymorphs and no eosinophiles. The adenopathy gradually regressed from below, but the preauricular node remained visibly and painfully enlarged. Approximately six weeks after the first visit, the preauricular node spontaneously discharged some "matter" while at home. The following day 3-cc. thin, greenish purulent material were aspirated from it. This material was bacteriologically sterile. Modified Verhoeff gram staining revealed no filaments or other organisms, and special cultures for Leptothrix were negative after one month's incubation. Guinea-pig inoculations of the aspirated material were negative for tuberculosis. The preauricular gland gradually regressed in size and again spontaneously drained some pus about one month later. Three months after the onset of the dis-

* From the Massachusetts Eye and Ear Infirmary.

the gland was still slightly enlarged and indurated but no longer painful.

The eye signs of redness, chemosis, and edema gradually regressed so that five weeks after the onset of the disease the lids were normal and only slight chemosis and simple conjunctival injection remained. This had cleared completely three weeks later.

During the illness the patient's temperature had ranged from 98.6°F. to 100°F., being highest at the height of the cervical adenopathy. General symptoms—mild lassitude, chilliness, and headache—closely paralleled the temperature variations. With the exception of the ocular and associated findings, physical examination was negative.

Treatment. This was symptomatic and consisted of aspirin, cold compresses to the glands, and zinc and adrenalin eye drops.

Comment

This case of leptothricosis conjunctivae was of particular interest to us for the following reasons:

1. The occurrence of suppuration of the preauricular node, which does not usually occur in this condition, and the spontaneous drainage, which to our knowledge has not been previously reported.

2. The occurrence of hemorrhage into the conjunctival nodule which we have not seen before either in this condition or in tubercle of the conjunctiva.

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PARALYSIS OF SUPERIOR RECTUS AND INFERIOR OBLIQUE FROM DIABETES MELLITUS

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Paralysis of the superior rectus and the inferior oblique muscles in one or both eyes is relatively rare. In cases in which ocular paralysis does occur, one immediately thinks of syphilis as the etiologic agent. Until the Wassermann test was developed, all cases of ocular paralysis in the adult were considered syphilitic in origin unless other definite causes could be established.

In 1930, James Collier reported a number of cases of paralysis of the oculomotor nerve-trunks in diabetes, and I wish to report one case in which paralysis of the superior rectus and inferior oblique muscles developed in a diabetic who had syphilis some 15 years previously. In discussing diabetic involvement of the oculomotor nerve trunks, it is well to remember that diabetes also affects the retina and the optic nerve rather frequently.

White reported on the paralysis of the superior rectus and the inferior oblique muscles of the same eye, in 1941. He stated that paralysis of both elevators of one eye, although one of the less common palsies, is not infrequently seen and is generally, if not always, congenital. His discussion dealt with the surgical treatment of these cases, and the patients were all children.

Report of a case

J. H., a Negro man, aged 62 years, was first seen on January 7, 1947, with the complaint that he was unable to open both eyes simultaneously. About December 1, 1945, the patient suddenly noticed that when he opened the right eye, the left upper lid would close, and vice versa. He was able to open both eyes at times, but saw double. There was no pain at any time. His only other complaint was that the stump of his left leg, which had been amputated, was painful.

History. The patient was first seen at the Brackenridge Hospital Clinic in 1931, complaining of a urethral discharge of three weeks' duration. The patient underwent proper gonorrheal treatment and was cured. A Wassermann test made at the time showed a plus-four, positive reaction. He was treated

regularly for syphilis in the Clinic, and the blood and spinal fluid became negative.

In 1935, the patient's left leg had to be amputated above the knee, following an accident. He had had a great deal of trouble with a painful stump, which had been operated on several times.

About 1940, the patient developed a severe diabetes and had been treated in the Brackenridge Hospital Diabetic Clinic since then. Insulin and diet had been more or less effective in keeping the blood sugar near normal levels. Occasionally he would break his regime, and the blood sugar would go up to over 200 mg. per cc.

Eye examination. Vision was: R.E., 20/60; L.E., 20/20. The eyes were normally prominent, and the pupils reacted to light and accommodation. When the patient opened the right eye, the left upper lid closed, and vice versa. By raising the right upper lid manually one noticed that the pupillary levels of the eyes were not the same. On having the patient look in the cardinal directions, the left eye moved normally. The right eye moved normally in the horizontal axis and in the lower-temporal, lower-central, and lower-nasal directions. He was unable to elevate the eye above the midline. Both fundi were essentially normal except for moderate arteriosclerosis.

Laboratory reports. On January 7, 1947, a blood Kahn and Wassermann were run and reported negative.

On January 16, 1947, spinal fluid was examined for syphilis and reported negative. Spinal-fluid sugar was 198 mg. percent. On January 21, 1947, the patient was placed on Mead's brewers yeast tablets, four times daily after meals, in addition to the insulin and diet regime that he had been on.

By March 11, 1947, the patient could open both eyes simultaneously, alone, with no effort. He did this, however, only when requested. The right eye could be elevated slightly above the horizontal line.



Fig. 1 (Hilgartner). (Left). Usual appearance with right eye closed and left eye open. (Right). Appearance when right eye is opened. Left upper lid practically closes, and left eye turns up.



Fig. 2 (Hilgartner). (Left). Forcing both eyes open. Note wrinkling of brow, turning up of left eye, and drooping of left upper lid. (Right). Looking to right in midline. Right eye can be seen moved to the right.



Fig. 3 (Hilgartner). (Left). Left eye elevated up and out. Right eye extended nasally but not above the midline. (Right). Left eye extended up. Right eye not elevated above the midline.

Diagnosis. Paralysis of superior rectus and inferior oblique due to diabetes.

Comment

In conclusion, a case of paralysis of the superior rectus and the inferior oblique muscles of the right eye, due to diabetes, has been reported. Contrary to the statement of Collier that most of these cases improve on regular diabetic treatment, this patient has not improved up to the present time.

202 West 13th Street.

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A MODIFIED ERISOPHAKE*

ALAN E. BELL, M.D.
Key West, Florida

A modification of the erisophake is reported, which has the following advantages:

1. It is light, small in size, and easy to handle.
2. The suction is easily controlled.
3. It is simple and inexpensive.

The tip is modeled after those of Dimitry and Castroviejo, and either of these tips

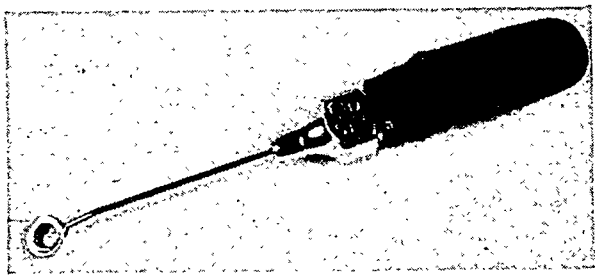


Fig. 1 (Bell). A modified erisophake.

may be used. The suction is provided by a small rubber bulb made from a contact-lens holder by cutting off the flexible lip. The working volume of the bulb (approximately 0.25 cc.) is ample, if the instrument is filled with normal saline solution prior to grasping the lens. The maximum vacuum is 60 to 70 cm. Hg, approximately equal to that provided by the Barraquer and Castroviejo vacuum pumps. The bulb is rugged and inexpensive and will stand many boilings. To sterilize them, the tip and nipple should be disassembled and boiled. If assembled when boiled, the rubber bulb will tend to adhere to the metal tip.

Before the operation, the instrument should be assembled and completely filled with normal saline. This is important, because if any air remains in the instrument, it will prevent the attainment of a high vacuum, and bubbles of air will be introduced into the anterior chamber, obscuring the operator's field of vision. The bulb should be squeezed, expelling as much of the saline as possible, when grasping the lens. This will provide a better grasp on the lens, as well as clear the anterior chamber of any blood or iris pigment and sweep the iris anterior to the erisophake cup.

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* From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University.

A SCREEN FOR PRISM COVER TEST

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Stamford, Connecticut

The screen about to be described was designed primarily for the prism (alternate) cover test, but may also be used to measure the near point of convergence or PcB.

It is 6-cm. wide and 15-cm. long, made of black X-ray film, with rounded corners. Notches on the sides mark it off in centimeters. Each fifth notch is deeper so that the right measurement may be quickly read in any position.

The advantages are many. The screen does not look soiled with handling. The width is just enough to occlude the eye properly, without requiring too much accuracy so that full attention may be devoted to observing ocular movements. The length is convenient not only in manipulation but in giving an even number of 5-cm. (notch) gradations so that measurements can be easily read off from any position or angle without the use of printed numbers or calculation.

Over-exposed X-ray film is plentiful, costs nothing, and is easily and quickly shaped into the above design.

Bradding together two films for increased rigidity, and using numbers or pinholes instead of notches were among the variations tried. None, however, were found so handy or practical as the simple model described.

65 South Street.

A SIMPLE METHOD OF PHOTOMICROGRAPHY*

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Los Angeles, California

At present, photomicrography is usually confined to the larger institutions where costly equipment may be found and special technicians are maintained. Such laboratories frequently use the optical bench to produce the photographs. Good photomicrographs can be taken with relative ease, with a minimum of equipment, and in little time.

Theoretically, all one needs is a microscope and a camera. Light rays emerging from the ocular of the microscope are parallel, if the observer is emmetropic or rendered so by the proper spectacle lens. When the camera focused for infinity is set on top of the microscope the rays of light should focus exactly on the film. In practice, this method is wasteful of time and film since the observer is rarely exactly emmetropic and the slightest error produces a blurred picture. A focusing apparatus that permits a direct view of the slide to be photographed is advantageous.

EQUIPMENT

The Exacta and other reflex cameras permit such a direct view and their use speeds the work. However, these cameras are very expensive and not readily available so that for ordinary use a copy attachment has been chosen as the simplest method. The apparatus chosen has the following advantages:

1. All around usefulness of 35-mm. equipment.
2. Direct-view focus of the slide.
3. Simplicity of lighting system.
4. Relatively inexpensive equipment.
5. All materials are readily available.
6. Photomicrographs in true color are as easy to take as black and white.
7. The same equipment may be used to photograph the anterior segment (fig. 3A).

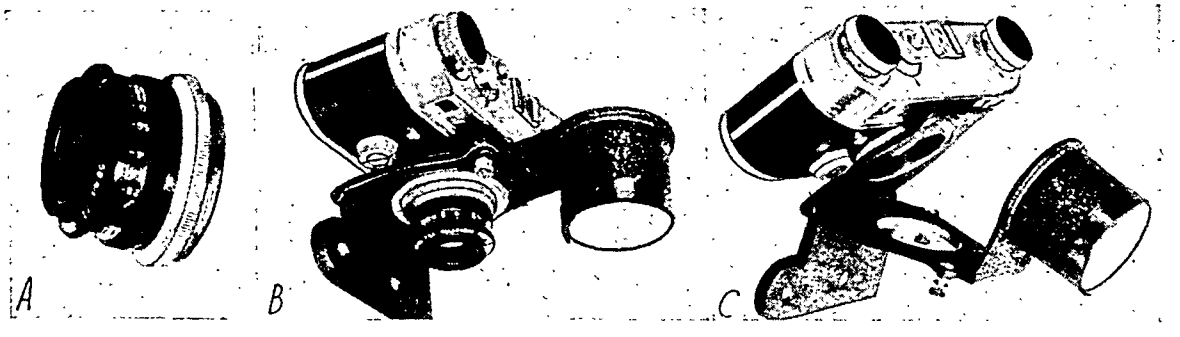


Fig. 1 (Wright). (A) Lens barrel dismounted from camera. (B) Lens mounted in lens plate of copy attachment. (C) Camera back mounted on camera plate of copy attachment.

The necessary items are:

1. A 35-mm. camera with focal plane shutter.
2. Copy attachment, preferably hinged type.
3. Camera support.
4. Connector.
5. Number-one photoflood bulb in any kind of lamp socket.
6. Ordinary microscope of standard make.

METHOD

After loading the camera with the desired film, the lens barrel (fig. 1A) is unscrewed from the camera and mounted in the lens plate of the copy attachment (fig. 1B). The camera back is mounted on the camera-back

* From the Department of Ophthalmology, Northwestern University Medical School.

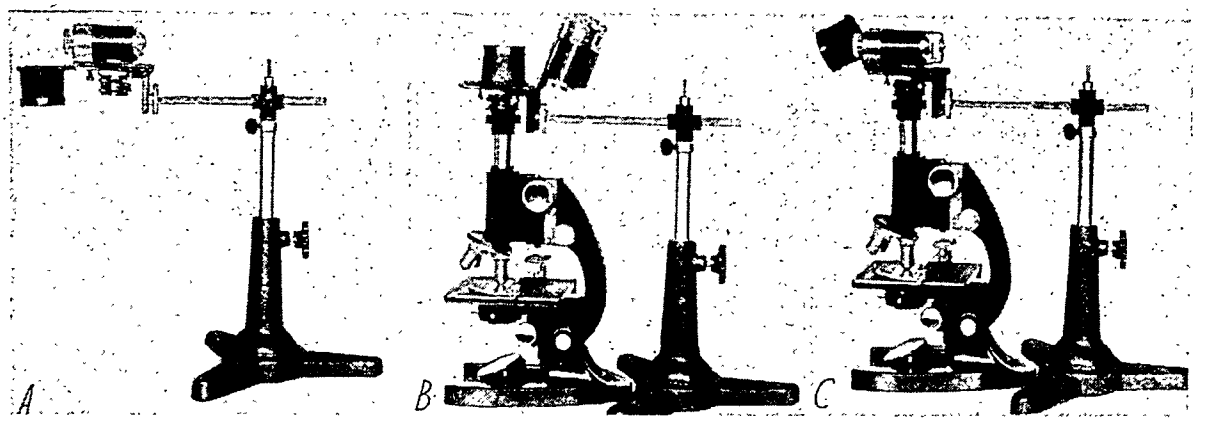


Fig. 2 (Wright). (A) Assembly mounted on support. (B) Focusing with ground-glass image. (C) After focusing, the ground glass is raised and the camera back is lowered into position.

plate of the copy attachment (fig. 1C). The assembly is mounted on the support (fig. 2A). The slide is placed on the stage and roughly focused on the desired area. The camera-copy assembly is gently lowered to the microscope connector and the slide is focused by means of the ground glass on the copy attachment (fig. 2B). The ground glass is raised and the camera lowered into its place and the picture made (fig. 2C).

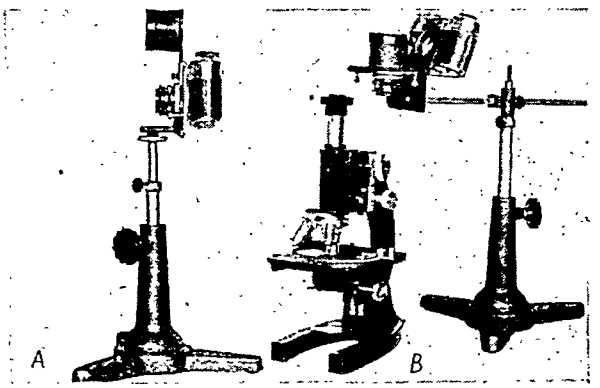


Fig. 3 (Wright). (A) Camera is set up for anterior-segment photography. (B) Shows camera assembly, microscope, and connector.

The light system is a number-one photoflood lamp placed about three feet from the concave mirror of the microscope whose condenser is opened fully and then closed until the light in the field of view just begins to dim. For black and white, using Eastman Super-XX film, about 1/30 of a second is required for a slide of average density. For Kodachrome type-A film, about one-half second of exposure is required. Thin slides require 1/5 second. These slides project nicely.

The connector is a short metal tube, or it may simply be a piece of black paper pasted around microscope and camera lens (fig. 3B). It need not be absolutely light tight. Pictures taken with high or low power require the same time of exposure, although the diaphragm of the condenser must be opened wider for high-power photographs. Critical focusing with the ground glass is facilitated by study of the ground-glass picture with a hand magnifying lens.

511 South Bonnie Brae.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

April 7, 1947

DR. BENJAMIN FRIEDMAN, *president*

This meeting, the annual round-table discussion, was devoted to the discussion of the "Clinical Aspects of Ocular Pathology." Questions were submitted before the meeting, and were edited and divided among the following ophthalmologists, who comprised the panel of experts: Dr. J. Arnold de Veer, Dr. Joseph Igersheimer, and Dr. Algernon B. Reese. Dr. Benjamin Friedman acted as the moderator.

IN WHAT WAY MAY ENDOPHTHALMITIS PHACO-ANAPHYLACTICA BE RELATED TO SYMPATHETIC OPHTHALMIA?

DR. J. ARNOLD DE VEER said that there are several respects in which injury of the lens may contribute to the development of sympathetic ophthalmia. The proponents of the "infectious" theory of sympathetic ophthalmia have occasionally referred to the possibility that lens substance may serve as a culture media for bacteria and so play a role in the development of sympathetic ophthalmia.

Inclusion of lens capsule in a wound has repeatedly been mentioned, along with inclusion of uveal tissue, as a possible factor. Long before Verhoeff and Lemoine attributed certain inflammatory conditions to an "anaphylactic" reaction to lens protein, it was well known that protracted inflammations occasionally followed retention of lens material after cataract extract and that whatever can cause an iridocyclitis can indirectly bring about sympathetic ophthalmia. So, in a nonspecific way, the lens has been thought to be concerned in sympathetic ophthalmia by a number of observers.

Before 1940, no one had suggested that sensitization to lens protein might be a direct precursor of sympathetic ophthalmia in certain cases. In these cases, there has usually been one or more injuries or operations involving the liberation of lens protein. Inflammation in one eye has been followed by irritation or inflammation of the other eye. Examination of the enucleated, exciting eye has shown features both of endophthalmitis phaco-anaphylactica and of sympathetic ophthalmia. The theory advanced by Dr. de Veer is chiefly on morphologic evidence. It is that these people had first become sensitized to lens protein, and developed an allergic type of uveitis and subsequently became sensitized to uveal pigment. This theory still awaits serologic or experimental proof. Dr. de Veer stressed that the lens may play an important role in the development of sympathetic ophthalmia, whether as a source of antigen, as food for infection, as a toxic irritant, or in other ways.

Discussion. Dr. Joseph Igersheimer asked Dr. de Veer whether he would comment on the conception of autoanaphylaxis and its relationship to endophthalmitis phaco-anaphylactica.

Dr. de Veer replied that lens protein is one of the antigens described as organ specific rather than species specific. The idea that certain inflammatory lesions of the eye might be the result of sensitization of the individual to its own lens protein was advanced by Verhoeff and Lemoine, in 1916, and has never been fully accepted, chiefly because lens substance is a weak antigen, and it has been impossible to produce any convincing experimental support of the theory. In 1934, however, Berkey struck upon

a method of augmenting antigenicity by the use of some adjuvant substance, notably staphylococcus toxin. By the intradermal inoculation of rabbits with lens antigen and this toxin, either in separate skin sites or combined, he succeeded for the first time in rendering rabbits highly sensitive to beef lens substance. When the lenses of these rabbits were then needled, so that some of their own lens substance was released, intense inflammations ensued rapidly. Sections of these eyes were reported by Friedenwald to show changes resembling endophthalmitis phaco-anaphylactica in man.

With this experimental support and the histologic evidence furnished by clinical material, there has been rather general acceptance of the fact that reactions of the type described by Verhoeff and Lemoine have at least an allergic aspect, although infection and toxicity of lens substance may also be concerned in the pathogenesis of the lesion. Dr. de Veer said that he believed that sensitization to lens protein plays the predominant role in endophthalmitis phaco-anaphylactica and that sensitization to uveal pigment and sympathetic ophthalmia may supervene. In other words, people who have become sensitized to lens antigen are more prone to develop sympathetic ophthalmia than those who have not suffered such an immunologic disturbance.

Is sarcoid a type of tuberculosis?

Dr. Joseph Igersheimer said that his personal experience with sarcoid is very limited and he felt that this is true of most ophthalmologists. Very few cases of sarcoid of the eye have been studied anatomically and published. The whole question of the relationship between sarcoid and tuberculosis cannot be decided by the microscopic picture alone.

The histologic picture of Boeck's sarcoid is characteristically nodular in form. It is composed mainly of epithelioid cells with a few giant cells, lymphocytes, and marked fibrosis. The lack of caseation or necrosis is particularly suggestive.

Heerfordt's uveoparotid fever and Mikulicz's syndrome belong to the same group as Boeck's sarcoid. The fact that all these diseases show a tuberculoid formation cannot be used as positive evidence that they have a tuberculous origin since we know that allergic reactions in general often cause nodules of epithelioid character.

It is not the pathologic picture alone but the combination of the clinical entity plus the microscopic changes which are important in the pathogenesis. The negative tuberculin reaction in high concentrations, the absence of Koch's bacilli, and the lack of any form of caseation are the main but not the only facts which suggest that sarcoid and similar diseases are not due to an infection caused by Koch's bacillus, but to another infectious agent which we have not yet discovered. On the other hand, it must be admitted that in a relatively small number of cases of sarcoid, tubercle bacilli are found, inoculations are positive, and caseation is present. Therefore, the whole question of the relationship between sarcoid and tuberculosis cannot be answered in a positive way.

Can malignancy be diagnosed on a study of the subretinal fluid?

Dr. Algernon B. Reese said that Meissner, Rintelen, and others have been able to demonstrate the presence of cancer cells in the centrifuged subretinal fluid in cases of malignant melanoma of the choroid. Tumor cells cannot get into the subretinal fluid in cases of melanoma of the choroid until the tumor has perforated the lamina vitrea. In early cases this has not taken place, and it is these cases which may be difficult to diagnose.

Dr. Reese said that there are pigment epithelial cells which proliferate readily in the subretinal fluid and which he felt would be difficult to distinguish from tumor cells. He did not believe that the withdrawal of

subretinal fluid for the purpose of identifying tumor cells was of any value diagnostically.

Cibis found a positive melanin test for the subretinal fluid in cases of malignant melanoma of the choroid. Similar tests were negative for the aqueous, vitreous, and subretinal fluid in idiopathic detachments. Cibis felt that this test was of diagnostic value. Dr. Reese said that he has never used it and doubted its validity.

Dr. Reese said that it is sometimes advantageous to drain the subretinal fluid in order to unmask a melanoma lurking in the choroid. Sometimes this can be accomplished by putting the patient to bed with absolute rest for several days and in rare instances it is advisable to withdraw the fluid with a syringe.

Discussion. Dr. Benjamin Friedman asked if, when the eye is tapped, there is any danger of cells being left in the conjunctiva and whether these cells could lead to a secondary growth in the conjunctiva. Dr. Reese replied that he did not believe that there was any danger of this happening.

Pathologic findings in cases of retained nonmetallic foreign bodies

Dr. J. Arnold de Veer said that he believed it to be axiomatic that even the most inert foreign bodies excite some foreign-body granulomatous reaction. The more intense inflammations come from foreign substances that are more or less soluble in tissue juices, but even such insoluble substances at talc, glass, or coal dust call forth a mobilization of macrophages that leads to fibrosis. Infection may, of course, be carried into the tissues with the foreign bodies, and the traumatic hemorrhage, necrosis of tissue, hyperemia, and edema incident to the entrance of the foreign body furnish food for the infecting organism.

Although infection may not be introduced at the time of entrance of a foreign body, the fibrosis that results from the trauma of introduction, plus the fibrosis about the foreign substance itself, present areas of modified circulation and other structural and functional abnormalities that may invite endogenous infection.

Many nonmetallic foreign substances may be tolerated within the eye for indefinite periods of time. The clinician must weigh the risk of removal against the risk of leaving the foreign body within the eye.

A type of delayed, posttraumatic glaucoma is known to occur occasionally months or years after introduction of a "nonirritating" foreign body of even minute size.

The problem of identification of a nonmetallic foreign body in an enucleated eye may tax the diagnostic acumen of the pathologist. Glass, cilia, or displaced fragments of lens are relatively simple. Various vegetable structures call for a knowledge of plant histology.

Are there any histologic ocular findings that one can definitely classify as exclusively luetic?

Dr. Joseph Igersheimer replied that there are no histologic findings exclusively characteristic of syphilis. In the early stages, plasma cells are often present abundantly and, in the later stages, giant cells and vascular changes are often found, but all such findings are not pathognomonic.

Discussion. Dr. de Veer remarked that, if there is a real gumma in the eye, you can often give a histologic diagnosis of lues. He said that his reports usually read, "infectious granuloma, probably lues or tuberculosis." Then a serologic or bacteriologic confirmation is sought.

Histologic criteria in determining rate of growth of choroidal sarcoma

Dr. Algernon B. Reese said that Callender gave a cytologic classification of melanomas of the uvea into spindle-cell A and B, fascicular, necrotic, epithelioid, and mixed. The spindle-cell and fascicular types were

the least malignant and the epithelioid and mixed types the most malignant.

Wilder has reported the use of the reticulum content of melanomas as a criterion. Tumors in which the reticulum content or argyrophile fibers are greatest are less malignant than the tumors in which the reticulum content is less. The principle involved here is that the more rapidly a tumor grows the more anaplastic it is, and the less the cell produces its by-product.

The melanomas of the uvea are divided into the neurogenic and the chromatogenic melanomas.

Incidence of intraocular tumors in blind eyes

Dr. J. Arnold de Veer said that he was not able to answer the question from the standpoint of personal experience of any statistical value. The question of etiologic factors in development of malignant melanomas arises in these cases. Leber and Krahnstöver, in 1898, reported 22 cases in which inflammation seemed to have preceded development of the tumor. In most instances, however, the tumor has been the cause of the phthisis.

Dr. de Veer said that it can be stated without exception that phthisical eyes always show inflammation. He said that he had seen many examples of malignant melanoma in phthisical eyes, and felt that chronic inflammatory and profound local metabolic disturbances in some of these cases may have been casually related to the development of malignancy just as chronic irritation is believed to cause malignant changes in nevi of the skin.

The question of the relationship of injury and the development of malignant melanoma is a difficult one. If, as is commonly thought, partial removal of a pigmented mole of the skin may cause the remaining nevus cells to take on a malignant character, perhaps an injury that produces blindness can be credited with the subsequent development of an intraocular tumor. There is a tendency today to view this question of activation of growth of nevi, by operation or other trauma, in a different light than heretofore. It is thought that the nevus that shows obvious malignancy after incomplete removal was probably already malignant at the time the operation was undertaken.

At any rate, continued Dr. de Veer, the fact that a malignancy, impossible to detect early, may develop into a hopelessly blind eye is one of the best reasons for urging removal of such eyes. Furthermore, the phthisis may have been caused by an unsuspected malignant tumor. Estimates of the incidence of malignant tumors in phthisical eyes run as high as 10 percent. For similar reasons, eyes with absolute glaucoma in which the fundus cannot be seen, may harbor malignant tumors and so should be enucleated.

Discussion. Dr. Joseph Igersheimer said that it would be wise to consider the possibility of an intraocular tumor when one eye is blind and when the fundus is not visible. E. von Grosz published, in 1929, the following interesting figures: Among 4,004 enucleations during a period of 25 years, there were 200 eyes which were diagnosed as having uveal sarcoma. In 68 cases of blindness, there was only a suspicion of a tumor, and a tumor was found in 26 of these cases. Among the enucleated blind eyes with no suspicion whatsoever of a tumor, 25 cases of sarcoma of the uvea were found anatomically.

Why do inflammatory lesions of the posterior segment heal with fewer complications than those located anteriorly?

Dr. Joseph Igersheimer said that we must first consider the uvea, because the consequences of healing the exudative stage are most important. The dangers of a fibrinous exudate getting into the anterior and posterior chambers from the vessels of the iris and ciliary body are well known, and it is not necessary to describe them. In the choroid, these exudates are generally very limited in

size and space. If they are in a small area and the inflammatory process extends to the pigment epithelium and the outer surface of the retina, a microscopic retinal detachment may be present. Large exudates and large detachments as in Harada's disease are very infrequent occurrences. Even if involvement of the retina takes place in many small areas, as in disseminated choroiditis, the lasting visual disturbances are generally not great, unless the macular region is involved.

Several factors, anatomic as well as physiologic, are probably instrumental in causing the difference in behavior of the anterior and posterior segments of the uvea.

Anatomically, it is the glass membrane bordering the choroid which resists the spread of inflammation to a rather high degree, as does Descemet's membrane in corneal infiltrations. The iris and the ciliary body do not have such a natural barrier.

Physiologically, the pressure on the outside of the blood vessels may play a role in the amount of fluid and fibrin passing through the vessel wall. It is apparent that the choroid is naturally compressed by the sclera on one side and the pigment epithelium plus the retina on the other side. In the iris there is no counterpart on either side; in the ciliary body, on one side only. This point may be of some importance in cases where the inflammatory process is very severe, but is mainly restricted to the uveal tissue itself. Tuberculous nodules for example generally grow larger in the anterior uvea than in the choroid.

In discussing the posterior segment, inflammatory processes in the retina proper must be considered. Here the inflammation can be very severe, as in endophthalmitis. Necrosis of the retinal elements follows quickly, and the healing consequences are as bad as in the anterior segment. If the inflammation is mild and is restricted to some septic emboli, the complications may be insignificant because the tissues of the retina have little or no inflammatory response, and the little embolus may cause only a microscopic necrotic reaction in its surroundings.

Discussion. Dr. J. Arnold de Veer commented on the apparent ease with which exudate gets out of the ciliary body and into the vitreous, particularly from the pars plana and the region of the ora serrata. Why that should be so is not entirely answered by the statement that there is a glass membrane behind the ora serrata and none anterior to it. The two layers of the lamina vitrea are represented in the ciliary body, but there is a connective-tissue layer interposed between them. If these two membranes, the cuticular and the elastic membranes, are as represented in the textbooks, it is remarkable that cells can migrate through them in their separated positions any more easily than through the lamina vitrea, where these two layers are fused. Perhaps the answer is that these glass membranes in the orbicular region of the ciliary body are fenestrated, or perhaps they are easily broken during inflammations, so that inflammatory cells stream out into the vitreous, pass forward along the zonular fibers, and give rise to the cyclitic membranes that are so destructive.

Dr. de Veer concluded that an investigation of the glass membranes in the ciliary body, by means of maceration preparations, would be worth while.

Potential Malignancy of Pigmented Lesions of Conjunctiva

Dr. Algernon B. Reese said that there are two types of tumors to be considered here. One is the nevus and the malignant melanoma which arises from it, and the other is precancerous melanosis and the malignant melanosis which arises from it.

The nevus is a congenital tumor, extremely common, and it is an extremely rare occurrence that it gives rise to a malignant melanoma. When this does occur, the malignant tumor is localized and elevated.

Precancerous melanosis is an acquired lesion, usually appearing at the age of from 40 to 50 years. It is diffuse and nonelevated

and characteristically gives rise to a malignant melanosis in from 5 to 15 years. This tumor stems from the basal layer of the epithelium.

Dr. Reese said that, in his experience with these tumors, he has found that cancerous melanosis which arises from a precancerous melanosis is at least 15 times more common than the malignant melanoma which arises from a nevus.

Clinical criteria for differentiating benign from malignant tumors of the iris

Dr. J. Arnold de Veer said that there should be close and careful observation of all nevi. Those in the iris should be under the observation of an ophthalmologist. Notations should be made of size, shape, color, exact location, and degree of vascularity. Continued growth, especially after a period of quiescence should be viewed with suspicion. Changes in the degree or pattern of the vascularity or the development of glaucoma in such an eye should arouse great suspicion. The nonpigmented nevus should be watched as carefully as the pigmented one.

Dr. de Veer said that he was glad to see the designation "pigmented nevus" replacing the term "melanoma" in ophthalmic literature. Melanoma for several decades has been used in general pathology to designate a malignant tumor of melanoblastic cells. The addition of the word malignant would seem a wise precaution. The designation "melanosarcoma" is being dropped from ophthalmic parlance and that of "malignant melanoma" substituted. The term "leukosarcoma" is also troublesome. In general oncology it means lymphosarcoma accompanied by a leukemic blood picture. The name "nonpigmented malignant melanoma" should replace that of "leukosarcoma" in referring to pigment-free malignant melanoblastic tumors of the eye.

Differentiate histologically between luetic and tuberculous keratitis

Dr. Joseph Igersheimer said that the opportunity to examine an interstitial keratitis histologically is extremely rare. If only the cornea is examined under the microscope, it may not be possible to decide whether the keratitis is of luetic or tuberculous origin. Nevertheless, there is a great difference between the two and this can be understood best if the problem is approached from an experimental angle.

If luetic material is injected into the cornea of a rabbit, an interstitial keratitis will develop after a certain incubation period. This keratitis is generally not in the region of the injection. If tubercle bacilli are injected into the cornea, a yellowish infection will appear at the site of the injection after a few days; this infiltration becomes larger and nodular and may be followed by ulceration or perforation of the cornea.

If spirochetes are inoculated into the anterior chamber a typical interstitial keratitis results; whereas, after inoculation of tuberculous material a specific nodular process develops first in the iris, and later on a caseating process develops in the cornea.

If the syphilitic infection is made somewhere else in the body, as in the testis, and if the eye becomes involved, a typical interstitial keratitis appears after several weeks. Often no other pathologic condition of the eye can be found even histologically. If tubercle bacilli are injected intravenously, a uveal tuberculosis frequently results, but very rarely and only in severe tuberculosis of the anterior uvea does the cornea become involved. In such a case, the corneal disease can have the clinical and histologic appearance of an interstitial keratitis.

With rare exceptions the same process exists in pathologic conditions in human beings. According to his experiences, Dr. Igersheimer said that a luetic interstitial keratitis is primary, which means it is independent of

other inflammatory foci in the eyeball. Tuberculosis affects the cornea either in the form of a nodular keratitis or an interstitial keratitis, but this interstital keratitis is always secondary to a specific process in the sclera or the anterior uvea. Dr. Igersheimer demonstrated a case of interstitial keratitis with tuberculosis of the iris.

Dr. Igersheimer also demonstrated with lantern slides one histologic peculiarity of luetic keratitis. He said that experimentally, as well as in human cases, he had found new formations on the posterior surface of the cornea. They appeared clinically like large Descemet precipitates, but histologically they were proliferations of the corneal endothelium. The interesting point was that in several of the experimental cases, a large number of spirochetes could be detected in these endothelial new formations.

Intraocular complications in cataract extractions

Dr. Algernon B. Reese said that the following complications were common to both intracapsular and extracapsular cataract extraction:

1. Choroidal detachment. The immediate type is due to loss of volume in the eyeball. The late type, which comes on several weeks or more following the operation, is probably due to a leaky wound.

2. Epithelization of the anterior chamber. This may be in the form of a localized cyst due to the impregnation of isolated epithelial cells in the anterior chamber. It may be in the nature of epithelium lining a portion of the anterior chamber or the posterior chamber. This is due to the ingrowth of epithelium at the wound and is perhaps encouraged by the incarceration of iris or capsule in the wound.

3. Various types of operative sections.

4. Glaucoma.

5. Postoperative inflammation, which may be early and ectogenous in character, or late and endogenous in character.

6. Prolapse of the iris.

In regard to the extracapsular extraction, by far the most common and serious complication is capsule in the wound. The subcapsular epithelium proliferates into large plaques of metaplastic tissue and gives rise to various types of complications.

In regard to the intracapsular extraction the following were discussed by Dr. Reese:

1. The protrusion of the anterior hyaloid membrane across the anterior chamber to touch the corneal surface.

2. Adhesion between the lens capsule and the anterior hyaloid membrane (ligamentum hyaloidea capsularis). When actual adhesions exist between the two, an intracapsular extraction causes a tearing of the anterior hyaloid membrane and thus gives rise to loss of vitreous.

3. A detachment of the retina due to the fact that the dislocation of the lens causes a hole to be pulled in the retina at the ora serrata because some of the zonules insert into the ora.

Obligations of pathologist to furnish unprejudiced opinions and of clinician to provide adequate clinical information

Dr. J. Arnold de Veer said that it has been the custom for many years to examine gross and microscopic sections without any clinical notes whatever. After gross and microscopic examinations are completed, he considers the clinical data in order to reach a diagnosis that is compatible with all the facts in the case.

Only when the complete clinical picture is known, can the globe be sectioned in the proper planes to yield the most information. Dr. de Veer said that he believed that many valuable specimens have been ruined because the clinician has not given enough data to the pathologist. The attending physician

should see to it that the proper information accompanies the specimen to the laboratory.

Sudden degeneration of the optic nerve and its clinical implications

Dr. Joseph Igersheimer discussed his experiences with rapid degeneration of the optic nerve, which are not generally mentioned in the textbooks.

The first group of such cases concerns papilledema. Dr. Igersheimer had the opportunity to follow up a large number of papilledema patients before and after decompression operations and also to examine histologically the whole peripheral visual apparatus of many such cases. Among these cases there were many patients who had normal visual functions before the operation which remained after the decompression. Others showed, even before the operation, a certain grayish discoloration of the disc and a slight decrease of the visual functions. Some of these latter patients demonstrated a rapid deterioration of their vision after the decompression. He recalled the case of a young girl who became totally blind a few days after the operation. She died shortly thereafter, and the microscopic examination showed total Marchi-degeneration of the optic nerve in its entire cross section. This should serve as a warning signal for recommending a decompression operation if the optic nerve already shows clinical signs of beginning atrophy.

A second group with sudden decrease of visual functions was demonstrated by a patient who was studied clinically and anatomically. This patient felt absolutely well until he suddenly developed a mist in front of each eye. The borders of the discs were hazy and the vision was beginning to fail. During the next two weeks, the vision decreased rapidly and the disc showed some grayish discoloration. In the retina there were some small hemorrhages with a tiny star figure on one side. The retinal changes could not explain the visual disturbances. The spinal pressure was normal. There was general hypertension and nephrosclerosis. The patient died practically blind four weeks after the beginning of the eye symptoms as a result of cerebral hemorrhage. Anatomically there was a degeneration of all optic-nerve bundles as shown by the Marchi-method. At the distal end of the optic nerve there was an increase of glial cells. Dr. Igersheimer showed by means of slides that both central vessels had normal lumen. There was no definite pathologic process apparent in the smaller vessels. The cause of the sudden degeneration in this case and in similar cases is not clear, but it must lie in the optic nerve itself. Dr. Igersheimer said that it was probably due to a circulatory damage, since the patients all seem to suffer from a general hypertension or severe atherosclerosis.

Tabetic optic atrophy can, in rare instances, also show a very rapid progression. A 25-year-old woman, who came to the clinic with early visual symptoms, was blind in both eyes six weeks later. Recently Bruetsch has also described such an experience. No case of this type has been studied microscopically as yet.

Differential diagnosis of retinoblastoma

Dr. Algernon B. Reese said that the important characteristics of retinoblastoma which are helpful in making a diagnosis are as follows:

1. The color of the tumor.
2. The identification of calcium in the tumor either by ophthalmoscopic examination or by X ray.
3. Globules of tumor tissue in the vitreous.
4. Implantation growths along the anterior surface of the iris or elsewhere in the eye.
5. A normal size eye.

Dr. Reese said that retinoblastoma must be differentiated from the following conditions:

1. Retrolental fibroplasia. In this condition the color of the lesion, the long ciliary processes, the anterior concavity of the lesion, its presence in an eye that is smaller than normal, and the premature birth of the patient are all important features.
2. Metastatic retinitis.
3. Massive retinal fibrosis.
4. Coats's disease.
5. Dictyoma.
6. Astrocytoma.
7. Extensive medullated nerve fibers.

Bernard Kronenberg,
Secretary.

CHICAGO OPHTHALMOLOGICAL SOCIETY

May 19, 1947

DR. WILLIAM A. MANN, *president*

CLINICAL PROGRAM

(Presented by the staffs of Children's Memorial, Michael Reese, and Mount Sinai Hospitals)

ERYTHEMA EXUDATIVUM MULTIFORME

DR. MARTHA RUBIN FOLK presented Mrs. L. K., seen first in consultation at Mount Sinai Hospital on July 25, 1945. Two days before admission, the patient experienced pain in the left shoulder and hip, for which her family physician gave her an injection of a gold preparation for rheumatism. On leaving his office she experienced a feeling of tightness around her mouth and an increase in saliva. Within a few hours an eruption appeared, covering the eyelids, conjunctiva, and most of the skin of the face, the dorsal part of the arms, chest, abdomen, legs, and feet.

History. Past medical history was not significant except for the story of an ulcer on her leg 20 years ago which healed slowly. Serologic tests were positive.

Physical examination showed an extensive eruption of macular, papular, and vesicle lesions scattered over the entire body with a predilection for the extremities. Many of the lesions had crusts of a violescent hue, and some coalesced into large erythematous patches. A profuse muco-frothy discharge was present on the lips. The buccal mucous membrane, bladder, and rectum were ulcerated. Blood pressure was 217/110. The heart was slightly enlarged. The Kahn test gave a positive result. The blood count was within normal limits. The urine showed a trace of albumin.

Eye findings. Vision was: R.E., 0.8; L.E., 5/200. The skin of the eyelids showed many crusts of various sizes, some of which oozed serum. The lids were adherent; a profuse mucopurulent discharge was visible between the palpebral fissures, which were narrowed to 2 mm. in size. After careful cleansing of the lids, pontocaine (1 percent) was instilled and some adhesions were broken so that the fundi might be examined. Many fine ulcerations were present on the palpebral conjunctiva, which was moderately injected. The cornea was clear but the fundi could not be satisfactorily examined.

Under hospital treatment for three weeks, the lesions of the skin cleared, leaving dark, pigmented patches. The palpebral fissures became larger, but some bands of adhesions near the canthus remained.

At this time there is still a scanty mucoid discharge present from the conjunctival sac. The patient has been receiving antisyphilitic treatment. Cultures and smears show many dead epithelial cells and a few Staph. aureus. No fungi were found. The obliteration of the conjunctival fornices persisted. On several occasions the cornea, stained with fluorescein, showed many punctate ulcerations. On slitlamp examination, both lenses showed grayish opacities and golden brown posterior cortical opacities. The right disc showed a temporal pallor. In the left macular

region, there was a pigmented patch the size of the disc, with others smaller in size. There were various changes in the blood vessels, some tortuosity and nicking of the veins by the arteries at the crossing.

Diagnosis. (1) Erythema exudativum multiforme, which caused scarring of the conjunctiva. (2) Bilateral incipient cataract. (3) Right partial optic atrophy. (4) Left central choroiditis—syphilitic. (5) Hypertensive retinopathy.

This patient is still under weekly observation.

SCIENTIFIC PROGRAM

1. Testing School Children with Massachusetts Vision Tests.—Mrs. B. H. Gray*

2. Toxoplasmosis.—A. C. Krause.

3. The Sodium Vapor Lamp and its Use for Refraction. (See Am. J. Ophth., 30: 1527 (Dec.) 1947).—Stefan Van Wien.

4. Streptomycin Therapy in Ocular Infections. (See Am. J. Ophth., 30: 1215 (Oct.) 1947).—John G. Bellows, and Chester J. Farmer.*

Richard C. Gamble,
Secretary.

* By invitation.

HISTORICAL MINIATURES

Toward the end of the middle ages one finds extensive efforts to elaborate a system of optics. The names of Alhazen (965-1038), Roger Bacon (1214-1291), and John Peckham (1240-1294) are well known. The work of Vitellio (1220-1280) is less well known, although he was highly appreciated in his time and during the Renaissance. Leonardo da Vinci thoroughly studied his book, Frederic Risner praised it extravagantly and Johannes Kepler, in 1604, entitled his treatise on optics: *Ad Vitellonem Paralipomens.*

The blackness of the pupil was so much taken for granted that the importance of Mery's demonstration of the visibility of the eyeground in an excised eye that is immersed in water was not recognized. In his student days Adolf Kussmaul not only recognized the importance of the problem of the blackness of the pupil but correctly formulated its details, although it remained for the genius of Helmholtz to provide the solution.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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RETROLENTAL FIBROPLASIA

In infants, and especially in those that are premature, blindness due to the presence of opaque tissue in the vitreous is assuming tremendous importance. The condition does not seem to be a new one, but merely represents an increased incidence of a lesion which has always appeared sporadically and has been called by various names. Terry, who coined the term "retrolental fibroplasia" to designate the lesion, gave great impetus to its study. He appreciated the lately increased incidence and was the first to concern himself regarding it.

At The Institute of Ophthalmology, New York City, we have seen 136 cases, and 89 of these have been seen in the past three years. At the Massachusetts Eye and Ear Infirmary, 165 blind preschool children are recorded as residing in Massachusetts, and in 108 of these the blindness is due to retrolental fibroplasia.

As the high incidence of the disease has occurred only in the past 10 or more years, and as the disease prior to this period was extremely rare, ophthalmologists over the country have not all incorporated the diagnosis in their repertoire. It is difficult, there-

fore, to arrive at a true estimate of the lesion's incidence because all statistics must be based on eye reports from ophthalmologists. The United States Public Health Service has no statistics on the subject. This is also true of many state and local organizations concerned with health statistics.

Figures on the incidence of the disease are available in five states. The reports from four of these states are as of April, 1947, ("The Blind Preschool Child," New York, American Foundation for the Blind, Inc., 1947, pp. 46-51).

The Division for the Blind, Department of Public Welfare, Chicago, Illinois, reported a total of 109 blind preschool children known in the state, and remarked "a more adequate coverage of the state would, we feel, reveal considerably more cases." Out of this total of 109, eye reports were available for only 48. Of these 48, 20 gave retrolental fibroplasia as the cause of blindness.

The New Jersey State Commission for the Blind reported 96 blind preschool children all of whom were covered by eye reports, and 28 of that number gave retrolental fibroplasia as the cause of blindness. Since this report, the New Jersey State Commission has listed a total of 135 cases under their supervision. This rise, within the last nine months, may be real, apparent, or both.

The New York State Commission for the Blind reported 115 cases, of which 93 were covered by eye reports; 20 of them are cases of retrolental fibroplasia.

The Wisconsin School for the Visually Handicapped reported that 58 visually handicapped preschool children were known to the field service of the Department of Public Instruction, and added "information included on causes of blindness is not too reliable as less than 40 percent of the cases are based on direct medical reports." Eight of the 58 cases had retrolental fibroplasia.

The Division of the Blind, Department of Education of the Commonwealth of Massachusetts, reports as of January 1, 1948, that 148 preschool blind children are recorded and that 82 of these have a diagnosis of retrolental fibroplasia.

The figures quoted from The Institute of Ophthalmology, New York City, and from the Massachusetts Eye and Ear Infirmary are not representative: they give too high an incidence of retrolental fibroplasia because both these institutions have manifested particular interest in the disease. On the other hand, the figures available from the four states show too low an incidence of retrolental fibroplasia, because all the ophthalmologists, upon whose certificate the statistics depend, are not diagnosing this condition which has only recently assumed importance. Eye reports covering a larger number of preschool children and better case-finding methods of the organizations interested in the blind would lead to the discovery of many more blind preschool children. Available statistics show that retrolental fibroplasia is by far the commonest cause of preschool blindness. I feel that a fair estimate is that one third of all preschool blindness now is due to retrolental fibroplasia. Furthermore, there are indications that the incidence not only has increased in the past decade or more, but has shown a particular increase in the last few years.

An important factor in this increased incidence is the decrease in mortality of premature infants. The pediatricians now are saving premature babies that formerly were lost. This may not, however, be the sole factor.

There is evidence indicating that the disease may result from an infection of some nature. In support of this it can be said that the incidence of the disease seems to vary in different localities. In one Boston hospital the incidence of retrolental fibroplasia has been found to average 18 percent of all premature births during the past eight years (King, M. J., The Blind Preschool

Child, 1947, pp. 138-142), while in some other localities, the incidence seems lower. My colleagues in other countries, including France, Austria, and Australia, tell me that they do not encounter the condition except as a rare sporadic case. Furthermore, in the fundi of these patients there are clinical manifestations over the areas accessible to examination which indicate that a choroiditis of a mild nature has existed. This manifests itself as a diffuse, mild, pigment disturbance. Also, some of the eyes having retrolental fibroplasia show evidence of an iridocyclitis. This manifests itself as posterior synechiae, atrophy of the iris, and the sequela of exudate around the pupillary margin of the iris. Moreover, from 40 to 60 percent of the mothers of these patients give a history of vaginal bleeding during pregnancy, and some give evidence of having had infection of some kind during their pregnancies. This may be a history of fever or of intercurrent infection such as brucellosis, German measles, ulcerative colitis, and so forth.

It is known that certain mild clinical, or even subclinical, infections of the mother affect the offspring. Toxoplasmosis is a subclinical infection of the mother which produces in the offspring chorioretinitis as well as congenital anomalies. Measles, and perhaps other virus diseases of the mother, can produce abnormalities in the offspring. There must be still other clinical and subclinical infections of the mother acting in similar fashion. In retrolental fibroplasia, therefore, it seems reasonable to postulate that a maternal infection of some nature is responsible for the variations in the incidence in different localities, for the vaginal bleeding and consequent premature birth, and for the signs of inflammation in the eyes of the offspring such as chorioretinitis and iridocyclitis. As pediatricians now save premature infants which would previously have been lost, the sequelae of this maternal infection on the infant now manifests itself as an increased incidence of this lesion which formerly appeared only sporadically. The increased incidence might also be attributed in part at least to an increase in the prevalence of some maternal infection.

The problem of retrolental fibroplasia is the most acute one in ophthalmology today. Is there not some way we can prevent the birth of so many blind infants whose parents, too frequently young and of modest means, can ill afford to have their resources decimated and to carry the tremendous burden of such a child? Often the affected child is the first one of young parents who, though they accept their plight, are terribly handicapped and plan to have no more children. Those concerned in this problem, including the ophthalmologist and the various public organizations and institutions, are not sufficiently aroused to, or conscious of, the importance of the problem. One of the first steps toward clarifying the issue should be a thorough and accurate accounting of premature children with regard to the incidence of retrolental fibroplasia, mental retardation, and other abnormalities. Then it can be decided whether or not the saving of premature infants should be entered on the credit or debit side of medicine.

Algernon B. Reese.

THE WILMER RESIDENTS ASSOCIATION MEETING

The seventh annual meeting of the Wilmer Residents Association was held at the Wilmer Ophthalmological Institute, Johns Hopkins Hospital and University, on April 14, 15, and 16, 1948. The total registration, including guests, was 181. Those privileged to attend came from many places in the United States.

The Residents Association is composed of former residents of the Wilmer Ophthalmological Institute. The purpose of their annual clinical meeting is to provide an opportunity for the returning residents, former house officers, assistant residents, and guests

to review the work done in the Wilmer Institute during the past year, and to follow the activities of the former residents. It has been the custom to invite a number of ophthalmologists from other cities to attend these meetings.

There were 26 papers or presentations by former residents, past and present members of the staff, and from members of other departments of the university. Thus, a most impressive array of authors and subjects was paraded before the keenly interested audience during the three delightful days of the meeting.

The quality of the work and its importance to ophthalmology was most striking. It is impossible here to do adequate justice or to describe in detail the individual contributions. Many of them will appear in subsequent issues of the JOURNAL. However, the papers by Woods on "Antibiotic and Chemotherapy in Experimental Ocular Tuberculosis," Owens and Owens, on "Retrolental Fibroplasia," Walsh on "Nasopharyngeal Carcinoma," Woods and Wood on "Bacterial Hypersensitivity and Its Relation to Ocular Disease," and Kuffler on "Synaptic Transmission with Reference to the Retina," were particularly worthy of note.

Dr. Alfred Blalock discussed the "Surgical Treatment of Coarctation of the Aorta and Pulmonic Stenosis," and showed a breath-taking motion picture in Kodachrome of his spectacular and life-saving operation in these conditions. Dr. Jonas Friedenwald brilliantly presented some of his recent work on "Enzymatic Histochemistry and Its Applications to Ophthalmic Research," and did his best to simplify the complexities of the subject for his overwhelmed listeners. Dr. William G. Marr debunked and devastated the cyclodiathermy operation for glaucoma. Dr. Samuel D. McPherson, Jr., and Dr. Ronald Wood exhibited convincing evidence that solutions of the usual drugs used in ophthalmology in 1:5,000 Zephiran remain sterile for weeks thereafter. Dr. M. Elliott Randolph read an excellent paper on "Recurrent Erosion of the Cornea," and suggested the value of histamine desensitization for this stubborn condition. The paper by Bruno and McPherson, Jr., on "Harada's Disease," was thought-provoking and stimulating. These and the other papers on the program showed careful observation, work, and skill in presentation. One cannot praise the meeting too highly.

There were many lighter moments and times for relaxation and entertainment during the evenings. A skit, ably performed by the active house officers and residents, poked harmless fun at their betters (in age at any rate) and slyly probed into the foibles and dignities of their directors. The actors' lines were clever and were relished by the onlookers, particularly those who were not in the line of fire. Derrick Vail.

CORRESPONDENCE

REPLY TO DR. CRISP

Editor,
American Journal of Ophthalmology:

In the March issue of the *American Journal of Ophthalmology,* there appears an editorial signed by Dr. W. H. Crisp, in which decided exception is taken to certain portions of an address delivered by me in Chicago at the recent meeting of the American Academy of Ophthalmology and Otolaryngology.

Dr. Crisp elected to express his disapproval through the medium of an editorial rather than take the more conventional method of a letter to the editor. In adopting this more formal and official approach he avails himself of his position as consulting editor of the *Journal* and in his use of the pronoun "us" implies general editorial approval. Thus his criticism immediately passes the boundary of personal disagreement and assumes the tenor of an official rebuke. Inasmuch as I have a natural reluctance to endure chastisement meekly, and am moreover quite unrepentant, may I take this opportunity to point out certain points

in Dr. Crisp's presentation where his argument appears to me difficult to follow?

In the address delivered in Chicago I endeavored to give full recognition to the solid accomplishments of the American Board of Ophthalmology and to the high character of their aims and purpose. Four adverse criticisms were offered, all of which I believe to be constructive and calculated to provide better internes, stimulate investigation, and to advance ophthalmology as a whole. These four criticisms concerned, first, the required year of general interneship; second, the so-called basic-science requirements; third, the principle of hospitals and institutions requiring certification of a specialty board as a prerequisite to appointment and promotion; and lastly, a question of the policies of the national ophthalmologic societies, wherein the certificate of the specialty boards is a prerequisite for membership. Dr. Crisp states that these criticisms might, if taken seriously, endanger the whole fabric of the Board's endeavor. I cannot agree that the Board's fabric of endeavor is so thin and tenuous that it is unable to stand constructive criticism. I considered the Boards established in a much more solid basis, and frankly said so in my address.

Dr. Crisp takes exception to three of the above criticisms. The first of these relates to the requirement by the Board of a preliminary year's interneship in a general hospital. This he admits is a debatable question. In essence he defends this requirement with a statement, that considering all phases, the rule is more frequently wise than foolish, that a waste of time is more or less unavoidable, that this is exemplified by the activities of student nurses, and indeed he suggests that my own internes in The Johns Hopkins Hospital are guilty of the same practice. Quite probably Dr. Crisp is correct in this accusation, but is this any argument in favor of waste of time? Dr. Crisp further asks if an understanding of the relation of ophthalmology to general medicine is not desirable. Obviously, everyone must answer this question in the affirmative. This, however, is not the point. The pertinent question is who shall initiate the instruction of the future ophthalmologist in this relation—an internist, a surgeon, a gynecologist, an obstetrician who knows little or nothing of ophthalmology, or a competent ophthalmologist who has spent his life in the study of the question? If the ophthalmologic service can provide this instruction, as any well-organized service should be able to do, I believe they should be entrusted with the task. In his concluding sentence Dr. Crisp states the duty of the American Board is to satisfy the clinical needs of the general community. On this point at least we see eye-to-eye. I expressed it slightly differently in saying that the Board is nothing more or less than an agency to determine the clinical fitness of practitioners of ophthalmology.

Dr. Crisp's next criticism involves the principle that hospitals should make Board Certification a requisite for appointment and promotion. Dr. Crisp states that my condemnation of this principle is extended to include the action of the Veterans Administration in requiring that persons appointed to its attending and consulting staffs be diplomates of the Boards representing their specialties and also in granting a 25-percent increase in salary to members of the full-time staff who obtain certification. In stating that I condemned this practice, Dr. Crisp makes an unwarranted assumption. In my address, I cited this action of the Veterans Administration as a contribution to the power, strength, and prestige of the Boards and as an example that Board certification might well mean actual dollars in the pockets of the diplomates. In no place in my address did I condemn this action of the Veterans Administration. Further on in Dr. Crisp's editorial, returning to the same subject, he refers to the action of the Medical Board of The Johns Hopkins Hospital in which that body refused to accede to the principle that certification by any specialty board be a condition of appointment or promotion

to any position on the staff of The Johns Hopkins Hospital, and their subsequent circulations of this resolution. This action Dr. Crisp characterizes as a "rather unpleasant slap at standardization." It is peculiar, however, that in his discussion and criticism Dr. Crisp does not similarly indict the Council of Medical Education and Hospitals and the House of Delegates of the American Medical Association, who somewhat belatedly have expressed similar views and have now taken official action condemning this practice.

For some peculiar reason Dr. Crisp appears somewhat puzzled that I did not adversely criticize the American Board of Otolaryngology, whose certificate Dr. Crisp states is "usually rather easier of attainment." I confess this did not occur to me, nor is it altogether clear even now why I should assail the Board of another specialty, about which I know nothing. The dual membership of the Academy and the relative severity of the two Boards were not subjects of my address.

Dr. Crisp next accuses me of an exaggerated fear that the application of the principle, presumably of the requirement of certification for appointment, will endanger the research institutions. I assure Dr. Crisp I have no such fear. Fortunately, the research institutions of the country are, far and large, under the control of intelligent men. In my address I merely speculated on what would be the effect did institutions accept such a stifling stricture.

Dr. Crisp's concluding charge concerns my opinion of the present policies of the national societies in which Board certification is made a prerequisite for membership. Here I stated, "If I am correct in my idea of the lines along which ophthalmology must henceforth develop, the present policies of the national societies lie squarely across this pathway." Here Dr. Crisp accuses me of exaggeration. He presents no arguments controverting my views on the future development of ophthalmology, although here there is obviously ground for differences of opinion, and it is quite probable Dr. Crisp and I may hold radically different views. Dr. Crisp contends that the national societies already fully comply with my "desideratum," and that no scientist can be regarded as an ophthalmologist unless he possesses the knowledge of clinical ophthalmology demanded by the American Board. On these conclusions, I am in complete disagreement with Dr. Crisp. I am prepared to admit that our concepts of the future development of ophthalmology, and our definitions of an ophthalmologist, may be so different there is no probable meeting of minds. I fail, however, to see where fundamentally different concepts of a problem justify the charge of exaggeration.

(Signed) Alan C. Woods,
Baltimore, Maryland.

An answer to Dr. Woods

Editor,
American Journal of Ophthalmology:

I am glad to have an opportunity to glance through Dr. Wood's comments. Incidentally I notice that, because I once used the word "us" in referring to my colleagues in ophthalmology, Dr. Woods assumes that I am indulging in the editorial "we" and therefore imply general editorial approval. Dr. Woods should know by this time that the policy of the *American Journal of Ophthalmology* has been to encourage each editorial writer to express his own individual opinions. As to Dr. Wood's lightly expressed suggestion that I was availing myself of editorial privilege, the editorial writer is surely no more privileged than an Academy president whose presidential address is not open to discussion.

In a general way I believe I correctly interpreted the tenor of Dr. Wood's remarks concerning the American Board of Ophthalmology. I may have gone astray a little as to his attitude with regard to the Veterans Administration and its beneficial recognition

of those having certificates from the Boards. The atmosphere created by the context led me to assume that this was among the disapproved activities of the Boards. I have met others who received the same impression.

Dr. Woods is certainly mistaken in supposing that I was accusing his internes of wasting time. Mere inspection of my question (Am. J. Ophth., 31:348 (Mar.) 1948—first paragraph, column 2) will indicate that I referred to systems rather than to persons. Oft-repeated performance of routine duties inevitably involves waste of time so far as the education of the individual is concerned.

My remarks about the certificate of the American Academy did not criticize the Board of Otolaryngology but suggested a certain result in regard to the Academy's certificate of membership.

I am content to have my editorial read in conjunction with the presidential address itself and with Dr. Wood's present letter. My purpose was not to find fault but to analyze the situation.

(Signed) William H. Crisp,
Denver, Colorado.

The serology of trachoma

Editor,
American Journal of Ophthalmology:

In 1944, I made serologic investigations upon trachoma patients. The number of these investigations was small, but in the following years I did not have an opportunity to go on with the work. I am, therefore, reporting the results already obtained in the hope that someone will be interested in continuing these studies.

I shall explain briefly what has already been done and what I intended to do. The supposition is not an entirely new one. For some time the connection between trachoma and the lymphatic apparatus has been well known (Angelucci, Kuhnt, and so forth). In my opinion, trachoma does not rank as an independent disease of the lymphatic system, but is rather only a symptom of one general lymphatic disease.

Both microscopically and clinically, trachoma resembles other diseases of the lymphatic system. The vascular picture in the conjunctiva is frequently strikingly similar to that in lymphatic leukemia. True acute trachoma is very like the "drüsenfieber" of Pfeiffer.

TABLE 1
Results of the Paul-Bunnel test in 32 cases of known trachoma

No. of Patients	Reading	Percent
8	1:112	25
4	1:224	12.5
5	1:28	15
1	1:448	3
12	1:56	37.5
2	1:896	6

* It is generally stated and accepted that a reading up to 1:56 is normal; over 1:56 is positive.

TABLE 2
Results of the Paul-Bunnel test in 11 cases known to be free from trachoma

No. of Patients	Reading	Percent
1	0:00	9
1	1:14	9
4	1:28	36
5	1:56	46

With these thoughts in mind, the Paul-Bunnel test was made in 32 cases of trachoma. As controls, the same serologic tests were made of 11 cases in which no trachoma was present but in which the following eye diseases had been diagnosed—3, serpent ulcers; 1, acute glaucoma; 1, keratoconjunctivitis sicca; 1, keratitis lymphatica; 1, wound from BB-shot; 2, marginal ulcers; 1, hematoma of the lids; 1, interstitial keratitis. The results are given in Tables 1 and 2.

Since many of my patients were young soldiers, some of them may have been artificially infected with trachoma. It was intended, therefore, as the next step to make serologic examinations of numerous patients with trachomatous pannus, as well as

of patients in whom trachoma had been positively diagnosed (MacCallan).

It was further intended to do a number of animal experiments, using the Paul-Bunnel reaction. Someone who reads this may be interested in developing these ideas.

(Signed) Janos Majoros, M.D.,
VIII. Brody Sandor-u. 6.,
Budapest, Hungary.

LUMINOUS CROSS FOR FIXATION

Editor,
American Journal of Ophthalmology:

I have not seen the following idea published, yet it has proved valuable in my practice. It is difficult to do a fundus examination on old persons with small pupils, who cannot fix the eyes on an object. With nothing to fixate on, they continue to move their eyes.

I bought a small bottle of luminous paint and a brush, then painted two pieces of adhesive tape. On the wall directly in front of a chair in the dark room, I pasted these two pieces of tape in the shape of a cross. The cross was then covered with Scotch tape to hold it in better position and to keep the surface clean.

(Signed) Sydney S. Deutch,
Fall River, Massachusetts.

BOOK REVIEWS

TABULAE BIOLOGICAE. Volume XXII (Oculus). Pars I. Uitfeverij, Dr. W. Junk, Amsterdam, 1947.

Of this monumental collection of biologic data, a volume of 408 pages, the first part of four on the eye, has appeared. It is fittingly prefaced by an appreciation of the work and enthusiasm of Kurt Steindorf, without which this great undertaking could never have been launched. Three other parts are in preparation in which data on vegetative physiology and physiologic optics will be presented. Like its predecessors the book is intended for reference, and, as a repository of every imaginable fact that can be expressed in numbers, it could not be surpassed.

This volume presents in tabular form all available data arranged in several chapters each of which has a most extensive list of references. In the first chapter, Hermann Kahmann deals with the eyes of invertebrate animals. Fifty pages of tables record such facts as the number and position of eyes, size and position of various ocular structures, and extent of visual fields of innumerable species of animals. The second chapter of more than a hundred pages by Stefanie Oppenheimer deals with metric and descriptive characteristics of the human and animal eye. The section which deals with the measurement of the bony orbit of primates is accompanied by 54 figures on 11 plates. The other part of the chapter deals with the lids and most extensively with the color of iris in relation to race, heredity, age, and pigmentation of hair.

In the third brief chapter Dejean and Granel describe the eye of the vertebrate embryo; 12 pages suffice for this. The fourth chapter by Steindorff presents the descriptive anatomy of the eye of vertebrates and man in 126 pages of tabulation and an extensive bibliography. In the remaining pages Nordmann discusses the anatomy and physiology of the pupil in vertebrates, and Ascher discusses the intraocular pressure and intravascular pressure in the eyes.

The index also lists those contributions in Volumes I to XXI of Tabulae Biologicae which refer to the eye.

F. H. Haessler.

AN INTRODUCTION TO THE PRESCRIBING AND FITTING OF CONTACT LENSES. By Dickinson and Hall. London, England. Hammond and Hammond and Co. Ltd., 1946. 168 pages. Index and 97 illustrations, Price, one guinea.

This publication, the first to be written in England on the subject of contact lenses, contains general information on the methods of fitting of molded and ground contact lenses. It contains chapters on the history, optical principles, and sphere of utility of the contact lens. There is a great deal of pertinent material as to the fitting of contact lenses and their usefulness.

While this book may give the ophthalmologist and optician an overall picture of contact lenses, there are many who feel that the techniques more recently evolved permit more rapid and accurate fitting than those described in this book. The chapter on the sphere of utility needs more strict scientific direction.

Francis W. Parker.

BULLETINS ET MEMOIRES DE LA SOCIÉTÉ FRANÇAISE D'OPHTHALMOLOGIE Published by the Members of the Board. Volume 59, 1940-1946.

This volume contains the membership lists of the Société Française d'Ophthalmologie, the transactions of the scientific sessions, and the minutes of the meetings from May 20, 1946, to May 23, 1946.

The first part contains the discussions about G. Renard's new ophthalmoscopic atlas and seven lectures about various fundus diseases. A. Fritz's paper, concerning the relation diameter of retinal veins and arteries has to retinal metabolism is one of the most interesting. So is Mme. S. Schiff-Wertheimer's and Mlle. G. Gaillard's study of the intravenous use of novocaine in thrombosis of the retinal veins. The authors use 1-percent novocaine solution of which as much as 10 cc. is injected very slowly. Improvement should be noticeable on the same day. If it is not, the injection should be repeated, at first daily, later two or three times per week, until 10 injections have been given. The prognosis of branch thrombosis is most favorable with this treatment.

The second part includes 16 lectures on corneal and conjunctival diseases and their treatment and it brings many interesting details, especially the symposium on corneal surgery. P. Sourdille's paper on complete keratoplasty, M. Franceschetti's study on the technique of this operation, and L. Paufique's comparison between complete and incomplete keratoplasty are valuable contributions.

The third and fourth parts record papers on varied topics. The biochemistry of the lens, the familial incidence of glaucoma, the symptomatic and surgical treatment of glaucoma were described at length. Special emphasis should be given to Kalt's lecture on iridencleisis, Coppez's lecture on microdiathermy puncture with the pyrometric electrode, Szymanovky's lecture on demi-Elliot, and Mme. Schiff-Wertheimer's symposium on the complications of diathermy coagulation in retinal detachment. Drouet, Thomas, Herbenvol, and Henry reported on five cases of recurrent vitreous hemorrhage which were caused by intestinal parasites (ascarides). A cutaneous reaction was helpful in the diagnosis. Verrey's study on the cytology and bacteriology of the aqueous may elucidate the etiology of uveitis and the detection of latent focal infections.

The etiology of uveitis was widely discussed. J. Babel discussed benign ocular leptospiroses. R. Nertoux and R. Chercheque reported their investigation of blood cultures from the gums in uveitis associated with alveolar pyorrhea. Amsler described, once more, his experiments on a blood-aqueous barrier, using the same equipment and technique as in earlier work described in Ophthalmologica 111:155, 1946. A. Franceschetti and V. Bischler analyzed the pharmacodynamics of Adie's syndrome. C. E. Joyle and A. G. Ourgand discussed retinal adaptation.

Alice R. Deutsch.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjuctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1
ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Deller, J. F. P., O'Conner, A. D., and Sorsby, A. **X-ray diameters of the living eye.** Proc. Roy. Soc., S.B. 134:456-466, Sept. 30, 1947.

To measure the diameters of the globe the subject undergoes 15 minutes preliminary dark adaptation. He is then seated facing the x-ray apparatus in a darkened room with his head immobilized in a clamp. A slit beam of Roentgen rays 0.5 by 50 mm. is projected so that it traverses the eyeball with the plane of the beam at right angles to the diameter to be measured. This excites the sensation of vision where the beam transects the retina. By moving the beam from side to side without changing its direction with respect to the diameter and questioning the patient as to his visual sensations, it is possible to determine a position where the beam is tangential to the retina, that is, the position where the reported sensation is that of a point of light. This position is marked by an exposure on a film introduced in front of the eye. The beam is then moved until it is again tangential at the opposite pole and its position again marked. On the developed film the distance between the two images gives the length of the diameter; thus any selected diameter can be measured provided its ends abut on the retina. As to the axial length, this is measured by determining the lateral projection of the posterior pole of the eye on a film by the method already described. A true lateral radiograph of the cornea is then taken on a dental film held at the inner canthus. A special cone is used carrying a cross-wire in its central ray, which impresses its image on both films. After development, the films are related to each other by superimposing the images of the cross-wire and the axial length measured between the corneal image and the slit image. Measurements may be regarded as accurate to the extent of ± 0.5 mm., the width of the slit.

A series of tables is presented. One displays the findings in 45 eyes of which routine clinical examination of refraction was combined with the measurement of the three diameters of the eye. A second shows the relation of diameters to each other and deviation from spherical shape in relation to refractive state; a third shows the volume of globe calculated on the assumption that the eye is ellipsoidal

(ratios of log. of volume/log. of the individual diameters). A fourth shows the volume in a series of eyes measured by L. Weiss (1897), assessed against the present series, the validity of the assumption as to calculated ellipsoid volume, and the application of the formula of ratio of log. of volume to log. of axial length. The fifth shows the relation of the computed total refraction to the axial length.

Theodore M. Shapira.

Wolff, Eugene. **A note on the attachments and action of the ciliary muscle.** Tr. Ophth. Soc. U. Kingdom 65:164-169, 1945.

The author attempts to describe the relationships of the origin of the ciliary muscle, the scleral spur and the ligamentum pectinatum. They all develop from a continuous mass of mesodermal cells in the neighborhood of the future angle of the anterior chamber. In the adult the tendinous fibers of the ciliary muscle arise partly from the scleral spur and from the ligamentum pectinatum. The percentage of origin from each structure seems to vary in different eyes and in different portions of the same eyes. In many cases the fibers of the ligamentum pectinatum pass outwards to give a tendinous attachment to some of the circular fibers and also to some of the radial fibers of the muscle, which form a tendinous ring.

The most posterior muscle fibers give place to the delicate muscle stars of Salzmann and are attached to fine elastic fibers continuous with the lamella of the suprachoroid. These posterior attachments of the ciliary muscle, consisting largely of delicate elastic tissue, seem to be adapted to allow the posterior ends of the muscle to pass forwards during contraction and to guide them back to their original positions on relaxation. Because of this, the action of the ciliary muscle causes as little disturbance to the choroid as possible. The ciliary muscle has no attachments to the ciliary processes, therefore, it is difficult to explain how it can draw the ciliary processes forward as is often stated. The forward movement of the ciliary processes would tighten those fibers which pass backwards to the posterior capsule of the lens and relax the anterior fibers of the zonule. The entire muscle gets thicker with contraction and this increases the cross-sectional diameter and may act as a sphincter to the ciliary ring. (5 figures.) Beulah Cushman.

2
GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Knisely, M. H., Bloch, E. H., Eliot, T. S., and Warner, L. **Sludged blood.** Science 106:431-440, Nov., 1947.

An outline and summary of 16 years of observation and experimentation is presented. The circulation of blood in the vessels of the internal organs of living anesthetized animals—amphibians, reptiles, birds and mammals—and in the bulbar conjunctiva of unanesthetized animals and man was observed. In 600 patients who had a wide variety of diseases the blood was changed from the normal, relatively fluid, state to a circulating sludge. This observation is not offered only as a criterion for the diagnosis of disease. Sludged blood does not traverse the smaller vessels and it is believed that this change in character is one of the fundamental processes of pathologic physiology that produces tissue damage fundamental to many diseases.

The observations on the conjunctiva were made with the corneal microscope familiar to the ophthalmologist. (1 figure, 53 references.) F. H. Haessler.

Mann, Ida. **Induction of an experimental tumor of the lens.** Brit. J. Ophth. 31:676-685, Nov., 1947.

Pathologists state that any tissue capable of cell division is capable of develop-

ing cancer yet neoplasms of the lens are unknown to ophthalmologists. Although mitoses occur in the subcapsular epithelium throughout life. It is not likely that the lens tissue is simply inherently resistant to malignant change or that the capsule inhibits new growth either by the tension it exerts or by its properties as a semipermeable membrane, preventing access of the required stimulus to the lens cells. This is not likely since lenses with ruptured capsules do not become malignant. A third possibility is that the lens owes its immunity to its lack of blood supply.

Pathologic techniques for the induction of experimental cancer include the use of a chemical carcinogenic agent such as methylcholanthrene, and the investigation of inbred laboratory animals. The first experiment consisted of the injection of the chemicals into the lens in situ of rabbits followed by repeated slit lamp examinations. No reactions whatever occurred for 10 months. The second experiment involved the transplantation of the lens to a new position where it could receive an ample blood supply. Mice were used and the chemically treated lenses, with capsule ruptured were implanted in the flank. Thirty-eight experiments were done and 26 tumors resulted; of these, three were cancers of subcapsular epithelium. These were highly malignant, true carcinomas and were reproduced exactly by transplantations. These tumors were chemically identical with lens substance and there was no doubt that they arose from the subcapsular epithelium of the lens. Thus lens epithelium is capable of becoming malignant and its poor blood supply is most probably a factor in its immunity. (9 photographs.)

Morris Kaplan.

Smelser, G. K., and Pfeiffer, R. L. **Influence of grenz rays on cell division and wound healing in the corneal epithelium.** Arch. Ophth. 39:1-8, Jan., 1948.

The eye is subjected to many forms of radiation for the purpose of treatment or diagnosis. Among these are the grenz rays, which have been used extensively for the past fifteen years. They are soft rays of 1 to 4 angstrom units, intermediate between the ultraviolet and the usual roentgen rays, and have some biologic properties in common with both. Grenz rays have been found of value in the treatment of superficial ophthalmic conditions, such as corneal ulcer or episcleritis.

The authors treated normal rats' eyes and eyes that were burned with the thermophore. Single exposure to grenz rays (410r) greatly inhibited cell division in the corneal epithelium for approximately five days. Grenz rays had no effect on the rate of epithelization of thermal burns made within six days of the irradiation. Thermal burns made eight days after a single irradiation healed more slowly than normal in 12 of the 13 animals studied. (2 figures, 11 references.)

R. W. Danielson.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Bliss, A. F. **Mechanism of retinal vitamin A formation.** J. Biol. Chem. 172:165-178, Jan., 1948.

The visual pigments needed for the experiments were obtained from the retinas of the common frog. It was found that fresh bleached solutions of the photosensitive pigment rhodopsin formed large quantities of vitamin A and that this vitamin formation was probably induced by a substance having the characteristics of an enzyme.

Francis M. Crage.

Dellaporta, A. **A case of transitory myopia after prontosil.** Proc. Ophth. Soc. Vienna p. 11, April 27, 1942.

A transitory myopia after prontosil therapy was favorably influenced by the local application of homatropin which indicates that in such cases the ciliary muscle is affected by the sulfa drug.

F. Nelson.

Euler, P. **Blindness through wood alcohol and its treatment, particularly with short wave diathermy.** Klin. Monatsbl. f. Augenh. 112:172-182, 1947.

In 20 cases of wood alcohol poisoning hot packs, subconjunctival and retrobulbar salt injections, retrobulbar injection of atropine and shortwave treatment of the eyes were given to produce hyperemia with increase in local metabolism. Short wave treatment proved beneficial in 90 percent of the patients who were subjected to it. (Bibliography.)

Max Hirschfelder.

Feigenbaum, A. and Kornblueth, W. **Human conjunctiva grafted on the chorioallantois of chick embryos.** Arch. Ophth. 39:67-79, Jan., 1948.

The experiments reported here show that it is possible to maintain human conjunctiva in fairly healthy condition outside the body by grafting conjunctival fragments onto the chorioallantoic membrane of developing chick embryos. The chief obstacle to be overcome in these experiments is native infection of the conjunctiva, which can be controlled only to a certain extent with the use of penicillin. The method presented seems to offer possibilities of a systematic study, under conditions excluding somatic factors, of the histogenesis of pathologic changes of the conjunctiva in various diseases, especially those caused by viruses. (7 figures, 3 references.)

R. W. Danielson.

Grignolo, Antonio. **The action of streptomycin on experimental infection of the eye produced by organism sensitive to streptomycin.** Boll. de la Soc. med.-chirurg. di Pavia, nos. 3 and 4, 1947.

Infection of the cornea and anterior chamber were produced in rabbits by the following organisms: Escherichia coli, Proteus vulgaris, Klegsiella pneumoniae (Friedlanderi), Pseudomanas aeruginosa, B. subtilis, Staphylococcus aureus. Identical inoculations were produced in both eyes. In most cases one eye was used as a control and the other was treated. Streptomycin ointments and irrigations were used in the corneal infections and subconjunctival and anterior chamber injections were used in the chamber infections.

Infections of the cornea produced by E. coli, B. proteus, B. Friedlanderi, B. subtilis and S. aureus treated within 12 hours responded to treatment. After 24-48 hours streptomycin was ineffective. Infections with B. pyocyaneous were not altered at any time. Ointments were found to be superior to irrigations. Infections of the anterior chamber by E. Coli and B. pyocyaneous were more resistant to treatment than the corneal infections. Injections of streptomycin into the anterior chamber two hours after inoculation arrested infection with E. coli but were ineffective in the pyocyaneous group. Injections after 12 hours were of little value. Subconjunctival injections produced no changes at all.

Experiments in vivo and in vitro have shown that there is no interference between the action of penicillin and that of streptomycin. The ointment contained 100,000 gamma per gram and was applied every three hours day and night. The solutions contained 100,000 gamma per cc. for irrigations and subconjunctival injections. A total of 50 gamma was injected into the anterior chamber.

Francis P. Guida.

Layton, A., Morgan, M. W., Jr., and Olmsted, J. M. D. **Refractive changes pro-**

duced by injection of fluids into the vitreous humor. Am. J. Physiol. 150:568-571, Oct., 1947.

Diets rich in galactose and intravenous injections of galactose have produced cataracts in the rat. The mechanism involved was thought to be an accentuation of the osmotic difference between the lens and aqueous humor resulting from a decreased permeability of the lens capsule.

The high incidence of cataracts and the refractive changes in human diabetics have therefore been attributed to abnormal osmotic pressure relations of the body fluids resulting from a high blood sugar. To ascertain whether local osmotic changes could also cause lens or refractive changes the effects on cats' eyes of intravitreal injections of hypotonic and hypertonic fluids was studied. If more than 0.25 cc. was injected, corneal edema from increased intraocular tension occurred. Similar temporary refractive changes, measured by retinoscopy, resulted after every fluid injection. A change of 1.00 to 3.00 diopters in the direction of hypermetropia was present in each animal injected. No lens clouding was seen. Amyl nitrite inhalations given with the injections inhibited the refractive changes. Adrenalin injections alone produced hypermetropia and the latter was increased when the adrenalin was given at the same time as the vitreous injections.

The cause for the refractive change was considered to be a mechanical one dependent on the blood content of the ciliary body and the consequent increase or decrease in the power of the lens through the action of a relaxed or tonic suspensory ligament. F. M. Crage.

Leopold, I. H., and Steele, W. H. **Penetration of locally applied BAL into the anterior chamber of the rabbit eye.** Arch. Ophth. 38:192-198, Aug., 1947.

Studies were made on rabbits to determine the penetration of BAL (2,3-dimercaptopropanol) into the aqueous when applied to the cornea. BAL essentially neutralizes the arsenic in burns due to lewisite (2-chlorobetachlolorinylarsine).

Aqueous solutions of BAL deteriorate more rapidly than solutions in ethylene glycol and the more dilute the aqueous solutions of BAL the more apparent the loss. Greater penetration into the aqueous humor occurs from the use of a 5-percent solution of BAL in water than from the use of a 5-percent solution of BAL in ethylene glycol. BAL penetrates more readily from a water-containing base, such as K-Y jelly, than it does from a nonaqueous base, such as Friedenwald-Fuqua ointment. John C. Long.

Rosso, Silvio. **A study of purine substances in the aqueous humor.** Ann. di ottal. e clin. ocul. 72:628-536, Oct., 1946.

By experiments on rabbits and man Rosso finds that the purine content of the aqueous varies more or less directly as the purine content of the blood serum. His researches indicate that inflammatory manifestations of the gouty type may occur in ocular tissues as well as elsewhere whenever conditions are favorable for the precipitation of uric salts, since uric acid is always present in the ocular fluids in varying quantities and is increased in hyperuricemia. Harry K. Messenger.

Schmerl, Ernst, and Steinberg, Bernhard. **The role of the diencephalon in regulating ocular tension.** Am. J. Ophth. 31:155-158, Feb., 1948. (6 figures, 12 references.)

Sondermann, R. **The physiology and pathology of intraocular pressure.** Klin. Monatsbl. f. Augenh. 112:113-124, 1947.

Sondermann does not believe that the intraocular pressure is maintained as a result of secretion of aqueous humor. The intraocular pressure is the result of a

damming up of the venous circulation on its way through the sclera and is only modified by the regulatory activities of the ciliary body and the canal of Schlemm. The intraocular pressure is shown to be the difference between the 50 mm. pressure in the vortex veins and the 25-mm. osmotic pressure. The pressure in the veins sinks abruptly after they leave the sclera. With advancing age the sclera becomes still denser, but an increased formation of aqueous and often enlarged Schlemm's canal regulate the intraocular pressure and keep it normal. Only if these emergency mechanisms fail in their regulatory functions because of sclerosis or inflammation will the intraocular pressure establish itself on a level higher than normal. This is the case in chronic simple glaucoma. Acute glaucoma is caused by a sudden exclusion of the regulatory mechanism. It is usually caused through a sudden pushing forward of the iris which blocks the chamber angle and prevents the outflow of aqueous. The pressure in the retinal veins is only about half of that in the vortex veins and is only slightly higher than the intraocular pressure. Almost no outside pressure is exerted on these retinal veins. The ciliary arteries with their thicker walls and more adventitia are also less exposed to outside squeeze and the question of stagnation within their lumen is of less importance. However, a certain amount of choking may exist and may act as an equalizing factor for the variations in the general blood pressure. This is particularly important when there is severe vascular hypertension. The persistence of higher arterial and venous pressures within the scleral channels causes a more even and a more quiet blood circulation within the eyeball. The circulatory stagnation prevents the rapid circulation that is sometimes required in pathologic, especially in inflammatory, conditions. Paracentesis and medication with pilocarpine lessen this stagnation and dilate the vessels which leads to improved circulation.

Max Hirschfelder.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Ahlenstiel, Heinz. **The entoptic phenomenon of Maxwell's spot in the normal and in the color blind.** Arch. f. Ophth. 148:162-167, 1947.

The shape of Maxwell's spot (central fovea) is studied entoptically in 127 normal and 94 color blind persons. Numerous forms of the spot are pictured and the conclusion is reached that under certain conditions the color blind notice this phenomenon more easily than the normal person. E. Schmerl.

Ahlenstiel, Heinz. **The red-green luster in the colorblind especially in the dichromates.** Arch. f. Ophth. 148:168-170, 1947.

The author is a protanope. He and some deuteranopes observed that the borderline between a green and a red area showed a slight luster. Insufficient discrimination between the reflected red and green light of the borderline is offered as an explanation of this phenomenon. E. Schmerl.

Albaugh, C. H. **Contact lenses.** Ann. West Med. and Surg. 1:369-373, Nov., 1947.

The author reviews the development of contact lenses. The indications for contact lenses are specific and the less the necessity, usually the shorter the wearing time. Many technical problems including the lens fluid remain to be solved. Although contact lenses worn for their cosmetic effect have become economically important this valuable therapeutic agent can often provide useful vision in otherwise hopeless cases. O. H. Ellis.

Brozek, J., Simonson, E., Bushard, W. J., and Peterson, J. H. **Effects of prac-**

tice and the consistency of repeated measurements of accommodation and vergence. Am. J. Ophth. 31:191-198, Feb., 1948. (5 tables, 7 references.)

Campos, Raffaele. **Practical notes for cylinder skiascopy.** Ann. di ottal. e clin. ocul. 72:726-748, Dec., 1946.

This succinct and clear exposition of the practice of cylinder retinoscopy is designed to do for Italian ophthalmologists what others have already done for those whose language is English, German, or French. Harry K. Messenger.

Candela, J. R. **Retinal complications in diabetes mellitus.** Arch. Soc. Oftal. hispano-am. 7:851-857, Sept., 1947.

The mechanism by means of which the retinal lesions in diabetes mellitus are produced is still entirely unknown. Formerly it was believed that the fundus picture found in hypertensive retinopathy was the same as diabetic retinopathy but later studies have proved that they are entirely different. A constant fact in diabetic retinitis is the decrease of the resistance of the capillary wall. Electrophoretic tests were made to determine alterations in the plasma proteins. In adequately treated diabetes mellitus one finds slight reduction of the total proteins with reduced level of albumin and an increased amount of B globulin. It has been proved that high protein diabetic diets are valuable in the prevention and treatment of diabetic retinitis. J. Wesley McKinney.

Carlevaro, Gianfranco. **Importance of the diagnosis of asymmetry or decentration in the prescribing of corrective lenses.** Ann. di ottal. e clin. ocul. 72:588-596, Oct., 1946.

A frequent cause of accommodative asthenopia is asymmetry or decentration of the cornea with respect to the pupillary aperture. This lack of coincidence of the optical center of the cornea with the center of the pupil gives rise to astigmatism quite independently of the curvature of the refractive surfaces of the eye. Correction of the corneal astigmatism as determined with the ophthalmometer is not enough; the total resultant astigmatism of the eye must be accurately corrected.

For objective determination of the astigmatism Carlevaro recommends axial or macular retinoscopy with Maggiore's retinoscope, which employs a transparent glass reflector instead of an opaque mirror with a central aperture. The asymmetry or decentration of the cornea may be studied with Gullstrand's square, but keratoscopic examination is neither easy nor rapid, and only the subjective tests can be relied upon for accurate determination of the total astigmatism.

In view of this factor of decentration it can be readily seen why the degree of astigmatism and the direction of the principal meridians may vary with the size of the pupil. Hence sometimes the astigmatic correction for near must differ from that prescribed for distance. A patient may incur accommodative asthenopia by holding his work very close, even though he is not myopic, in order to benefit by the smaller pupillary aperture which reduces the astigmatism due to asymmetry.

Attention is likewise called to the importance of asymmetry in the optics of aphakic eyes, especially where there is a coloboma, and of eyes that have suffered trauma in the anterior segment.

Harry K. Messenger.

Cibis, Paul. **Contribution to the pathology of the adaptation of definite retinal areas.** Arch. f. Ophth. 148:1-92, 1947.

The author studies form and color fields campimetrically. His purpose is to determine the time parameter involved in this test. He uses a Bjerrum screen 130 by 130 cm. in size at a distance of 115 cm. The time is measured which passes by before an object of definite size, color,

and brightness disappears. By help of a stopwatch the disappearance of the object is recorded for one or more meridians at different distances from the point of fixation. Daylight serves as illumination. The objects used are Engelking-Ecksteins pigments that have an area of 10, 20, and 50 square millimeters and are placed on a gray background of the same brightness. Practically the procedure is almost the same as in ordinary campimetry except that usually in perimetry slight movements of the object are preferred whereas in studying the "local adaptation" of the retina the object must be completely at rest. The resulting curves for the normal show a certain range of variation and resemble Wertheim's curve for peripheral visual acuity. Deviations from the normal were found in disturbances of color vision, diseases of the choroid, retina, visual pathways, and cortex, and in cerebral trauma. The studies will be completed by a second contribution.

E. Schmerl.

De Leonibus, Fernando. **Investigations concerning the shape of the conical cornea.** Boll.d'ocul. 26:433-448, July, 1947.

Six conical corneas were meticulously measured. Readings were taken at the center, and 4, 8, 12 and so on to 32 degrees above, below, nasally and temporally from it in the two meridians of greatest dioptric difference. In six tables and diagrams the results concerning radius of curvature and refractive power are demonstrated. These measurements, taken with the Helmholtz-Javal-Schiøtz ophthalmometer, show that there was no approximately spheric zone in the center in any of the eyes and that a decentration of the corneal vertex was present in all of them; the refractive power was unusually high in at least one of these eyes, in which it was reaching 140 diopters maximally. (Bibliography.)

K. W. Ascher.

Goldmann, H. **Contribution to angioscotometry.** Ophthalmologica 114:147-158, Sept., 1947.

The purpose of this study was to investigate the basic mechanism underlying the scotomas which conventionally are designated as angioscotomas. Goldmann has found that the width of a certain angioscotoma (near the upper border of the blind spot) depends characteristically upon the contrast between target and background: The greater the contrast the narrower the scotoma. The increase in width caused by the decreasing contrast occurs in asymmetric fashion, the scotoma gaining in width chiefly in the direction in which the target is carried across the field. The increase in the width of angioscotomas that occurs characteristically after compression of the globe or neck compression also occurs in asymmetric fashion. The point of disappearance of the target remains more or less the same while the place of reappearance is shifted under these experimental manipulations.

Similar observations have been made with a setup that creates an artificial scotoma when a projected target disappears over a bandshaped area because of lack of a reflecting background. The author explains the asymmetric character of the natural angioscotomas and their artificial counterparts as a phenomenon of spatial summation (see Marshall and Talbot, Visual mechanisms, the Jacques Cattell Press, Lancaster, Pa., 1942).

Peter C. Kronfeld.

Hartridge, H. **Some fatigue effects on the human retina produced by using colored lights.** Nature 160:538-539, Oct. 18, 1947.

From his experiments the author concludes that fatiguing the eye to rays from about 65μ to 55μ causes changes in the red, yellow, and green parts of the spectrum but fatiguing the eyes simultaneous-

ly to these rays and to greenish-blue rays, produces little or no effect. The latter rays appear to inhibit the onset of the fatigue effects which rays from 65μ to 55μ would otherwise produce.

F. M. Crage.

Hecht, S., and Hsia, Y. **Colorblind vision. 1. Luminosity losses in the spectrum for dichromats.** J. General Physiol. 31:141-152, Nov. 20, 1947.

The authors feel that there is no completely adequate theory of color vision. The one having the most reasonable basis is that formulated by Young in 1807 which assumes the existence of three receptor systems in the retina for blue, green, and red. Young's supposition that colorblindness was due to the loss of one of these three receptor systems is still held in some form or other.

The author's dark-adapted foveal threshold test values of normal and color blind persons supports this theory of colorblindness but not the notion that these three systems contribute equally to the brightness of the spectrum. Because of this and because the color sensations reported by color blind persons do not support the idea of a lost or inactivated receptor system, they feel that a fresh explanation for colorblindness is necessary.

F. M. Crage.

Jaeger, Alfred. **The changes in the barrel shaped distortion by the eye.** Arch. f. Ophth. 148:152-161, 1947.

The author finds this distortion more pronounced for closer than for more remote objects. Demonstration of the phenomenon by the use of the checkerboard pattern is correct only for a definite distance of the observer from the object.

E. Schmerl.

Lindner, K. **The influence of environment and heredity on the development of school myopia.** Wien. Klin. Wchnschr. 59:867-868, Dec. 31, 1947.

Lindner mentions various theories about school myopia and discusses Steiger's theory which attempted to explain the elongated myopic eye on the basis of growth variation. The author obtained statistics from the Vienna and St. Poelten arch-diocese where he found that 48 percent of the Catholic clergy were myopic. He presents tables showing the amount of myopia, age and occupation of the parents of the priests most of whom did manual labor.

The anlage for both school myopia and for high myopia is similarly and rather evenly distributed in the population, therefor an environmental factor must be assumed. If this factor appears late, then the development of myopia begins late, too. Even though we are sure that so-called school myopia is hereditary, it does not develop without the influence of an environmental factor.

Theodore M. Shapira.

Mihalyhegyi, G. **New experiences with contact lenses.** Ophthalmologica 114:159-167, Sept., 1947.

The author's experiences with plastic contact lenses made from molds of the anterior segment have not been unusual and will therefore hardly be "new" to the American reader. Peter C. Kronfeld.

Obrig, T. E. **Solutions used with contact lenses.** Arch. Ophth. 38:668-676, Nov., 1947.

A research program was conducted throughout the year 1945 to obtain more information concerning the causes and prevention of clouding of the corneal epithelium by solutions used with contact lenses.

To eliminate varying personal equations, Obrig used his own eyes exclusively and employed the same pair of contact lenses in all experiments. The addition of carbon dioxide or oxygen to solutions for use with contact lenses did not

affect the time in which corneal clouding occurs. Solutions with osmotic pressure as high as that of 2.8-percent sodium chloride solution can be worn if the pressure is increased gradually. Correct osmotic pressure is important. The addition of amino acids and methyl cellulose to the solutions increases the time before clouding of the cornea occurs.

R. W. Danielson.

Pace, Mario. **The "invisible spectacles" and their practical use (new contact lenses made of plastic).** Boll. d'ocul. 26:481-504, Aug., 1947.

This is a rather complete review of the pertinent literature with justified criticism of the exaggerations noted. (3 pages of references.) K. W. Ascher.

Rocco, Alfredo. **Color vision.** Arqu. brasil. de oftal. 10:79-91, 1946.

The various grades of perfection or defect in color vision are briefly described, from heptochromia down to monochromia and achromia. The significance of the chromatic sense in relation to aeronautics is discussed. W. H. Crisp.

Ronchi, Vasco. **Recent theoretical developments concerning shape and color perception.** Boll. d'ocul. 26:281-316, May, 1947.

Rayleigh's rule lacks experimental verification. The resolving phenomena of the retina as well as of the photographic film are to be understood energetically rather than in the classic formal way. The photochemical deductions of Hecht will prove more helpful in understanding of the visual and acoustic phenomena, and also of color vision. The trichromatic explanation of color vision will have to be replaced by the assumption of a binary retinal mechanism; this will also explain the Purkinje effect in reduced illumination. (16 figures, 23 references.)

K. W. Ascher.

Santoni, A. **Contribution to the study of the form of the posterior segment of the globe in very high ametropia.** Ann. di ottal. e clin. ocul. 72:577-587, Oct., 1946.

With the aid of leaden casts made from formalin-hardened eyes it was found that the curvature of the posterior segment of both highly myopic and highly hypermetropic eyes is approximately elliptical and that the radius of curvature in each case is noticeably less than in emmetropic eyes. Diagrams with measurements and calculations are given.

Harry K. Messenger.

Schober, Herbert. **Color blindness due to head injury.** Arch. f. Ophth. 148:93-100, 1947.

In 1945 the patient was treated for a gunshot wound in the midline of the occipital bone. The underlying tissue was slightly involved. An examination of the eyes in 1946 revealed homonymous scotomas in the right upper quadrants. Color vision was tested according to Holmgren, Stilling and Nagel. Symptoms of protanopia as well as deuteranopia were found. Purkinje's phenomenon was missing, the adaptation to light was delayed. The findings are discussed in relation to the theories of color vision.

E. Schmerl.

Schober, Herbert. **Night myopia and its causes.** Arch. f. Ophth. 148:171-186, 1947.

Starting from the observation that at night sailors give their telescopes a turn to the minus side the author studied the phenomenon of night myopia in 12 persons. Several hundred tests with telescopes were made and night myopia was found in almost all of the tested persons. The average value amounted to -2.0D, with a standard deviation of ± 1.5D. To some extent the adjustment of the telescopes or the amount of night myopia depended upon the weather and the color of the observed object. With dimness the

composition of the natural light shifted to bluish green and the myopia increased by —0.5D. The myopia increased with the decrease in brightness of the observed object. The night myopia stimulated retinal sensitivity to light and it decreased the visual acuity. As possible factors that might produce night myopia the tendency to increased accommodation in the dark, and the increase in sensitivity to light are considered. This increased sensitivity in night myopia is caused by the formation of larger circles of diffusion on the retina. In emmetropia punctual imagery would have been produced. (References.)

E. Schmerl.

Sloane, Albert E. **Refraction clinic. Discussion.** Am. J. Ophth. 31:213-214, Feb., 1948.

Stoll, M. R., and Boeder, P. **Stereoscope as training instrument.** Arch. Ophth. 39:27-36, Jan., 1948.

This technical paper discusses the theory and use of the Brewster stereoscope. (2 figures, 2 references.)

R. W. Danielson.

von Tschermak-Seysenegg, Armin. **The principle of spatial coöperation of the eye muscles.** Arch. f. Ophth. 148:101-106, 1947.

The author presents a description which is largely a summary of his former studies of this problem. E. Schmerl.

Veloso, Paulo. **Recreative optics.** Rev. brasil. oftal. 6:75-84, Dec., 1947.

Optical illusions are described and illustrated by the various geometric figures commonly included in the literature of this subject. W. H. Crisp.

5

DIAGNOSIS AND THERAPY

Borioni, Domenico. **Metastatic meningococcic ophthalmia favorably treated with penicillin.** Boll. d'ocul., 26:337-339, May, 1947.

Intravenous, intramuscular, and subarachnoid application of penicillin influenced favorably a case of meningococcic meningitis associated with unilateral endophthalmitis in a two-year-old girl.

K. W. Ascher.

Bothman, Louis. **Minor surgery of the eye.** Surg. Cl. North America pp. 46-55, Feb., 1948.

This article is written for the nonophthalmologic practitioner. It is a series of brief descriptions of ocular diseases and injuries with equally brief consideration of the fundamentals of treatment. The author recommends the use of the 2-percent solution of pyribenzamine in cases of allergic conjunctivitis. The McReynolds technique for transplanting pterygia is described briefly. He also describes briefly the principles of closure of lacerations of the lids, emphasizing that through-and-through lacerations should be closed in layers.

The author describes principles of the removal of foreign bodies and warns against the use of anesthetic ointment by the patient in the home because of possible delayed corneal healing and the production of corneal ulceration. The treatment of various types of burns of the globe and of serpentic ulcers is outlined. For the treatment of acid burns irrigation with 3-percent sodium bicarbonate solution is suggested and for alkali burns 10-percent neutrol ammonium tartrate.

Benjamin Milder.

Fox, S. A. **Use of preserved cartilage in plastic surgery of the eye.** Arch. Ophth. 38:182-191, Aug., 1947.

Cartilage obtained at autopsy and preserved in merthiolate solution may be used in plastic surgery. Under proper conditions it may be kept for use as long as

two years. The use of isografts with this "pickled" cartilage is often easier and more satisfactory than the use of fresh autografts. Seventeen cases are reported in which preserved cartilage was used as an isograft. In four cases it was used in reconstruction of the lid to replace a lost tarsal plate. In nine cases preserved cartilage was used inside the orbit to repair depressions of the floor and walls due to fractures. The results were good.

John C. Long.

Levitt, J. M. **Guarded muscle scissors.** Arch. Ophth. 39:93, Jan., 1948.

In order to make the scissors safer in surgical procedures the author has modified the Aebli scissors by putting small spherical knobs in the ends and added elevator guards halfway between the tips and the screw. (1 diagram.)

R. W. Danielson.

Reeh, M. J. **Use of the goniolens for diagnosis of retained foreign body in the anterior chamber.** Am. J. Ophth. 31:336-337, March, 1948.

6

OCULAR MOTILITY

Bartels, Martin, **Nervous factors affecting the ocular movements.** Arch. f. Ophth. 148:107-110, 1947.

Using a schematic drawing the author enumerates a number of factors which in men, mammals, and lower vertebrates cause ocular movements. Stimuli might arise from the vestibulum, the neck, the frontal cortex, the corpora quadrigemina, the nucleus ruber, the cerebellum, the sympathetic, the cutis, the retina, the cochlea, the contents of the orbit, the movement of the limbs or the pelvis and from the urge to fuse the images.

E. Schmerl.

Cushman, B., and Sarro, L. **Vertical anomalies—presentation of vertical anomalies in 100 cases studied.** Quart. Bull. Northwestern Univ.-Med. Sch. 22:17-20, 1948.

Patients with strabismus who get no improvement from lenses or means other than surgical usually have a vertical imbalance. In operative failures a vertical imbalance is almost always found. A bilateral recession gives the most satisfactory result in uncomplicated convergence excess. A conservative recession of one or both external rectus muscles is indicated in uncomplicated divergence excess. If these anomalies are complicated by a vertical imbalance, there may be an undercorrection, but usually a marked overcorrection. In convergence insufficiency with secondary divergence excess or primary divergence excess, if complicated by hypertropia the result may be a definite overcorrection, but more probably an undercorrection. Of 100 patients who had ocular muscle imbalance 71 had vertical anomalies which required surgery. Vertical anomalies should be suspected in every case of imbalance. Irwin E. Gaynon.

Miles, P. W. **Clinic for binocular problems. Three emmetropic patients treated with aniseikonic glasses over 8- to 10-year periods.** Am. J. Ophth. 31:333-336, March 1948. (3 references.)

Ribas Valero, Ramón. **Biastigmatism and bicylinder combinations.** Arch. Soc. oftal. hispano-am. 7:858-889, Sept., 1947.

The subject is extensively reviewed.

J. Wesley McKinney.

Zavalia, A. U. **Divergence paralysis.** Arch. Soc. oftal. hispano-am. 7:890-898, Sept., 1947.

The characteristic findings of divergence paralysis are listed. There is homonymous diplopia for all objects beyond a certain distance, usually 25 to 50 cms. The angle of the deviation remains unchanged or decreased in secondary

positions of gaze. If an object is brought near to the patient, the two images approach each other and finally fuse when the object is 15 to 20 cms. away. When the object is brought still nearer, insufficient convergence causes crossed diplopia. Prisms base out give binocular single vision throughout the entire field of binocular fixation. There is no restriction in the field of fixation in either eye. The angle of the deviation is relatively constant on repeated examinations. The author reports a case of divergence paralysis. A 40-year-old man complained of diplopia of a few days duration. The images are not clear and, in trying to fixate, the images separate more. The eyes seem to be normal and no past history of any illness is given. There is hyperopia of one diopter in each eye. When vision is fixed at distance the eyes seem to be in orthophoria, but the patient sees a double image of light at 5 meters. Fusion of the images begins at 33 cms. and is held when the light is brought to 9 or 10 cms. consequently there is no convergence insufficiency. The diplopia is overcome with a prism of 10 diopters base out. Binocular single vision is conserved in all the fields of vision with this prism. Repeated examinations gave the same findings. Adequate glasses were prescribed and a month later at the patient's last visit all troubles had disappeared.

J. Wesley McKinney.

7

CONJUNCTIVA, CORNEA, SCLERA

D'Ombrain, Arthur. **The surgical treatment of pterygium.** Brit. J. Ophth. 32:65-71, Feb., 1948.

The author enthusiastically presents a method of surgical removal of pterygium evolved over many years. To the principles of excision of the head and the leaving of a perilimbal strip 4mm. in width, he added complete excision of all submucosal tissue from the limbus to caruncle. No sutures are used. This has yielded uniform success for the past seven years. He also discusses the pathology of the condition and concludes that pterygium is an irritative and secondarily a degenerative disease. (5 figures.)

O. H. Ellis.

Murray, W. B. **Notes on trachoma.** Canad. M. A. J. 58:81-82, Jan., 1948.

In his "notes on trachoma" the author aims to arouse the interest of the general practitioner to the problem of trachoma in western Canada. There the disease exists among Indians, Orientals and Central Europeans, and should be looked for in service men returned from Africa and Italy. Inflamed eyes should be watched with suspicion and prompt, proper treatment started before the serious complications appear. Symptoms, signs, diagnosis, and treatment are briefly discussed.

Francis M. Crage.

Panzardi, Domenico. **Use of fetal membranes for conjunctival plastic, particularly for pterygium.** Boll. d'ocul. 26:332-336, May, 1947.

Amniotic membrane was used in seven cases of severe symblepharon, one case of diffuse papillomatosis, and in 11 cases of pterygium. The results were satisfactory except in eyes with symblepharon. The fetal membranes were obtained from definitely healthy mothers and were kept in Ringer's solution before the implantation.

K. W. Ascher.

Romero, Eduardo. **Keratitis due to vapor of alcohol.** Arch. Soc. oftal. hispano-am. 7:912-914, Sept., 1947.

The author has observed an especial type of keratitis caused by alcohol fumes from shampoo. He does not agree with Valdecasas, who believes that the corneal damage is due to the caustic effect of chirmoya seeds, commonly steeped in al-

cohol and used as a treatment for head lice. J. Wesley McKinney.

Sorsby, Arnold. **The incubation period of ophthalmia neonatorum.** J. Obst. and Gynec. Brit. Emp. 54:842-847, Dec., 1947.

Of 290 consecutive cases of ophthalmia neonatorum, 84.5 percent occur within the first 10 days of life. In the first 5 days of life one sees 70 percent of gonococcal ophthalmia, 50 percent of diphtheroid, 37 percent of staphylococcal and occasional cases of inclusion blennorrhea. Of inclusion blennorrhea 20 to 25 percent begins between the 11th and 15th day of life.

Irwin E. Gaynon.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Drell, M. J., Miller, C. P., and Bohnhoff, M. **Gonorrheal iritis.** Arch. Ophth. 38: 221-244, Aug., 1948.

A technique for producing gonorrheal iritis in the rabbit eye is reported. The percentage of eyes yielding cultures containing the gonococcus fell progressively during the first week after inoculation. Thereafter, the infection became chronic in about one third of the eyes. It seemed that injury to the lens was the major factor in making the infection chronic.

The rabbit eyes exhibited many of the gross appearances of human gonorrheal iritis. The histologic picture was initially that of an acute fibrinocellular response and later that of a chronic inflammatory process. The inflammation remained localized to the anterior segment of the eye. The experimental infection lent itself well to in vivo testing of gonococcidal agents.

John C. Long.

Hayden, R. **Questionable sympathetic ophthalmia.** Proc. Ophth. Soc. Vienna p. 13, April 27, 1924.

Seven weeks after perforating injury to the left eye mild iridocyclitis of the right eye started. The exciting left eye was not enucleated because it had comparatively good vision and because, according to Hayden and Lindner, there is still no proof that removing of the exciting eye really can influence the course of established sympathetic inflammation. Vision in both eyes became nearly normal.

F. Nelson.

Lindner, K. **Case of expulsive hemorrhage operated with scleral trephining.** Proc. Ophth. Soc. Vienna p. 12, April 27, 1942.

A man, 63 years of age, with traumatic dislocation of the lens into the vitreous body, was operated upon with a loop after iridectomy. Immediately after removal of the lens a large choroidal detachment developed temporally. The sclera was immediately trephined and blood released through the opening. The bleeding stopped but another choroidal detachment began in the nasal section. Here again the sclera was trephined. The eye became blind. F. Nelson.

Pincus, M. H. **Aniridia congenita: report of five cases; genealogy; possibilities of treatment.** Arch. Ophth. 30:60-66, Jan., 1948.

Five cases of bilateral aniridia, with the genealogic charts and a discussion of the possibilities of treatment, are presented.

Several useful procedures are available to help unfortunate persons with this defect to obtain and to maintain useful vision. In order to be effective, treatment should be started early in life. Tatooing of the outer portions of the cornea, extraction of a cataractous lens and the wearing of an opaque contact lens with a 3 to 4-mm., clear central pupil are the methods of choice. (4 figures, 5 case histories, 12 references.) R. W. Danielson.

Scholz, R. O. **Epivascular choroidal pigment streaks, their pathology and pos-**

sible prognostic significance, additional cases. South. M. J. 41:112-118, Feb., 1948.

Three more cases are added to a previous report, and the literature is reviewed. The generally poor prognosis after the discovery of the fundus picture is discussed. The streaks consist of clumps of pigment deposited serially over partially but not completely sclerosed choroidal vessels. They appear not unlike a chain of black beads, and usually begin one to two disc diameters below the papilla, extend radially, and sometimes are seen far in the periphery. They must be differentiated from angioid streaks, pigment streaks following retinal detachment, and perivascular choroidal pigment atrophy. (8 figures, references.)

Bennett W. Muir.

Thomas, M., and Burnside, R. **Fibrous exudative cysts of the iris.** Am. J. Ophth. 31:331-333, March, 1948. (1 figure, 2 references.)

9

GLAUCOMA AND OCULAR TENSION

Brausewetter, G. **Comparison between Elliot trephining and Holth iridencleisis.** Proc. Ophth. Soc. Vienna p. 6, Jan. 19, 1942.

Seventy-five patients with chronic simple glaucoma submitted to Elliot trephining in one eye and Holth iridencleisis in the other. The tension was lowered in 77 percent of all cases. Second operations were necessary after 11 Elliot operations and 19 Holth. Eventual blindness resulted within four years in 13 Elliot operations and 11 Holth. No infections followed the Holth procedure. After the Elliot operations five eyes were infected and three lost. F. Nelson.

Christini, H. **Precapillary and capillary function in glaucoma.** Ann. d'ocul. 180: 530-541, Sept., 1947.

The same vascular degenerations which are at least a factor in practically all glaucomas also exist throughout the body. They are principally arteriolar. Microscopic thinning and atrophy is observed much more frequently in arterioles than venules. Ocular tension is an expression of the hydrostatic pressure in the uveal vessels diminished by the colloidal osmotic force of the plasma proteins, or the balance between intra-ocular secretion and reabsorption.

To coordinate precapillary and capillary function with intra-ocular tension, similar studies were made in 20 persons between the ages of 45 and 65 years with glaucoma and numerous similar persons without glaucoma. These studies included nasal septum oscillograms representing the capillary bed, subungual photoplethymographs representing the precapillary bed and measurements of intra-ocular tension. Coördinated graphs of these data were made before the inhalation of amyl nitrate during the vasodilative phase, and during the vasoconstrictive phase. In the glaucomatous before amyl nitrate inhalation the pulse volume was reduced in the nasal septum but not subungually. During the vasodilative stage changes in the nasal septum were practically nil and during the subsequent vasoconstrictive stage, pulse reduction, especially subungually, was less than in the non-glaucomatous. In the glaucomatous, the capillary and especially the precapillary bed does not react normally to vasodilators. One of the principal and initial causes of ocular hypertension in chronic glaucoma is precapillary arteriolar degeneration occurring also in the posterior uveal vessels. The hydrostatic factors involved in intra-ocular secretion and absorption are altered and vascular permeability is affected. Chas. A. Bahn.

Schorn, Julius. **Glaucomatous attack and weather.** Arch. f. Ophth. 148:121-128, 1947.

Ninety-one patients are studied. In 78 percent of the cases the glaucomatous

attack coincided with atmospheric changes, especially those in temperature.

E. Schmerl.

Wessely, Karl. **Problems of glaucoma.** Arch. f. Ophth. 148:111-120, 1947.

I. Glaucoma in excessive myopia. The author surveys 54 of his cases of glaucoma in myopia of more than −8.0D. He emphasizes the insidious development of the increase in tension, the pale, atrophic appearance and rather shallow excavation of the papilla and the frequent occurrence of glaucoma in surgical aphakia. II. Hemorrhagic glaucoma. A report of cases with thrombosis of the central retinal vein in one eye and chronic glaucoma in the other eye is presented. A common cause of both phenomena is considered.

E. Schmerl.

10
CRYSTALLINE LENS

Alexander, G. F. **The size of the standard eye and limbal sections.** Tr. Ophth. Soc. U. Kingdom. 65:232-239, 1945.

The author presents a highly mathematical paper with formulas for the type of knife that is best suited for a perfect cataract section. The perfect cataract section must be adjusted to the size of the lens. He found that the one-third section would suffice for ordinary cataracts, the two-fifths section should be reserved for especially large and hard lenses, and the four-ninths sections for the intracapsular removal of the lens. He discusses five characteristics of the perfect cataract section. A Beer pattern knife was accepted as ideal with a blade 26 mm. long, a base of 7 mm., and a point angle of 20° with a stop to prevent the point from moving within the limbus farther than 14 mm. (3 figures.)

Beulah Cushman.

Daily, Louis, Jr., and Daily, Ray K. **A procedure to facilitate intracapsular forceps extraction of intumescent cataracts.** Am. J. Ophth. 31:328-330, March, 1948. (7 references.)

Roper, K. L. **Lancaster's technique of cataract extraction.** Illinois M.J. 93:81-91, Feb., 1948.

The author describes in detail his modification of Lancaster's technique for cataract extraction. This technique is best suited for combating the major postoperative complications:—loss of vitreous, expulsive hemorrhage, delayed reformation of the anterior chamber, hyphema, iris prolapse, retinal detachment, secondary glaucoma and high degrees of astigmatism.

Essential features of the procedure are the use of the O'Brien akinesia with basal anesthesia, topical cocaine, and for prolonged effect, the subconjunctival and retrobulbar injection of a mixture of novocaine-pontocaine-cobephrin. Superior rectus bridle suture is used. The conjunctiva is incised from nine to three o'clock at the limbus and dissected back in the superior quadrant. After making a limbal groove with the Lancaster guarded knife, three appositional corneo-scleral sutures, similar to those used by McLean, are placed but not tied. Section is made with keratome and scissors. The author prefers peripheral button-hole iridectomy and an intracapsular extraction of the lens, where possible. Sutures are tied over the conjunctival flap, drawing the flap over the wound.

Results of 125 consecutive cataract operations, performed by this technique, are summarized. Seventy-four percent of the author's operations were of the intracapsular variety. The incidence of complications is strikingly low in all respects. The average postoperative astigmatism amounted to 0.85 diopters.

Benjamin Milder.

Schiff-Wertheimer, S., and Sedan, J. **Total lens extraction in retinal detachment.** Ann. d'ocul. 180: 513-520, Sept., 1947.

Is retinal detachment more frequent after intra-capsular or extra-capsular lens

extraction? Older statistics say yes, but the authors believe no, because older statistics were inaccurate and incomplete. The 1.3 percent of retinal detachment that statistically follows cataract extraction depends on numerous factors. Complications and failures are as frequent as vascular and other senile degenerative processes. Removal of the lens capsule in intracapsular extraction potentially increases the vitreous vibration and alters retinal tension especially during ocular movement. In the predisposed, retinal detachment is thus facilitated. In the young, intracapsular extraction is contra-indicated and in the middle aged it does not increase the risks of failure. The authors analyze 25 cases of retinal detachment in eyes which were previously operated upon for cataract by the intra-and extracapsular methods. Of these detachments, 60 percent were greatly improved by subsequent operation. In three of them 1½ years elapsed between the injury and the retinal detachment. Generally speaking, the authors believe that the technique and the trauma involved in the operation is more important than the type of operation technique employed. The importance of accurate and complete binocular examination is stressed. Chorioretinal disease and other evidence of constitutional or other degenerations due to injury or disease which may effect the advisability of the cataract extraction as well as the risks of the subsequent retinal detachment are sought. Chas. A. Bahn.

11
RETINA AND VITREOUS

Bagley, C. H. **Retinal detachment. A survey of the etiology and results of treatments on phakics and aphakics.** Am. J. Ophth. 31:285-289, March, 1948. (26 tables, 14 references.)

Dollfus, M. M. A. **Late results in retinal detachment surgery.** Ann. d'ocul. 180:547-552, Sept., 1947.

This interesting study of approximately 50 eyes successfully operated upon ten or more years previously for primary retinal detachment is most enlightening. In 90 percent, the location of original tears was visible. The operative techniques used included those of Gonin, galvano cauterization with juxtachoroidal tunnelization of Paufique, Coppez, cauterization with the pyrometric electrode, Weeve's with the perforating electrode, Guist's with potassium hydrate pencil, and Hudello's by electrolysis. The first was apparently the most efficient. Only 15 percent developed recurrences, and of these only 10 percent occurred more than six months after operation. The number of recurrences paralleled the number of detachments in the contralateral eye. Recurrences had no relation to the operative technique used. Drawings made at the time of operation showed that little or no progressive damage had been done in either retina or vitreous by the retinal detachment operation. Seventy percent did not have pathologic lens changes of importance. Detachment in the eye that was not operated upon was responsible for more cataracts than were observed in the eye that was. In 35 percent vision was better ten or more years after than at the time of operation. In fifty percent of those studied the ultimate vision in the eye with a successful operation was 0.2 or worse. The other visions ranged rather uniformly up to 0.6.
Chas. A. Bahn.

Eisenberg, I. J. **Congenital retinal fold with vitreous disorganization. A case report.** Am. J. Ophth. 31:337-338, March, 1948.

Foroni, Camillo. **New pathogenetic conception and treatment of retinosis pigmentosa.** Boll. d'ocul. 26:505-524, August, 1947.

Observation of 15 cases during 30 years convinced the author that retinosis pig-

mentosa was caused by an intoxication of the inner membranes of the eye that originated from a hidden chronic infiltration inflammation of the bulbar conjunctiva; heredity and febrille diseases are contributing factors. Without histopathologic evidence this etiologic conjunctivitis was assumed because of the difficulty encountered during retrobulbar or subconjunctival injections. For it, intensive massaging of the bulbar conjunctiva with a glass or metal spoon is suggested. This new procedure, called massoressi, produces extensive hemorrhages which the author considers to be pathognomonic. He even advocates it as a preventive measure to prevent retinal disease and claims secure and permanent arrest of retinal degeneration, rarefaction and eventual disappearance of the retinal pigment spots, and sometimes even an increase of visual acuity and improvement of visual fields and of hemeralopia.

K. W. Ascher.

Grafton, E. G., Jr., and Guyton, J. S. **The value of injecting saline into the vitreous as an adjunct to diathermy operations for retinal detachment.** Am. J. Ophth. 31:299-303, March, 1948. (3 tables 5 references.)

Lindner, K. **Two especially interesting cases of shortening of the bulbus.** Proc. Ophth. Soc. Vienna p. 3, Jan. 19, 1942.

A male, 31 years of age, with disseminated choroiditis, dislocated lens and amaurosis in left eye developed a retinal detachment in the right eye one month after cataract operation which improved temporarily under conservative treatment. Deterioration started again 1½ years later and vision was reduced to recognition of hand movements eccentrically. No tear was found. First the upper half of bulbus was shortened by 2 mm., two months later the lower half, and partial reattachment and improvement of the function resulted. Deterioration again set in after several months. Eventually complete reattachment was achieved after a third shortening operation in the temporal section. Corrected vision 6/24 and Jaeger 2 resulted.

The other patient; a man, 47 years of age, who had been operated upon for nuclear cataract in each eye at the age of eight years, developed retinal detachment in the right eye three years later. The eye became blind. The left eye developed chronic glaucoma 22 years after the cataract operation. A "trephining-cyclodialysis" was performed with loss of some vitreous. Subsequently there was retinal detachment of short duration. After reattachment there again was increase of tension. About seven years later retinal detachment was again noted but no tear found. A large radial resection of sclera was done above and temporally without improvement. A second excision in the upper half of the sclera several months later was temporarily successful. During the second postoperative week the scleral wound ruptured and a large staphyloma resulted. This was excised and the sclera sutured with silk. The end result was a partial reattachment and the corrected vision equalled 3/36. F. Nelson.

McKerman, R. L., and Lavery, F. S. **Bilateral retinal detachment.** Tr. Ophth. Soc. U. Kingdom 65:409, 1945.

The history of a patient with bilateral retinal detachment, 49 years of age, is presented. In each eye a "staphylomatous area" of the sclera was found during the operation. The first eye was suspected of having an intraocular tumor during the operation and the eye was enucleated. Ten months later he lost vision in the other eye because of a retinal separation. A staphyloma of the sclera was found and the conjunctiva closed.

Beulah Cushman.

Meyer-Schwickerath, Gerhard. **"Gliomarosettes" and similar formations.** Arch. f. Ophth. 148:139-151, 1947.

Forty-six cases of "gliomas" (retinoblastomas) were studied histologically. Thirteen times rosettes were found. They are described as spherical incompletely closed shells consisting of 60 to 70 tumor cells each. Folding of the retina and retinal rosettes occurred in nine of the 46 eyes. The retinal rosettes consisted of cells of the sensory epithelium. They are said to differ from the gliomo rosettes morphologically as well as ontogenetically. The discussion of the findings refers to Bailey's and Cushing's work. (References.) E. Schmerl.

Michaleson, I. C. **Retinal artery occlusion. A report illustrating the pathogenesis of the fundal appearances and the effect of acetyl-choline.** Brit. J. Ophth. 32:111-117, Feb., 1948.

The author presents an interesting experience of occlusion of the macular branch of the inferior temporal retinal artery of six days duration in a woman, 41 years of age. A retrobulbar injection of acetyl-choline relieved the spasm and restored the circulation; however, there was no notable change in the diameter of the other retinal vessels. The capillary stasis and anoxemia resulting from the diminished arterial inflow had produced a large white opacity of the retina which rapidly disappeared after the injection. (4 figures.) O. H. Ellis.

Loewenstein, Arnold. **Intramural vascular system (vasa vasorum) in retinal vessels.** Arch. Ophth. 39:9-26, Jan., 1948.

Vessels within the wall of retinal vessels have not hitherto been recognized. In general, only the walls of vessels with a caliber greater than 1 mm. are provided with vasa vasorum. The latter arise from adjacent small arteries and form a dense capillary network in the adventitia.

In unstained retinal specimens cleared in glycerin the author found that capillaries are present in many sclerosed vascular walls. Hemorrhage into the diseased wall from these intramural vessels is frequent, especially in cases of vasculitis retinae. He has not yet observed intramural retinal vessels in normal eyes.

New formation of vessels in the diseased retina is a well known fact, but the existence of intramural newly formed retinal vessels was not known. They seem to serve to improve a disturbed nutrition of the walls where new vessels have been described. The intramural vessels may serve to transport blood over an occluded or narrowed part of the lumen. (18 figures, 11 references.) R. W. Danielson.

Pridle, Ronald. **Miliary aneurysms with retinal degeneration.** Bull. Guthrie Clin. 7:128-131, Jan., 1948.

The author presents a white male, 12 years of age, with miliary aneurysms of the right eye. There was an associated extensive macular atrophy with pigmentation. Other atrophic and pigmentary areas were present in the lower temporal quadrant. A grayish connective tissue mass covered the lower half of the disc. The hyaloid artery was large and persistent. The eye had never been injured. The child had had severe pneumonia when he was 1½ years old. This was followed by perineal abscess and bilateral otitis media. He had recurrent croup until he was nine years old and tonsillectomy and adenoidectomy when eleven. The youngster is now healthy, robust, cooperative, and intelligent. All clinical and laboratory investigations were negative.

The author says that it will be interesting to observe whether this is truly a case of miliary aneurysms with retinal degeneration or an early case of angiomatosis or Von Hippel's disease.

Francis M. Crage.

Puntenney, Irving. **Vascular fundus disease with especial reference to the classification of Gifford and MacPherson.** Quart. Bull. Northwestern Univ. Med. Sch. 22:74-79, no. 1, 1948.

A modification of the Gifford and MacPherson classification is suggested to include essential hypertension in Groups 1 and 2 and the collective grouping of pure angiospasm with well developed essential hypertension in groups 3 and 4.

Irwin E. Gaynon.

Shapland, C. D. **Traumatic detachment of the retina.** Tr. Ophth. Soc. U. Kingdom 55:187-211, 1945.

The author reports 16 patients with detachment of the retina while in military service. They averaged 12 years younger than a group of 425 civilian patients that he reported in 1933. The reposition was achieved in 10 of the military men and in less than one-half of the civilians. Eleven of the military men were emmetropic or had hypermetropia and there was no aphakia, whereas myopia was common and of higher degree in the civilians.

Beulah Cushman.

Weekers R., Roussel, F., and Heintz, A. **Visual recovery after successful retinal detachment surgery.** Ann. d'ocul. 180:521-529, Sept., 1947.

Defective central and peripheral vision, light adaptation, and fusion frequently follow successful retinal detachment surgery. After three months no operation can restore visual function completely. Central and peripheral retinal degenerations are frequent, as are central scotomas which may cause twilight amblyopia. The chorioretinitis produced by operation shrinks one or more isopters and often disorganizes fusion. Efficient preoperative examination usually indicates the prognosis, the surgical risks involved, and the most desirable technique.

In the twenty-five retinal detachments successfully operated upon by the authors they used superficial non-perforating coagulating diathermy, perforating diathermy, and the evacuation of subretinal fluid with galvanocautery. Repeated extensive detailed examinations were made before and after operation. The importance of potentially pertinent subjective information is stressed.

The rods and cones and the pigment epithelium depend primarily upon the chorio-capillaris for nutrition. The retinal and subretinal fluid is normally biologically similar to the other body tissue fluids. During detachment it becomes lowered, and oxidation and glycolysis are retarded. Evidences of temporary or permanent retinal ischemia and anoxemia are therefore not surprising. Prompt surgical treatment is urgently indicated in all retinal detachments that are not due to neoplasm or inflammation, and if degenerative changes have not made surgical risks prohibitive. Chas. A. Bahn.

12

OPTIC NERVE AND CHIASM

Bruetsch, W. L. **Unilateral syphilitic primary atrophy of the optic nerves: an anatomic study of two cases.** Arch. Ophth. 30:80-91, Jan., 1948.

Syphilitic optochiasmatic arachnoiditis, which is frequently present in neurosyphilis, has nothing to do with the causation of the atrophy of the optic nerves. The most efficacious treatment of syphilitic optic nerve atrophy is malarial therapy, aided by concomitant and subsequent courses of penicillin, each course consisting of the administration of at least 5,000,000 units. (3 figures, 2 case histories, 8 references.) R. W. Danielson.

Esposito, A. C. **Tryparsamide optic atrophy.** West Virginia M.J. 44, Feb., 1948.

Tryparsamide exhibits a toxic affinity for the optic nerve and its use in central

nervous system syphilis should be controlled by frequent detailed examination of the visual fields, central vision and fundi. The patient should be cautioned as to the symptoms of toxicity. At the first signs of damage tryparsamide should be immediately and permanently discontinued and other measures should be instituted. F. H. Haessler.

Hess, Leo. **Atrophy of the optic nerve associated with tabes dorsalis and with glaucoma.** Arch. Ophth. 38:199-220, Aug., 1947.

It is suggested that the atrophy of the optic nerve in tabes begins behind the bulbus, somewhere in the optic pathways, producing secondary degeneration along the optic nerve and the optic tract as far as, and including, the lateral geniculate body. A congenital or acquired anomaly of the spinal cord may predispose a patient to the development of tabes. It is fair to assume that an analogous irregularity in the structure of the optic nerve and optic tract may account for the variety of the visual defects associated with tabetic atrophy of the optic nerve. Evidence, including clinical cases, is presented to show that tabes dorsalis is not merely a disease of the spinal cord but may involve the diencephalon. The author also demonstrates that definite characteristics of body build and growth are clinically noticeable in tabetic persons with atrophy of the optic nerve, demonstrating an endogenous alteration of the diencephalic area. The above implies that syphilis is the precipitating, not the causative, agent in tabes and tabetic optic atrophy.

Like the primary atrophy of the optic nerve in certain cases of tabes dorsalis, "glaucomatous" atrophy of the optic nerve may be connected with a congenital anomaly of the diencephalic area. Atrophy of the optic nerve is prone to develop either in persons with asthenia associated with acromegaloid features or in those with a pyknic body build associated with signs of adiposogenital disturbance.

John C. Long.

Kaminskaia-Pavlova, Z. **The role of the premorbid state in the beginning of ocular fundus changes after cranial trauma.** Semana Méd. 15:223-225, Feb. 5, 1948.

The author cites four cases of trifling trauma in which she thinks there might be good reasons to suppose that the injury had stirred up previously existing pathologic conditions so as to produce visual deterioration.

The first patient, a man, aged 42 years, sustained a slight blow on the head, and began to complain of nausea and reduced vision. Examination showed descending atrophy of the optic nerve, and the patient had other evidence of tabes. The second patient, said to have been a sharpshooter, suffered a cerebral contusion, with progressive loss of vision. The third patient was a woman of 45 years who had general vascular hypertension and had struck her head in a fall. She underwent spells of loss of consciousness, showed hemorrhages of the eye-grounds, and then some failing of vision, although the latter had previously been normal. The fourth patient was a man of 30 years who suffered reduction of vision after cranial trauma during a bombardment. He had a descending atrophy.

The author does not offer any analysis as to the validity of the previous histories of the patients as related to spurious claims concerning the causes of loss of vision. W. H. Crisp.

13

NEURO-OPHTHALMOLOGY

Bender, M. B., and Teuber, H. L. **Spatial organization of visual perception following injury to the brain.** Arch.

Neurol. and Psychiat. 58:721-739, Dec., 1947.

The authors discuss the problem as it hitherto had been studied, and concluded that the approach often was general and uncritical. They describe two of 12 cases, which were characterized by a specific disability to localize objects in a limited portion of the field of vision. They examined for reduced visual function, visual perception of spatial relations, and intellectual functions pertinent to generalized orientation in space. There is a complete report of the case of a 22-year-old Marine officer with a shrapnel wound in the region of the right motor cortex. (References.) Bennett W. Muir.

Cogan, D. G. **Neurologic significance of lateral conjugate deviation of the eyes on forced closure of the lids.** Arch. Ophth. 39:37-42, Jan., 1948.

This paper evaluates a diagnostic sign, a variant of Bell's phenomenon, which consists of a lateral conjugate deviation of the eyes on forced closure of the lids. It occurs in persons with intracranial disease.

Cogan finds that this sign is relatively infrequent in persons with no known neurologic disease. Of the present series of 156 persons, it occurred in only 3. With unilateral cerebral disease, a lateral conjugate deviation of the eyes with closure of the lids does occur in a significantly large percentage of patients. It was present in more than one-half of the present series. The deviation is characteristically to the side opposite the lesion (that is, to the side of the hemiplegia and hemianopsia). It occurs with lesions in the anterior or the posterior part of the hemisphere. However, with presumably unilateral lesions of the cerebellum, brain stem or labyrinth, the deviation of the eyes with closure of the lids was not significantly more frequent to one side than to the other.

As a cognate sign of unilateral cerebral disease, deviation of the eyes on closure of the lids supplements, but does not replace, other signs. It may be present or absent when there is, or is not, gross paresis of conjugate gaze. Similarly, it may be present or absent with or without disturbances of the opticokinetic response, and with or without hemiplegic or hemianopic disturbances. (5 references.)

R. W. Danielson.

Javett, S. N., and Samuel, E. **Tumor of the optic chiasma.** Arch. Dis. Child. 22: 248-250, Dec., 1947.

A five-year-old boy had slight frontal headache for two months preceding the discovery of defective vision of the right eye with retention of only some of the temporal field. He had bilateral atrophy of the disc greater in the right eye. Eight hours after lumbar puncture the patient had a severe pain in the back and the right hip, followed by headache and vomiting. X-ray films showed a characteristic enlargement of the anterior part of the sella turcica with excavation of the under surfaces of both anterior clinoid processes and with increased size of the optic foramina, greater on the right side. A diagnosis of chiasmal glioma was made, and surgery done. After the optic nerve had been stripped, a large tumefaction about the size of a pigeon's egg was encountered. It was continuous with the chiasma and extended backward along the optic tracts. Removal of this lesion would have been technically impossible or nearly so. Chiasmal glioma is essentially a condition of childhood. Growth is slow and may not lead to death for many years. The visual effect is bizarre. In the differential diagnosis one must consider craniopharyngioma, pituitary tumor, aneurysm of the

circle of Willis, suprasellar meningioma, and chiasmal arachnoiditis with cyst formation. (6 figures, references.)

Bennett W. Muir.

Puglisi-Duranti, G. **Treatment of neurolues and particularly of tabetic opticoneuritis and neuro-ophthalmic affections.** Riv. oto-neuro-oftal. 22:179-221, May-June, 1947.

The writer reports 21 cases of neurosyphilis in men from 25 to 43 years of age. There were 2 cases of tabetic optic atrophy, 2 of postneuritic optic atrophy, 2 of retrobulbar neuritis, 5 of optic neuritis, 2 third nerve paralysis and 4 of paralysis of the seventh nerve. Chemiotherapy was associated with the simple rachicentesis or subarachnoid injection of air, phenolsulphonphthalein or even arsenic. In almost all cases the treatment was followed by a rapid improvement of the symptoms, a shortening of the duration of the disease and in some cases by the recovery. The meningeal reaction to the subarachnoid injection was never intense. (Bibliography.)

Melchoire Lombardo.

Matteucci, P. **Congenital nystagmus and spasmus nutans with unusual vertical dissociation in an individual with normal visual and vestibular apparatus.** Boll. d'ocul. 26:317-331, May, 1947.

In an eight-year-old boy an odd posture of the head was noted since early life. The head was tilted forward and exhibited slight rotary movements that were not synchronous with the nystagmus present and continued at all times except during sleep. The eyes, with visual acuity of 9/10, emmetropia, binocular fusion and three diopters of exophoria, presented a horizontal-rotary type of nystagmus with a balance-like vertical component which was characterized by elevation of one eye when the other was depressed. Elevation and depression of the eyes were accompanied by lid elevation and drooping and both were irregular in extent and frequency. The frequency of the vertical movements was less than that of the horizontal-rotary nystagmus which occurred about 50 to 70 times a minute. There was no history of severe infection and the parents and seven siblings were healthy. The discussion of the unique observation is inconclusive. Poetzl and Sittig described similar movements in the Hertwig-Magendie syndrome and related them to a lesion in the posterior longitudinal fasciculus. On the other hand one might assume that the spasmus nutans and nystagmus are congenital and the vertical dissociation of the latter could be ascribed to a more recent process, possibly multiple sclerosis. (Bibliography.)

K. W. Ascher.

14

EYEBALL, ORBIT, SINUSES

De Voe, A. G. **Repair of orbital deformities with glass wool.** Arch. Ophth. 38:245-247, Aug., 1947.

Depressed fractures of the orbital floor are frequently associated with traumatic enophthalmos. A similar type of cosmetic defect in the position of the lids may be seen following some uncomplicated enucleations in which there has been atrophy of the orbital fat. Both types of defect may be remedied by the subperiosteal insertion of inert material in the floor of the orbit so as to restore the orbital volume to its original mass. Many materials have been so used. These include autogenous and preserved cartilage, autogenous and preserved fascia lata, bone, tantalum wool, plates, ribbon and acrylic plates.

Glass wool, known as "fiberglas," has been found to be an excellent material for the subperiosteal insertion. It is nonabsorbent, is not affected by tissue fluids, does not produce toxins, is not susceptible to attack by bacteria and is not considered carcinogenic.

John C. Long.

Diaz Gómez, E., and Marín Amat, M. **Two cases of pseudo-tumors of the orbit, one of the inflammatory type and the other of a hydatid cyst. Treatment.** Arch. Soc. oftal. hispano-am. 7:899-908, Sept., 1947.

Two cases of pseudotumor of the orbit are reported. From the clinical standpoint a diagnosis of neoplasm of the orbit was made in both. A 45-year-old woman had developed an almond-sized painless mass in the right orbit at the superior external angle during the previous year. Exophthalmos. edema and ptosis of the right upper lid were noted. Ocular movements were limited in all directions. Upon exploration, an encapsulated mass of inflammatory tissue was removed from the orbit, which also contained glandular tissue from the lacrimal gland. The second patient, a 16-year-old girl, had had an irreductible, painless exophthalmos of the left eye for three months, with ptosis of the left upper lid and limitation of the ocular movements. Visual acuity was almost nil. Upon exploration, liquid was found in the superior part of the orbit which was enclosed in a hydatid membrane. Recovery was uneventful in both cases. J. Wesley McKinney.

Hughes, W. L. **Integrated implants and artificial eyes for use after enucleation and evisceration.** Am. J. Ophth. 31:303-310, March, 1948. (6 figures, 3 references.)

Naffziger, H. C. **Exophthalmos. Some principles of surgical management from the neurosurgical aspect.** Am. J. Surg. 75:25-41, Jan., 1948.

Unilateral exophthalmos necessitates a diagnosis of the type of lesion and its location. Is it orbital, intracranial, or both? Where the protrusion is bilateral the lesion is not removable and decompression is indicated. With normal bulbar extension of 11 to 20 mm. on the exophalmometer it is not always possible to say that a state of abnormal protrusion is present. By looking down on the cornea from above and comparing the positions relative to the superior orbital margin one can determine a difference in the relative positions of the bulbs. Unilateral protrusion suggests a tumor. With the latter a difference of 5 or 6 mm. on the exophthalmometer is usually seen. Goiter, aneurysm, cavernous sinus thrombosis, and mucocele have caused unilateral exophthalmos. Lesions on one side, confined to the anterior part of the orbit should be treated by the ophthalmic surgeon. The anterior route is the operative approach. Reese, Davis, and Benedict have described suitable procedures the choice of which depends upon the location of the lesion.

As early as 1915 the author produced bilateral decompression by a transcranial but extradural route. Visual improvement resulted where bilateral exophthalmos, from general causes, existed.

The experiences gained by such wide orbital exposure has helped when applied to patients with unilateral tumors, for the technique is the same.

Anterior pituitary injections in animals have shown that the increase in orbital content is dependent upon hormonal and constitutional disturbances. Exophthalmometer readings in those requiring surgery have ranged from 22 to 35 mm. About 16 is the average normal.

In thyrotoxicosis decompression should not be delayed too long; the most important surgical indication in this type of exophthalmos is diminishing vision. When decompression is required, the wider the bone removed the better the result. Krönlein and other restricted procedures are very unsatisfactory.

The surgical procedure employed by the author is described in detail. Frontal bone flaps, smaller than originally, are used and the dura is peeled from the or-

bital plate. Removal of bone from the orbit and incision of the annulus of Zinn, where necessary, complete the important steps in the operation. Postoperative progress is described in detail. Bulbar pulsation is easily seen, protrusion is lessened quickly but returns to some degree temporarily. The choked disc disappears quickly without unroofing the optic foramina. The operation for unilateral intraorbital tumors varies but little from this transcranial extradural operation. Other methods of decompression are referred to in brief. Francis M. Crage.

15

EYELIDS, LACRIMAL APPARATUS

Agnello, F. **Palpebral ephidrosis in the light of modern theories on pathology of the sympathetic system.** Riv. oto-neuro-oftal. 22:222-228, May-June, 1947.

A boy, 15 years of age, complained of continuous lacrimation of both eyes with burning sensation and itching of the lids. The lids showed hyperchromic spots near the orbitopalpebral fold and looked as though covered by water. Injections of atropine gave only temporary relief. The writer suggests that the lesion is probably a result of a disfunction of sympathetic innervation. Melchiore Lombardo.

Armstrong, C. J., and Garcia, F. A. **The use of a composite graft in reconstructive surgery of the lower eyelid.** Plastic and Reconstructive Surg. 3:79-83, Jan., 1947.

Brown and Cannon have used a composite graft from the helix of the ear for nasal reconstruction, and the authors applied this technic to reconstruction of the lower eyelid in four cases. Under local anesthesia all cicatricial tissue removed, the lid margin is straightened and the complete defect is exposed. A pattern of it is mapped out on the aural crus. Then the composite graft is cut with a no. 11 Bard-Parker blade, which cuts through all layers. Interrupted sutures (6-0 silk) are used along both edges to hold the graft in place. One arm of each suture is left long to tie over a vaseline gauze-cotton stent. The donor area is closed without formation of a defect.

The skin on the orbital side of the graft is tailored or removed so that the conjunctiva is used to its fullest extent. If a normally functioning eyeball is present, the skin on the ocular surface of the grafts should be replaced with an oral mucous membrane graft at a secondary stage. (11 photographs.) Alston Callahan.

Fox, S. A. **Some methods of lid repair and reconstruction. V. Displacement of the canthi.** Am. J. Ophth. 31:317-322, March, 1948. (6 figures, 3 references.)

Mohs, F. E. **Chemosurgical treatment of cancer of the eyelid: a microscopically controlled method of excision.** Arch. Ophth. 39:43-59, Jan., 1948.

In the chemosurgical treatment of cancer of the eyelid, as in the treatment of cancer in other sites, the microscopic control is accomplished by means of a process consisting of the following steps: (1) in situ chemical fixation of the tissues suspected of being cancerous by means of a zinc chloride paste; (2) excision of a layer of the fixed tissue; (3) location of the cancerous areas by systematic microscopic examination of the excised tissues; (4) further chemical treatment of the areas demonstrated to be cancerous, and (5) repetition of the process until the cancer, including all its irregular extensions, has been entirely excised.

The chief advantage of the chemosurgical treatment of cancer of the eyelid is the microscopic control of excision afforded by the method. The reliability of the method is attested by the high rates of cure. (15 figures, 6 tables, 8 references.) R. W. Danielson.

Sugar, H. S., and Forestner, H. J. **Plastic implant for sunken lid.** Illinois M. J. 92:219-224, 1947.

A methyl methacrylate implant (27 to 30 mm. in length and 5 to 8 mm. in width) was inserted beneath the orbicularis muscle in 20 patients. Satisfactory cosmetic results were obtained in all. (6 figures.) Irwin E. Gaynon.

Walser, Erwin. **Nida's ptosis operation.** Arch. f. Ophth. 148:129-138, 1947.

Fifteen operations were performed. The results were very satisfactory. The author describes the procedure quoting from Nida (Bull. Soc. Ophthalm. Paris 1928. No. 9, 566): "A narrow tarso-conjunctival strip is pulled through underneath the tendon of the superior rectus. The strip is taken from the margin of the tarsus. The free end of the strip is stitched to the underlying tissue near the site of its origin." E. Schmerl.

16

TUMORS

François, Jules. **Intraocular Schwanoma.** Ann. d'ocul. 180:542-545, Sept., 1947.

Schwanoma or neurinoma, is a tumor which originates in the sheath of Schwann in the cerebro-spinal nerves. Pathologically, its lesions are identical with those in von Recklinghausen's disease. Cell nuclei are small, elongated or truncated at the ends; the protoplasm is reticular or fibrillar and usually elongated. Although not usually malignant it is potentially so, beginning in meningoblasts or nevus cells. Retinal Schwanoma occurs mostly in the young.

In the case reported, a 44-year-old woman with von Recklinghausen's disease had observed visual failure in one eye one month previously. The eye was totally blind when examined. The retina was detached and a large mass was observed in the periphery. The eye was enucleated, with a tentative diagnosis of melanotic choroidal sarcoma. Sections were characteristic of Schwanoma, the site of which depends upon the location of the ciliary nerves. Chas. A. Bahn.

Miller, D., and Bowling, J. L. **Orbital hydatid.** Brit. J. Surg. 35:211-212, Oct., 1947.

A case of orbital hydatid is presented. The patient, a female white child aged 4½ years, complained of poor vision in the left eye. There was a marked exophthalmos, the cornea was directed downward, the nerve head swollen, and the superior rectus paretic. The vision was reduced to counting fingers.

After raising a frontal osteoplastic flap, the frontal lobe was retracted and the orbital plate removed. Under the orbital fascia and fat a glistening cyst was found. After aspiration of clear fluid it was removed in toto. There was a return to normal but the vision was not mentioned.

The cyst wall revealed a typical hydatid membrane. The literature and five other reported cases are briefly described. Francis M. Crage.

Wolff, Eugene. **The origin of the malignant melanomata.** Brit. J. Ophth. 32:72-82, Feb., 1948.

In a carefully prepared article the author reviews the literature and points out the important contributions that have been made regarding the origin of the malignant melanomata. He believes that these tumors do not arise from a single cell type. Malignant melanomata are known to arise from branched chromatophores, proliferation of surface epithelium and nevus cells (of neurogenic origin, since nevus cells are developed from the end apparatus of the sensory nerves). The nevus should be regarded as a composite of these three types of cells; each may proliferate alone or with the others pro-

ducing a malignant pigmented tumor, the final structure of which depends upon the relative proportions of the three types of cells. (7 photomicrographs.)

O. H. Ellis.

17

INJURIES

Amendola, Francisco. **Ocular manifestations of foliaceous pemphigus.** Arq. brazil. de Oftal. 10:105-119, 1947.

This paper to be published later in the American Journal of Ophthalmology.

W. H. Crisp.

Doppel, H. **Iron splinter, healed in iris, removed after 37 years.** Proc. Ophth. Soc. Vienna p. 10, April 27, 1942.

In a man, 42 years of age, showing signs of endophthalmitis with hypopyon, a foreign body could be demonstrated in the iris near the pupillary margin directly and with X-ray. Uneventful recovery followed removal of the splinter. F. Nelson.

MacRae, Alex. **Injuries to the eyeball excluding intraocular foreign bodies.** Tr. Ophth. Soc. U. Kingdom 65:305-317, 1945.

The author reports 5178 patients with eye injuries who came to the Eye Hospital in Newcastle in 1943, and 113 of them, or 2.2 percent, were serious enough to require admission. The total time lost to industry with these injuries was 17.4 years. Among patients with nonpenetrating injuries were some with hypopyon ulcers, vitreous opacities and dendriform ulcers. Beulah Cushman.

McLaughlin, R. S. **Chemical burns of the human cornea.** Tr. Am. Acad. Ophth. pp. 112-114, Nov.-Dec., 1947.

Employees who are subject to ocular burns should be trained in their emergency treatment. First aid should be with tap water from a faucet, bucket, or a hose. Attempts at chemical neutralization should be postponed until later and when the chemical action is understood. After emergency irrigation the treatment may include the instillation of 0.5 percent pontocaine, irrigation with a siphon of saline, and the removal of foreign matter, preferably with cotton swabs, chemical analysis of the offending substance, staining with fluorescein, a second washing, and restaining. Diseased epithelium is then removed with cotton swabs under the biomicroscope. Final irrigation with stainless merthiolate and instillation of sulfathiazole ointment is followed by closing of the eye with a cover. Patients with local or general evidences of infection are hospitalized. Potentially permanent corneal opacities are treated with 0.5 percent solution of choline chloride instillations, four or five times daily. Sorsby's amniotic membrane grafts are advised in all deep corneal and conjunctival burns. In 800 consecutive cases reported, permanent corneal opacities occurred in less than two percent.

Chas. A. Bahn.

Rudd, Charles. **Injuries to the eyeball excluding intraocular foreign bodies.** Tr. Ophth. Soc. U. Kingdom. 65:318-327, 1945.

One hundred cases of perforating injury were reviewed. Enucleation was necessary in 25 patients. There was one case of sympathetic ophthalmia in which vision of both eyes was lost. Suppuration occurred in seven eyes.

Beulah Cushman.

Uhde, G. I. **Eye injuries from so-called noncasualty war gasses. Report of cases.** Am. J. Ophth. 31:323-327, March, 1948. (4 figures, 9 references.)

18

SYSTEMIC DISEASE AND PARASITES

Tassman, I. S. **Ocular changes in the metabolic diseases.** Virginia M. Monthly 75:70-74, Feb., 1948.

The main portion of this article deals with the ocular changes related to dia-

betes. After a brief consideration of the relationship between the autonomic nervous system and the endocrine glands, the author describes the ocular picture produced by sympathetic hyperfunction and hypofunction. The former is characterized by proptosis, widened palpebral fissure, and tearing, with dilated pupil and the latter is manifest as Horner's syndrome. The author discusses briefly the Laurence-Moon-Biedl syndrome, in association with pituitary hypofunction.

In diabetes, there is no correlation between blood sugar level and the appearance of retinal hemorrhages, but there is a correlation between blood sugar level and transient changes in refraction, accommodation, and vision. Oculomotor pareses occur in diabetes. Rubeosis of the iris is described. The retinal changes are predominantly hard yellow exudates, sometimes in circinate arrangement, deep retinal hemorrhage, preretinal hemorrhage and sometimes retinitis proliferans. They depend on the duration of the diabetes rather than its severity. The hemorrhages are probably not on an atheromatous basis. The retinal picture may be altered by coexistent diseases, such as nephritis or hypertension. However, even under these circumstances one may still recognize the underlying characteristic features of diabetic retinosis. The author, with Friedenwald, associates these retinal hemorrhages with increased capillary frigility. Benjamin Milder.

Valdecasas, Pedro. **Ocular myiasis.** Arch. Soc. oft. hispano.-am. 7:909-911, Sept., 1947.

A 15-year-old boy had external ophthalmomyiasis, the larvae of the genus Oestrus ovis were found in the bulbar conjunctiva. J. Wesley McKinney.

19

CONGENITAL DEFORMITIES, HEREDITY

Lisman, J. V. **Oxycephaly with optic atrophy. Report on results of the King operation.** Am. J. Ophth. 31:311-317, March, 1948. (8 figures, 12 references.)

Stephens, F. E. **Case of sex-linked microphthalmia.** J. Heredity 38:307-310, Oct., 1947.

Cases of microphthalmia occurring only in males in four different generations of a Utah family are reported. The inheritance seems to be recessive and sex-linked Irwin E. Gaynon.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Cogan, D. G. **Students' model for demonstration of action of the extraocular muscles.** Arch. Ophth. 39:92-93, Jan., 1948.

The author describes a model eye made from a golf ball. Screws are placed at the muscle insertions and strings are tied to them. By pulling the strings, one can visualize the action of each muscle in any position of the eye. (1 reference, 1 diagram.) R. W. Danielson.

Crisp, W. H. **Early development of the filtration operations for glaucoma.** Am. J. Ophth. 31:277-285, March, 1948. (29 references.)

Fishbein, M. **Medical leadership and education.** Tr. Am. Acad. Ophth. pp. 98-106, Nov.-Dec., 1947.

Medical education, medical leadership and the public health are closely alligned and parallel. They can no more be normally separated than can the marrow and nerves in the bone. The destructions and dislocations of war only temporarily change these relationships. The history of the American Medical Association parallels that of medical education and the public health. Progress in the reduction of infectious diseases is shown by the decreased prominence and second place which typhoid and similiar diseases now

occupy in text-books as compared with only one generation ago.

A recent visit by the author to our Latin neighbors further illustrates these facts. In the United States, tuberculosis is the seventh cause of death with a rate of approximately 42 to 100,000 population; in several South American countries, its death rate is approximately 400 per 100,000. In Chile, 400 of every 1000 babies born die before their first birthday.

In evaluating our medical progress in this, the last bulwark of democratic medicine, comparative methods illustrate the importance especially of preventive medicine. In our medical schools the average class varies between 40 and 100; while in Cuba, one first year class had 1200 students. Adequate medical facilities, equipment, teachers, and discipline are woefully lacking in many Latin American countries. Graded and orderly advancement in training, internships, residencies, as well as the control of specialties, hospitals and nurses are practically nonexistent. The recognition of specialists by boards of certification is unique in this country as are special associations for clinical and study groups. Occasionally, some highly advanced specialist rises above the general sub-standard and accomplishes much, but the general level of medical leadership, education and public health is lamentably low. Disease, like crime, doesn't pay. Death, sickness and deficiency are bed fellows in both.

Of all God's creatures, physicians have the most prolonged infancy. The price of leadership, especially medical, is high and rightly so. The real medical leader of today and especially of tomorrow must first have a deep understanding of the natures of men. He must always and in all ways be steadfast and fair and, just as important, he must be brimful of moral and professional honesty. He must be public-minded and above pettiness, giving without ulterior motives generously of his time and efforts for the good of all.

Investigation has shown that we doctors are not the invariable suckers which we are pictured and generally believed to be. Strange as it seems, ophthalmologists over a period of years have not done badly for themselves economically.

The only free and independent medical profession left in the world is in the United States. To preserve it, bureaucracy and government domination with its stupidities and inefficiencies must be fought every day and in every way by all of us. Now the trend is fortunately away from the governmental domination of medical practice and the medical profession. Your Academy is and has been a material contributor to the quantity and quality of medical leadership, education and the public health. Chas. A. Bahn.

Foster, John. **An oculist in Switzerland.** Brit. J. Ophth. 32:83-111, Feb., 1948.

This is a travelogue of visits to many Swiss ophthalmological centers. It is written so engagingly and refers to such a wealth of interesting work that one is not only moved to admiration of Swiss ophthalmology but is tempted to go see for oneself. O. H. Ellis.

Fiedenwald, J. S. **Standardization of tonometers.** South. M. J. 41:44-47, Jan., 1948.

The data and recordings from instruments made according to the specifications of Schiøtz have been generally accepted as reliable. However, due to differences in manufacturing, many instruments vary widely from the desirable standards. This led to the establishment by the American Academy of Ophthalmology and Otolaryngology of a committee on standardization of tonometers. Three checking stations are now in operation, the charge for each instrument checked is $5.00. All American manufacturers have now agreed to produce

instruments which conform to the standards that are considered essential. All instruments are independently tested by the Electrical Testing Laboratories, Inc., New York, and those passing are certified. (References.) Bennett W. Muir.

McCoy, D. A. **Experiences in industrial eye problems.** Tr. Am. Acad. Ophth. pp. 107-114, Nov.-Dec., 1947.

The 45 million industrial employees in the United States all potentially need industrial ophthalmic service. This should include pre-placement examination for the job, as well as periodic and diagnostic examinations and treatment for all eye injuries and diseases. Twenty percent of all employees are visually handicapped for their specific jobs. The approximately one thousand eye injuries which occur daily cost in medical care and compensation alone over one billion dollars yearly. The importance of preventive and industrial ophthalmology is illustrated in the epidemic of industrial keratoconjunctivitis which occurred in 1942. Soon after efficient treatment was instituted and transmission through unsanitary practices was reduced, the disease practically ceased to exist.

In industrial ophthalmology, the most difficult problems involve the inability or unwillingness of individuals to use reasonable precautions. The magnitude of industrial ophthalmology necessitates optometric assistance but the primary responsibility for screening and other examinations as well as leadership should be in ophthalmic hands. Greater standardization of eye examinations is needed as is greater efficiency in first aid treatment. United and concerted policy and action of management, labor, and insurance companies are badly needed. Even slight differences are harmful to all concerned. Ophthalmology and ophthalmologists have unfortunately drawn away from industrial ophthalmology in the past, apparently because of its slightly different techniques and standards. Industrial medicine and surgery, including ophthalmic, should be taught in all undergraduate medical schools. Chas. A. Bahn.

Minton, Joseph. **Vision and the selection of personnel in industry.** Tr. Ophth. Soc. U. Kingdom. 65:211-218, 1945.

The author recommends that all individuals whose vision is less than 6/12 in each eye be referred for an ophthalmological examination and that the standards of vision should not be rigid, but vary according to the analysis of the job.

He suggests that five visual groups are possible among the workers and describes the visual acuity and the characteristics of the work in each. Special visual problems are presented in the selection and allocation of jobs to juveniles, those with myopia, and for fine, close work.

Beulah Cushman.

Payne, B. F. **Aviation Ophthalmology.** Jour. Aviation Med. 18:367-378, Aug., 1947.

Aviation ophthalmology is concerned with the visual standards for personnel engaged in flying and maintaining aircraft. The examination is concerned with visual acuity, depth perception, color testing, extraocular muscle balance, and the discovery and elimination of disease in the external or internal portions of the eye. An outline of the course in ophthalmology at the AAF School of Aviation Medicine is given.

Irwin E. Gaynon.

Rennie, T. A. D. **General aspects.** Harrington, D. O. **Ophthalmology. Psychosomatic manifestations.** Tr. Am. Acad. Ophth. pp. 65-74, pp. 78-89, Nov.-Dec., 1947.

This symposium should be read by every ophthalmologist. Its parts are so closely alligned that a composite abstract is advisable.

Only psychosomatic ophthalmology is good ophthalmology because it, alone, is comprehensive ophthalmology. Among the general diseases with important psychosomatic ophthalmic manifestations are diabetes, hypertension and hyperthyroidism. The sensory stimuli which begin in the retina play an especially important part in physical and mental activities and inactivities, both quantitatively and qualitatively. Therefore, the mental processes of sight are vitally involved in psychosomatic sickness, in which anxiety is always involved. There is nothing to which one will not resort to escape the discomforts of prolonged anxiety when it becomes intolerable. The most frequent escape mechanisms include numerous patterns of mental conversions and/or vegetative psychoneuroses. The former includes blepharospasm, convergence spasm, asthenopia, photophobia, hysterical amblyopias, and amauroses; the latter ciliary spasm, transient amblyopias, angiospastic retinopathies, migraine and glaucoma.

Limited space precludes even a brief discussion of the many important concepts presented. My paraphrasing of a few of its more provocative ideas will, I hope, stimulate the readers' interest. The first function of all physicians is to honestly and intelligently care for the human beings who have sickness. Psychosomatic ophthalmology is not veterinary ophthalmology, because only human beings can express in the spoken and written word the link that connects symptoms with their complete causation. The eyes have been closely associated with both sight and understanding since the beginning of history in all phases of human activity. All psychosomatic sickness is an expression of anxiety and its effects. Their manifestations are expressed positively and not negatively to those who can and will see. The proponents of psychosomatic ophthalmology have been damned with faint praise. Those who have professed to cure symptoms of psychosomatic sickness both within and without our profession have probably aggravated more neuroses than they have cured. There would be fewer unsuccessful operations or blind and unhappy patients, if more ophthalmologists would practice more psychosomatic ophthalmology. Words are to the practitioner of psychosmatic ophthalmology what ophthalmoscopes are to physical opthalmologists. Chas. A. Bahn.

PAN-AMERICAN NOTES

Edited by M. URIBE TRONCOSO, M.D.
500 West End Avenue, New York
Communications should reach the editor by the 12th of the month

III PAN-AMERICAN CONGRESS

This Congress convened at Havana, Cuba, from January 3 to 10, 1948, with great success and a larger attendance than at any of the previous meetings in Cleveland, Ohio, and in Montevideo, Uruguay. Although Dr. Vail has already reported in the editorial section on the principal features, excellent organization of the meetings, and on the scientific and commercial exhibitions, it may be pertinent to emphasize some other results obtained by the Congress.

Although a greater number of ophthalmologists were present from the United States, nearly one half of the total came from the Latin-American countries. Not only the big nations on the continent sent delegates, but even the smaller countries in Central America had several representatives. I met colleagues from Guatemala down to Costa Rica. Mexico had a big delegation with about 12 members; Brazil had nearly 20 members, with Argentina and Chile following in numbers. Three ophthalmologists came from Uruguay. Paraguay, Peru, and Bolivia were also well represented. Cuba, the host of the Congress, had numerous official members who vied with each other in helping the colleagues who had difficulties with lodgings, language, or with traveling after the Congress was finished.

Latin-American members showed a great spirit of comradeship between themselves and made friends with physicians of other Spanish- or Portuguese-speaking countries. The English-speaking ophthalmologists also made numerous acquaintances with Latin physicians and a true international atmosphere prevailed.

The many courses of instruction were a new departure greatly appreciated by all members. Some courses were given in Spanish, although the majority were in English. All had many attentive listeners.

The entertainments provided by the Congress were all splendid and enthusiastically attended. The last one, in the Cathedral Square, the final day of the Congress, was particularly brilliant. The mild climate allowed the ladies and members to remain outdoors in evening attire and dance until the early hours of morning. There were many couples in costumes from different countries and Cuban performers gave special exhibitions.

The next Congress should convene in 1950, but is delayed until 1952 because of the meeting in London that year of the 15th International Congress of Ophthalmology. The next Pan-American reunion will be held in Mexico City in 1952.

Dr. Harry S. Gradle was honored in absentia with the first Pan-American Medal of the National Society for the Prevention of Blindness for his services in establishing friendly relations with the Latin-American countries.

New officers elected for the Pan-American Ophthalmological Society were Dr. C. Berens, president; Dr. W. L. Benedict, vice-president; Dr. Thomas D. Allen, secretary; and Dr. Derrick Vail, secretary for instructional courses.

SOCIETIES

MEXICAN OPHTHALMOLOGICAL SOCIETY

The board of directors of the society for 1948-1949 has been changed as follows: president, Dr. Lino Vergara Espino; vice-president, Dr. F. Martinez Hinojosa; secretary, Dr. Raul A. Chavira; annual secretary, Dr. J. Antonio Quiroz; treasurer, Dr. F. Palomino Dena.

NATIONAL CONGRESS IN MEXICO

The Mexican Society of Ophthalmology has initiated and will organize the meeting of the National Congress to be held in Mexico City in the second week of January, 1949.

SOCIETY OF SÃO PAULO, BRAZIL

This society elected new members for the board of directors for the period 1947-1948 as follows: president, Dr. Benedito Paula Santos Filho; vice-president, Dr. Plinio Toledo Piza; executive secretary, Dr. Paulo Braga Bagalhães; secretary, Dr. Rubens Belfort Mattos; archives, Dr. Alcides Del Ciello; treasurer, Dr. Aureliano Fonseca.

SOCIETY OF GUADALAJARA, MEXICO

Guadalajara is the second city in population in Mexico. The ophthalmologists practicing there have formed a new Society of Ophthalmology with the following board of directors: Dr. Elias Mendoza Gonzalez, president; Dr. Manuel Romo, vice-president; Dr. L. Nunez Leal, secretary; Dr. Antonio Diaz Guerrero, treasurer. Dr. Enrique Avalos, Sr., was appointed honorary president.

PERSONALS

Dr. H. Arruga, the well-known surgeon from Barcelona, Spain, after attending the Pan-American Congress of Ophthalmology in Havana, came to New York to renew old acquaintances in the city and to supervise the translation into English of his book on ocular surgery which has received so many laudatory comments.

Dr. Karl Lindner and Dr. Adalbert Fuchs of Vienna, Austria, came to the United States after attending the congress in Havana. Dr. Lindner gave lectures at the New York Academy of Medicine and

at the St. Louis Ophthalmic Society and Dr. Fuchs lectured at Gill Memorial Eye, Ear and Throat Hospital in Roanoke, Virginia.

Dr. Algernon B. Reese has just returned from Mexico where he gave a series of lectures on "Tumors of the Eye."

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2
News items should reach the editor by the 12th of the month

DEATHS

Dr. Willis Orville Nance, Chicago, Illinois, died January 16, 1947, aged 76 years.

Dr. Elias Selinger, Chicago, Illinois, died December 21, 1947, aged 49 years.

ANNOUNCEMENTS

ACADEMY HOME STUDY COURSE

The home study courses, sponsored by the American Academy of Ophthalmology and Otolaryngology, in the basic sciences related to these two specialties, will be given again, beginning September 1, 1948. Registrations must be completed before August 15. Detailed information may be obtained from Dr. William L. Benedict, executive secretary, 100 First Avenue Building, Rochester, Minnesota.

JACKSON'S "SKIASCOPY"

About 25 copies of Dr. Edward Jackson's 120-page volume on "Skiascopy" are still available for distribution, and a copy will be sent without charge to each of those ophthalmologists first addressing a request to receive one to Dr. William H. Crisp, 1276 Emerson Street, Denver 3, Colorado.

There will probably be several months delay in complying with these requests, since Dr. Crisp will be out of the United States from a little after the middle of May until the latter part of September, and will not be represented by an office secretary during his absence.

MISCELLANEOUS

ITALIAN JOURNAL CHANGE

The Italian *Rivista di Oftalmologia,* beginning in January, 1947, under the editorship of Prof. B. Alajmo and published by L. Salpietra is being continued by Dr. B. Alajmo and the same group of collaborators as the *Giornale Italiano di Oftalmologia* under the management of the Clinica Oculistica of the Universitaria of Florence, Italy. The journal will be published every two months. Volume 1, number 1, January-February, 1948, has already been received in this country.

UNIVERSITY OF MICHIGAN CONFERENCE

On May 6th to 8th, an ophthalmology conference was held at the University of Michigan. The first day's program included: "Applied Physiologic Optics," Charles Sheard, Ph.D.; "Toxoplasmosis," Dr. Raymond L. Pfeiffer; "Anomalies and Diseases of the Optic Nerve," Dr. Winsor S. Davies; a fundus clinic at the Wayne County General Hospital; and a joint meeting with the Detroit Ophthalmological Society and Club and the Michigan Triological Society.

The program for the second day was: "Applied Physiologic Optics," Charles Sheard, Ph.D.; "The Roentgenographic Diagnosis of Retinoblastoma," and "Roentgenography of Exophthalmos," Dr. Raymond L. Pfeiffer; "Modern Trends in Ophthalmic Surgery," and "The Management of Common Ocular Injuries," Dr. William B. Clark; "Vascular Lesions of the Ocular Adnexa," and "Vascular Lesions of the Globe," Dr. Banks Anderson.

On the concluding day, the following program was presented: "Recent Advances in Ocular Therapeutics," Dr. Harold F. Falls; "Applied Physiologic Optics," Charles Sheard, Ph.D.; "The Familial Corneal Dystrophies," Dr. William B. Clark; "Ocular Manifestations of Dermatological Disease," Dr. Banks Anderson; "Clinical Manifestations of Involvement of the Visual Pathway," Dr. John W. Henderson; and "Surgical Anatomy of Operations for Glaucoma," (movies) Dr. F. Bruce Fralick.

REFRESHER SYMPOSIUM

During the four-week period, April 26th through May 22nd, a full-time refresher symposium in ophthalmology is being given to eight qualified ophthalmologists by the ophthalmologic and medical staffs of the Mount Sinai Hospital in affiliation with Columbia University. This symposium is designed to be an intensive review of modern concepts in the field and consists of clinical, laboratory, and didactic instruction in pathology, embryology, bacteriology, optics, surgery, ophthalmoscopy, and so forth.

SOCIETIES

WINS ADVERTISING AWARD

At the first quarterly meeting of the Better Vision Institute, Inc., Pres. M. J. Julian displayed the medal won by the Institute in the annual advertising awards for 1947. This was the highest honor given in the classification of association advertising.

BROOKLYN PROGRAM

The 104th regular meeting of the Brooklyn Ophthalmological Society was held at the Brooklyn

Eye and Ear Hospital on April 15th. Case presentations on the scientific program included: "Stevens-Johnsons Disease," Dr. Julius M. Dan; "Coloboma Iris, Choroid, and Optic Nerve," Dr. A. B. Rizzuti; "Boeck's Sarcoid of the Orbit," Dr. Martin Bodian; "Spontaneous Dislocation of the Lens," Dr. Charles Stern, *(By Invitation);* "Ciliary Staphyloma," Dr. Jerome Samuel, *(By Invitation);* "Subchoroidal Hemorrhage Complicating Intraocular Surgery," Dr. Leo Esbin, *(By Invitation);* "Herpes Zoster Ophthalmicus," Dr. Mortimer Cholst, *(By Invitation);* "Aniridia In Three Generations," Dr. Israel Gerberg.

University of Glasgow Meetings

During the month of May a series of meetings will be held in the Department of Ophthalmology, University of Glasgow, on Wednesdays at 8 p.m. The general arrangements will be similar to the series held last year. Tea will be served after the paper and a discussion will follow. The meetings will be open to all medical practitioners and senior students interested in ophthalmology. On May 5, Dr. I. C. Michaelson will present "The Growth of Ocular Vessels;" May 12, Dr. James Hill, "Disturbances of Lacrimal Apparatus;" May 17, Dr. W. O. G. Taylor, "Wounds of the Cornea;" May 26, Mr. O. M. Duthie, "Cataract Extraction."

Oxford Congress

The next meeting of the Oxford Ophthalmological Congress had been arranged for Thursday, Friday, and Saturday, July 8th, 9th, and 10th, at the School of Geography, Mansfield Road, Oxford.

The congress will be opened by a discussion on "The Use and Abuse of Topical Ocular Therapy," and will be led by Mr. Frederick Ridley, Dr. J. R. Robson (pharmacology), and Dr. F. E. Preston.

The Doyne Memorial Lecture will be delivered by Sir Stewart Duke-Elder and will be entitled "The Blood Aqueous Barrier."

Round-table conference

The annual round-table conference of the New York Society for Clinical Ophthalmology was held on April 5th. The subject for discussion was "Nonsurgical Therapy in Ophthalmology." On the panel of discussors were: Dr. Irving H. Leopold, Philadelphia; Dr. Parker Heath, Boston; Dr. Ludwig von Sallmann, New York; and Dr. Derrick Vail, Chicago. Dr. Daniel Kravitz, president of the society, acted as moderator.

Milwaukee society

The regular meeting of the Milwaukee Otoophthalmic Society was held on March 23rd. "Tumors of Ciliary Body: A Case Report," was presented by Dr. M. Kadin, as a membership thesis.

Los Angeles officers

The Los Angeles Society of Ophthalmology and Otolaryngology has elected the following officers for 1948: president, Dr. Colby Hall; secretary-treasurer, Dr. Warren A. Wilson; chairman of section on ophthalmology, Dr. John A. Bullis; secretary of section on ophthalmology, Dr. Rodman Irvine; chairman of section on otolaryngology, Dr. Leland G. Hunnicutt; secretary of section on otolaryngology, Dr. Alden H. Miller.

The Los Angeles County Medical Association Building, 1925 Wilshire Boulevard, Los Angeles, is the place of meeting, and the time is 6 P.M. the fourth Monday of each month from September to May, inclusive.

N.S.P.B. appoints nursing consultant

The National Society for the Prevention of Blindness announces the appointment of Helen E. Weaver, R.N., as consultant in nursing activities. Miss Weaver comes to her position from the New York State Department of Health where she was consultant public health nurse of the Division of Venereal Disease Control.

United Kingdom society meets

The annual congress of the Ophthalmological Society of the United Kingdom was held on April 8th, 9th, and 10th at the Royal Society of Medicine, London. Dr. A. J. Ballantyne, president, gave the welcoming address. Others participating in the program were: Prof. H. Cohen, Dr. Denis Williams, and Mr. J. H. Doggart, who presented "Subjective Disorders of Vision;" Dr. Helen Dimsdale and Mr. D. G. Phillips, "Ocular Palsies Due to Infection of the Nasal Sinuses;" Mr. J. P. F. Lloyd, "A Preliminary Survey of 45 Consecutive Cases of Congestive Glaucoma;" Mr. Eugene Wolff, "The Conjunctival Nevus and the Neurogenic Theory of Melanomas;" Dr. H. M. Traquair, "Pictorial Demonstrations;" Prof. Marc Amsler, "New Clinical Aspects of the Vegetative Eye" (The Bowman Lecture); Dr. T. L. Thomassen, "The Venous Pressure in Glaucomatous Eyes;" Dr. G. I. Scott, "Some Observations on Clinical Perimetry;" Mr. G. T. W. Cashell, "Two Case Presentations—Subconjunctival Rupture of the Globe with Extensive Migration of Uveal Pigment, and an Aneurysmal Varix of the Retina;" Mr. A. G. Cross, "Papilledema in Association with Toxic Hydrocephalus;" Mr. T. Keith Lyle, "Latent Nystagmus;" Prof. Arnold Sorsby, "The Classification of the Unassociated Dystrophies of the Fundus;" Dr. J. Ellison, "Pictorial Demonstrations;" Mr. C. Dee Shapland, "Prognosis in Detachment of the Retina;" Dr. I. C. Michaelson, "The Mode of Development of the Vascular System of the Retina, with Some Observations on Its Significance for Certain Retinal Diseases;" Prof. W. H. Melanowski, "Atropin in the Treatment of Glaucomatous Iridocyclitis;" Dr. W. C. Souter, "Auto-Eversion of Upper Lid, Voluntary, Unaided."

New York society officers

Newly elected officers of New York Society for Clinical Ophthalmology for the year 1948-1949, are:

president, Dr. Benjamin Esterman; vice-president, Dr. Sidney A. Fox; recording secretary, Dr. Bernard Kronenberg; corresponding secretary, Dr. Leon H. Ehrlich; treasurer, Dr. Edward Saskin; historian, Dr. Howard J. Agatston. Committee chairmen are: program, Dr. Adolph Posner; instruction hour, Dr. Frederick H. Theodore; legislative, Dr. Max Chamlin; membership, Dr. Bernard Fread; industrial, Dr. David A. Newman. Dr. Daniel Kravitz, the retiring president, was elected to the advisory council.

Journal club organized

A meeting was held at the home of Dr. Samuel V. Abraham, 610 North Linden Drive, Beverly Hills, California on April 15, for the purpose of organizing the Ophthalmological Journal Club.

The primary interest of the club is to abstract current literature on ophthalmology and related subjects for the purpose of presenting it to the members for discussion.

The meetings will be held the first Thursday of each month at 8 P.M., at 416 Bedford Drive, Beverly Hills. Dr. Samuel V. Abraham is chairman of the club.

Personals

Retires because of ill health

Dr. Frank R. Slopanskey, Salt Lake City, Utah, has recently retired because of ill health after 42 years of active medical and surgical practice.

Will tour European area

Dr. Harold Scheie, associate professor of ophthalmology at the University of Pennsylvania and chief of the eye service at the University of Pennsylvania Hospital, will visit the United States Army hospitals in the European area under the program whereby a team of civilian medical consultants spend several days at each hospital advising the theater surgeon and hospital staffs in the treatment of their patients.

To conduct clinics

Dr. Albert D. Ruedemann, professor of ophthalmology, Wayne University College of Medicine, Detroit, is conducting clinics on beta irradiation in ophthalmology at the City of Detroit Receiving Hospital from 10 a.m. to noon every other Wednesday until June.

Gives lectures

On February 13, 1948, Dr. Joseph I. Pascal gave a lecture to the graduate class in ophthalmology of the Harvard Medical School on "A Graphic Study of Ocular Muscles." The same subject was presented by Dr. Pascal at the March 4th meeting of the Eastern New York Eye, Ear, Nose, and Throat Association in Albany, New York, and at the March 8th meeting of the Passaic-Bergen Ophthalmological Club.

Awarded medal

The Richard Pearson Strong medal for distinguished and outstanding work in tropical medicine has been presented to Dr. Neil P. Macphail, medical superintendent, East Coast Division, United Fruit Company, Quirigua, Guatemala, for a lifetime of service devoted to tropical medicine in Central America.

Resigns hospital appointment

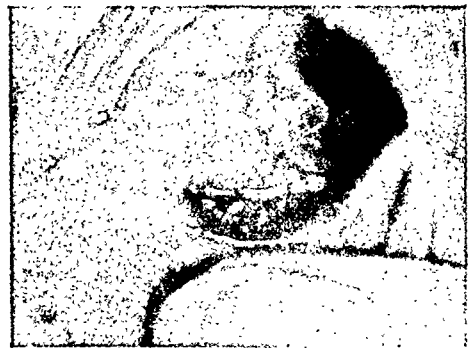
On April 1, 1948, Dr. John N. Evans resigned as Ophthalmologist-in-Chief of Long Island College Hospital, and has been appointed Consultant to the Department of Ophthalmology.

Colorado consulting ophthalmologist

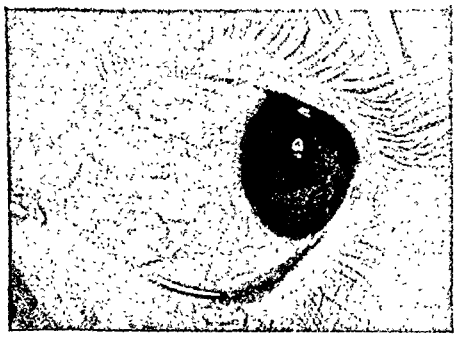
Dr. John C. Long has been appointed as consulting ophthalmologist to the State of Colorado under the Aid to the Blind law, in place of Dr. William H. Crisp (resigned).

Announcement

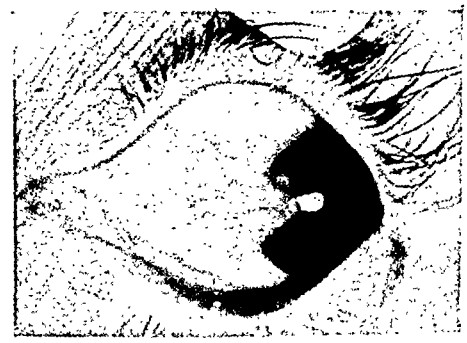
The 20th semiannual conference in "Neuromuscular Anomalies of the Eyes," will be held at The Children's Memorial Hospital, Chicago, Illinois, by Dr. George P. Guibor on June 13 to 18. The class will be limited and no applications will be accepted after June 8. Lectures and Demonstrations will be at the Hospital, Entrance 700 Fullerton Avenue. The tuition is $50.00; $25.00 payable on enrollment, balance payable on registration. All correspondence and checks should be addressed to The Children's Memorial Hospital.



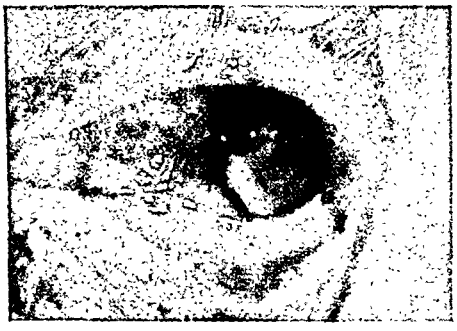
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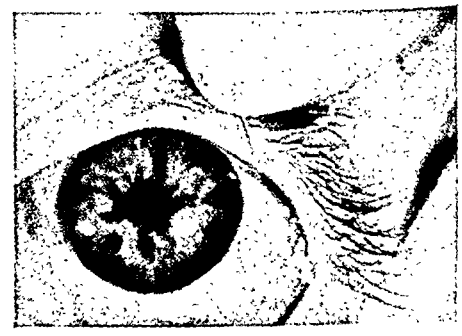
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FIG. 1 (HILGARTNER, WILSON, AND WILSON). (A) LARGE, EXTREMELY VASCULAR TYPE OF PTERYGIUM. (B) THIS SHOWS THE HEAD OF THE PTERYGIUM TRANSPLANTED BENEATH THE BULBAR CONJUNCTIVA BELOW. (C) THIN, RELATIVELY AVASCULAR TYPE OF PTERYGIUM. (D) THIS EYE HAD BEEN OPERATED ON SOME MONTHS BEFORE THIS PICTURE WAS TAKEN. IT SHOWS VASCULARITY AND THICKENING OF THE BULBAR CONJUNCTIVA. NO X-RAY THERAPY WAS GIVEN. (E) THIS EYE SHOWS A SLIGHT AMOUNT OF INJECTION FOLLOWING SURGERY AND X-RAY THERAPY.

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 31 JUNE, 1948 NUMBER 6

SURGICAL TREATMENT OF PTERYGIA FOLLOWED BY X-RAY THERAPY TO PREVENT RECURRENCE*

HENRY L. HILGARTNER, M.D., R. T. WILSON, M.D., AND J. D. WILSON, M.D.
Austin, Texas

One of the most common conditions seen in the southwest section of this country is that of a pterygium encroaching on the cornea of one or both eyes. As everyone knows, this is usually a painless, slow-growing, disfiguring growth composed of fibrillar connective tissue and epithelium of the conjunctiva. It may or may not be vascular. It is most commonly seen growing from the nasal side, but it may also grow from the temporal side at the same time, and, in some rare cases, the pterygium will descend from above, or ascend from below. This latter condition is, however, infrequent.

STRUCTURE OF PTERYGIUM

Doherty has divided the pterygium into four parts: (1) the cap, which is the flat grayish section which precedes the head as it encroaches on the cornea, (2) the head, (3) the neck, and (4) the body. The head consists of loose connective tissue which advances between Bowman's membrane and the epithelium, the latter becoming detached. Bowman's membrane is partly or completely destroyed. The neck and body consist of blood vessels, connective tissues, and conjunctival epithelium.

It is not our purpose to give a long dissertation on the pathology, incidence, and surgical technique for the removal of pterygia, but it is necessary to review briefly the facts. In conclusion we wish to present our technique for the prevention of the recurrence of the growth.

TYPES OF PTERYGIA

We feel that there are two distinct types of pterygia: (1) The small, slow growing, rather avascular pterygium with a flat, more or less whitish-gray head, and practically no cap. (2) The highly vascular, thick, somewhat inflamed growth, with elevated head and a very definite cap which extends some distance beyond the head onto the cornea. The second type is fast growing and invades the deeper structures of the cornea. If allowed to stay on the cornea for any length of time, a definite grayish scar may form beneath it, which is disfiguring after removal of the pterygium from the cornea.

It is this second type of pterygia with which we are really concerned and which usually recurs following surgery. The usual story is that the growth recurred soon after surgery was performed, sometimes within a few days after the operation, and that the growth developed more rapidly than it formerly had.

A true pterygium develops and grows without previous corneal ulceration or injury. A false pterygium is one in which there has been a corneal ulcer or injury and the healing process has pulled the conjunctiva up on the cornea.

In our opinion, a pterygium seldom stops growing; the growth may be very, very

* Presented at the meeting of the Texas Ophthalmological and Otolaryngological Society, Houston, Texas, December 5, 1947.

slow, but if measured and observed over a period of years, it will be seen that it has progressed.

Surgical treatment

Various procedures have been described for the removal of pterygia. Des Marres was the first to transplant the pterygium after dissecting it from the cornea. McReynolds later modified the Des Marres operation, and his is the procedure most commonly used. We will not go into detail regarding the surgical technique, but we wish to stress several points that seem important to us.

In the first place, the head and cap of the pterygium should be dissected free from the cornea, removing all of the strands and trabeculae on the initial dissection. We generally incise the conjunctiva just adjacent to the body of the pterygium above and below, and then (this is important) see whether the pterygium fits with the least distortion with the head pulled upward or downward, bringing normal conjunctiva over the former site of the growth and adjacent to the limbus. No tension should be exerted.

All the surgical textbooks emphasize that the pterygium should be buried beneath the lower bulbar conjunctiva, but this is not obligatory. It is better surgical judgment to adapt the transplant to its new position in the most normal and natural way, with no tension and no bulging of the body under the conjunctiva.

The head of the growth is anchored beneath the bulbar conjunctiva, either above or below, with a double-armed, black-silk, 6-0 suture. Then the bulbar conjunctival flap is picked up and brought down over the transplanted pterygium and anchored into the body of the pterygium with a single black-silk suture.

Indication for X-ray treatments

During the last two years one of us (H. L. H.) has operated on 36 cases of pterygia. Nine of these had bilateral growths, and both eyes were operated on at the same time. One of the first cases which was operated on soon after resumption of private practice showed a recurrence following the first operation. This patient was operated on a second time, and there was a recurrence within a short time. Since the nasal side of the eye was quite vascular and the pterygium again commenced to extend onto the cornea, the patient was referred for X-ray treatments. Following the first X-ray treatment, the vascularity subsided, and the pterygium stopped growing.

X-ray treatments following surgery are not indicated in every case; in fact, they are contraindicated in the avascular, small, flat type of pterygium. Only the vascular, raised, large type requires X-ray treatment, but these cases need it badly. Of the 36 cases operated on, 10 required X-ray treatment. Our usual procedure is to advise the patients that on the fifth day following surgery, when the stitches are removed, they will be referred to the roentgenologist for one or more X-ray treatments. Our results from the combined procedures have been excellent.

X-ray treatment of pterygium

X rays have been useful in the treatment of various lesions about the eyes. Of these pterygium has been one that has received some attention in the literature. Bucky reported the use of soft X rays in this condition in 1927. Other workers, notably Burnham and Neill, have used Beta rays of radium in the form of radon applied by a special applicator in the treatment of superficial lesions of the eye. Estrada brings out the value of postoperative X-ray therapy in cases prone to recurrence. It has been in these cases that we have used radiation therapy. Choice of the patients to be treated is made by the ophthalmologist after consideration of the patient's history and study of the type of pterygium.

The purpose of X-ray treatment is to help prevent recurrence and growth of the

pterygia. The vascular type, being the kind most likely to recur, is also the type most sensitive to radiation. The effect is produced by the inhibiting action of X rays upon young connective tissue, the epithelial cells, and the blood vessels. This means that the younger the cells of the tissues and the faster the growth, the more pronounced are the effects of radiation. Therefore, we have chosen to treat these pterygia only after surgery, and soon after the operation, while the tissues are in the active reparative phase. In this manner, the maximum effect is produced on the pterygium and also on the scar of the cornea. We begin treatment on about the fifth postoperative day.

Technique of X-ray therapy

The size and shape of the pterygium is measured accurately and a portal is cut out of lead foil which will closely fit the lesion. Then the eye is anesthetized with 1-percent pontocaine, and the lids are held open with a speculum. The lead-foil shield is put in place over the eye and the X-ray beam is directed through the portal (fig. 2). Its direction is angulated to the side of the lesion being treated so that the center of the beam does not go through the center of the orbit.

Unfiltered X rays produced at a voltage of 70 K.V. (H.V.L. 1.0 mm. al.) are used at a distance of 22.5 cm. (9 inches). This gives the longer wave-length, less penetrating rays. The output is 130r per minute so that the exposure time is short and rarely runs over two minutes. Each pterygium is treated in this manner at each treatment, and the treatments are repeated at intervals of 3 to 5 days. It is important to give the treatments in a period of 2 to 3 weeks to take advantage of the altered pathologic processes which follow the operation.

Comment

In this series of cases, 10 patients were given postoperative radiation. Of these two were women. Six of the patients had bilateral lesions and one of these had three pterygia. There was a history of multiple operations and recurrences up to a total of six in one patient.

No statistical analysis of this small series of cases will be attempted. The patients received an average of six treatments, with

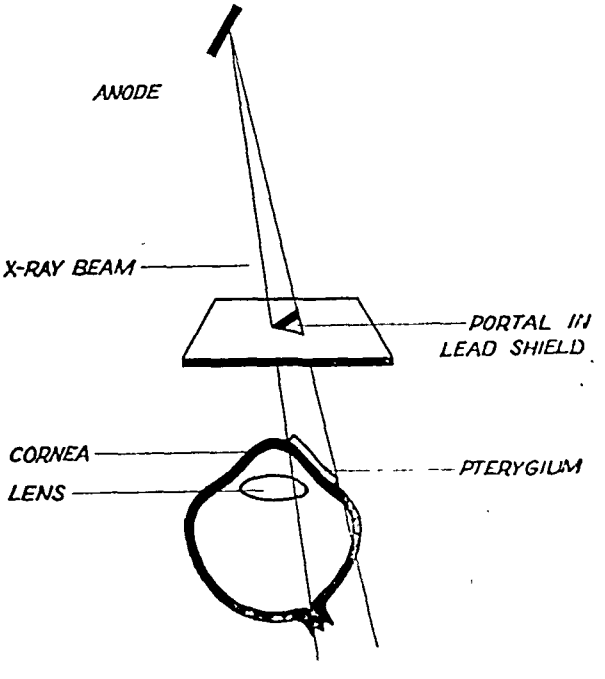


Fig. 2 (Hilgartner, Wilson, and Wilson). Diagram illustrating the angled X-ray beam striking the pterygium.

an average total dosage of 1,100r. Very gratifying results have been obtained. In some of the earlier cases, which have been followed for almost two years, the lesions show no evidence of growth. No complications of any kind have been noticed. We might stress that the tolerance of the cornea to irradiation is much higher than is generally thought so that no adverse effects from this or even higher dosage are to be expected.

We are presenting this combined method of treatment of pterygium because of its simplicity, availability, and its effectiveness in stopping the growth and preventing the recurrence of these lesions.

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CAPILLARY FRAGILITY AND CUTANEOUS LYMPHATIC FLOW IN RELATION TO SYSTEMIC AND RETINAL VASCULAR MANIFESTATIONS: RUTIN THERAPY*

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With increasing frequency it is recognized that vascular accidents, particularly of arterioles and capillaries, are not solely the result of simple elevation of blood pressure with mechanical rupture, or of degenerative atheromatous changes, such as may lead in larger vessels to massive hemorrhage or dissection of the wall, but are due to some defect in the architecture of the vessel, similar to but not identical with the disorders seen in scurvy, occurring in many persons with normal blood pressures, and bearing no relationship to the actual level of pressure in hypertensives.

Thus, we have long pondered over the cause of the ecchymoses and bruises so frequently seen in a certain type of woman—usually blonde, well nourished or obese, with skin of fine texture, good complexion —whose arms and legs are covered with numerous black and blue spots which result from the slightest pressure or injury. These bruises are not due to scurvy, are not relieved by enormous quantities of ascorbic acid, and appear in patients without other ascertainable cause.

Working in Europe in 1936,[1] Szent-Györgi isolated from the rinds of citrus fruits a substance which corrected or prevented artificially produced capillary fragility in experimental animals and for which he proposed the name citrin, briefly referred to as vitamin P (for permeability). Since it is not a vitamin, none of the effects that it remedies having been observed in dietary restrictions, and since its action is more concerned with capillary fragility, the designation of vitamin P is obviously inappropriate.

Citrin is composed of at least two distinct glucosides, hesperidin and eriodictyol, the former of which varies greatly in physiologic activity while the latter is inert. Presumably much of the activity of this impure mixture is due to rutin,† derived at present from the flowering leaves of immature buckwheat. Rutin is a flavonal glucoside, and is now available in an accurate and stable form.

The pioneer work on capillary fragility and its control has been done in this country by Griffith, Lindhauer, Couch, and Shanno,[2-6] and we have drawn freely from their results, especially as exhibited at the Scientific Assembly of the American Medical Association, July, 1946, to supplement the work which we are reporting. Fragility is measured by one of various techniques, all of which depend on the number of petechiae produced in a measured area following application of a tourniquet, commonly a blood pressure cuff, for a definite time and pressure. Griffith and his associates prefer the Göthlin technique (see references), while we have used a modification of the Wright and Lilienfeld method, performed in the following manner.

A circle 2.5 cm. in diameter is outlined in the antecubital fossa, the upper edge lying 4-cm. below the crease of the elbow, and all confusing blemishes in this area are marked off. The cuff of the blood-pressure manometer is then applied in the usual position, the pressure set at a point midway between the previously determined systolic and diastolic pressure. After five minutes the pressure is released, and one-half hour later the petechiae in the circle are counted. On the average, normal subjects of varying

* Presented in part before the Chicago Ophthalmological Society December 16, 1946. From the Presbyterian Hospital, Chicago.

† Supplied for this work by Abbott & Co., Chicago.

ages will exhibit not more than 10 petechiae after this procedure.

Our reason for selecting this method rather than that of Göthlin (which elevates the pressure to 35 mm. Hg for 15 minutes, followed in an hour by pressure of 50 mm. Hg for 15 minutes) is that with the great variations encountered in both systolic and diastolic pressures, determination of the number of petechiae in a given individual with a certain blood pressure will more nearly represent the state of capillary fragility than a more arbitrary procedure. We have as yet found no reason to modify this technique, but the matter is open to debate and correction. However, it is clear that any such procedure, if carefully standardized, will give accurate and reliable results in the hands of those employing it.

The first comprehensive work of Griffith and Lindauer[2] may be summarized as follows. Increased capillary fragility, occurring in approximately 20 percent of 1,600 hypertensives, irrespective of the blood-pressure level, is accompanied by an incidence of cerebral or retinal hemorrhages and death, varying from 6 to 10 times that found in hypertensives of comparable levels showing normal fragility. This abnormal fragility can be restored to normal by rutin therapy in 75 percent of cases, becomes borderline in 15 percent, becomes normal but relapses in 4 percent, and remains abnormal despite large dosage in 6 percent.

Furthermore, restoration of normal fragility is followed by a decrease of vascular complications to the approximate frequency encountered in hypertensives with normal fragility, only to be followed by a return of greater incidence in relapse due to discontinuance of therapy or failure of treatment.

Finally, thiocyanate therapy, extensively used for control of hypertension, produces in a significantly large number of cases an increased fragility, thus predisposing the patient to the hazard of vascular complications that are frequently more serious than uncomplicated hypertension, which tendency is fortunately controlled by rutin.

These findings of Griffith and Lindauer are in complete accord with our findings in a smaller series of hypertensives and are in marked contrast to the results obtained in diabetics, to be discussed later.

The determination of the rate or expectancy of vascular complications in normal and increased fragility is obviously difficult, since one cannot select two groups of 100 cases each, with 20 exhibiting normal fragility, proceed to treat one group with rutin, and conclude either that, in the treated group, this or that specific individual would or would not have met with some hemorrhagic phenomenon; or that, in the untreated cases, any specific complication would have been prevented by therapy.

Consequently, it is necessary to adopt a post-hoc method, whereby a comparison of the incidence of accidents is made after they have occurred, and then related to the state of fragility. To complicate the situation further, we cannot withhold treatment, or withdraw it, in order to obtain additional data on human beings, thus exposing them to the danger of disaster.

Rutin, available in 20-mg. and 60-mg tablets, has conventionally been administered in doses of 80 to 100 mg. daily. However, in resistant cases, or where rapidity of action is desirable, 240, 300, or even 500 mg. daily may be given for long periods without any evidence of untoward or toxic effects. When apparently adequate dosage has been established, the tourniquet test should be done every 4 to 6 weeks to forestall relapses due to possible increase of rutin requirement, bearing in mind that the result is not valid if done within three weeks of a previous test on the same arm.

During an acute shortage of rutin while these studies were in progress, we fortified our meager dosage with large amounts of ascorbic acid, such as 1,000 mg. intravenously once or twice daily, or 200 to 300 mg. orally if tolerated. Although the struc-

tural formula of rutin, a flavonal glucoside, in no way resembles that of ascorbic acid, their action in capillary bleeding is similar, and we found that this addition so enhanced the action of rutin, that administration of 40 to 60 mg., by itself ineffective, resulted in satisfactory and prolonged control of increased fragility. Recent work demonstrating control by Tocopherol of hemorrhage in dogs produced by large doses of Stilbestrol, led to a trial of this substance in a similar manner, but in dosage of 300 to 400 mg., daily. Tocopherol* failed to modify or enhance the action of rutin.

Cutaneous lymphatic flow (C.L.F.),[5] when increased, indicates in many instances increased permeability of vessel walls and was found to accompany increased fragility in about one third of the cases.

Apart from increased permeability, increased C.L.F. occurs in increased capillary pressure due to renal or pituitary disease, is decreased in congestive heart failure, lymphatic block (such as in phlebitis accompanied by peri-venous inflammation), and in edema of nephritis and nephrosis. Work in progress indicates marked reduction or absence of flow in edematous lower extremities of nephrotic patients, while remaining normal in the noninvolved areas of the arms, increasing to normal values in the legs as edema subsides.

As one example, a girl with pure nephrosis or nephrotic syndrome (total serum proteins 2.63, albumin 1.01, globulin 1.62), persistently four-plus albumin, and massive edema of all tissues below the diaphragm, had normal capillary fragility in both antecubital and popliteal spaces, with C.L.F. normal in arms and absent in her legs. During five days she lost 40 pounds as the result of strict electrolyte management, administration of two units of plasma daily for the preceding seven days (this was discontinued at the onset of diuresis), and maximum doses of vitamin K. C.L.F. became normal in the legs (1 to 6 cm. in 14 minutes) in spite of the fact that there was no decrease in the quantitative 24-hour output of protein.

This indicated either that (1) a return to normal C.L.F. was not paralleled by improved capillary permeability, at least in so far as the kidneys were concerned; (2) the decreased C.L.F. in the edematous portions was due to mechanical forces rather than derangement of permeability, which in this instance would have been decreased; or (3) proteinuria in such cases may be due to faulty protein metabolism rather than changes in permeability.

On the other hand, macular edema, as described in subsequent case reports, responded in some instances with amazing rapidity, paralleling improvement in capillary fragility induced by rutin therapy. Unfortunately, determination of C.L.F. was not available at the time but was presumably increased before therapy. C.L.F. studies are now to be made routinely on such cases. On patients exhibiting increased C.L.F., cyanate therapy is ineffective and may actually be harmful, but, following response to rutin, cyanate may be administered with satisfactory results in those in whom it is ordinarily effective.

In striking contrast to the retinal picture and generally satisfactory response to rutin in the hypertensive and sclerotic patient, is that condition encountered in the diabetic, and more frequently in the patient carrying a moderate degree of hyperglycemia without frank glycosuria.

Briefly, the retinal lesions are small, round rather than flame shaped, are situated deep in the retina, are relatively permanent in size and shape, appearing unchanged in character and location over long periods, and respond little or not at all to therapy.

Moreover, these individuals display a much higher average petechial index than hypertensives and are extremely resistant to rutin, in some cases showing no improvement and in 45 cases, as reported herein,

* Supplied by Hoffman-La Roche Co.

responding with a final average of 29 petechiae following maximum treatment.

In his discussion of edema and hemorrhages of the retina, Duke-Elder[7] states "in most cases the escape of fluid from the circulation is through the capillary walls, and since it is probable that these preserve their permeablity to a great extent so long as the endothelial cells are healthy, the appearance of edema is usually an indication of capillary or tissue damage."

He considers as an essential factor in this process, "an increased transference of fluid to the tissues when the capillary permeability is increased, as in toxic and inflammatory conditions, a process which, when accentuated, leads to the escape of albumin and fibrinogen which coagulate in the form of exudates, and eventually to the escape of the formed elements of the blood as actual hemorrhages."

"It would seem," he further states, "that the essence of retinal hemorrhage is probably capillary dysfunction rather than high blood pressure itself."

Of the many instances of exudation and hemorrhage in the retina, which the ophthalmologist constantly observes, none is more troublesome than that which occurs, in apparently ever-increasing frequency, in diabetes mellitus. Despite almost a century of investigation, the cause and cure of this type of retinopathy still eludes us. Opinion is still divided as to whether the retinal changes observed are specific or are merely the findings which are generally accepted as characteristic of arteriosclerotic or renal retinopathy. Recently the latter view has been challenged by Ballantyne,[8] who found that 50 percent of diabetics with retinopathy exhibited no evidence of arteriosclerosis or hypertension. He contends that the condition is primarily venous in origin and begins with fatty infiltration and swelling of the endothelium of the smaller vessels and proceeds to capillary and venous stasis.

Elwyn[9] also feels that the small retinal hemorrhages observed in diabetes have no relation to the vascular changes of aging, sclerosis, hypertension, and obstruction of veins, but rather are dependent on a prestatic condition in the capillaries of the retina which is in some way related to continuous moderate hyperglycemia.

"This," he states, "is as far as anyone can go unless one would rather assume as a cause of the hemorrhage the presence of toxic substances which cannot be found, or a deficiency of unknown vitamins, which so far have not been discovered."

During the course of the Gifford Lecture before the Chicago Ophthalmological Society in 1946, Friedenwald[10] related that he had observed an increase in the general capillary fragility, as determined by the arm-band test, in patients with diabetes mellitus. Recently Wagener[11] referred to some as-yet-unpublished observations of Foxworthy of the Mayo Clinic. In a group of 85 nondiabetic patients of varying ages and in whom, too, there was no evidence of hypertension, she found an average of 14 petechiae after application of the blood-pressure manometer cuff for 10 minutes; 69 diabetics without retinopathy presented an average of 41 petechiae, and in 44 diabetics with retinopathy, the petechial average was 101.

This paper is a preliminary report of some studies which are being continued and expanded. Until recently rutin was not generally available, and the number of patients treated and the size of the dosage were consequently limited.

In addition to the determination of the capillary fragility other related data were obtained. These include the age, general medical studies, urinalyses, complete blood counts, the bleeding time, platelet count, blood sugar level, blood cholesterol, plasma vitamin-C level, and prothrombin time. The capillary fragility was determined by the positive pressure method described above.

Of the 81 patients studied, 45 had diabetes mellitus, and these diabetics revealed the following pertinent data: their average

age was 55 years, varying from 24 to 73 years; 33 were females and 12 males. General studies revealed complicating mild nephritis in 8, and arterial hypertension in 15. Evidence of arteriosclerosis was present in 13 instances. Incipient or immature cataract was found in 11 patients, and retinopathy was present in 25 of the 45. The average systolic blood pressure was 154 mm. Hg, ranging from 96 to 270 mm., and the average diastolic was 85 mm. Hg, varying from 60 to 130 mm. Glycosuria was present in 11 instances, and blood studies revealed mild anemia in 3, and leukocytosis in the same number. A prolonged bleeding time was found in only one patient and a lowered platelet count in two. The fasting blood sugar ranged between 84 mg. percent and 289 mg. percent and averaged 141. Blood cholesterol was also generally elevated, averaging 320.6 mg. percent. In more than one third of these patients the fasting plasma vitamin-C level was subnormal, averaging 0.74 mg. percent and varying between 0.15 and 1.35. Prothrombin was reduced to 60 percent and 80 percent, respectively, in two instances. Nineteen of these patients took insulin daily.

Capillary fragility averaged 53 petechiae for the whole group and 60 for those with retinopathy. In the 20 diabetic patients without retinopathy the average capillary fragility was 16. Except for three instances the capillary fragility decreased, usually within 12 to 18 days, after the administration of an average daily dosage of 160 mgm. of rutin by mouth, to an average level of 29 petechiae.

Despite the reduction in the general capillary fragility, there was no significant objective improvement in vision or in the appearance of the retinopathy in these 25 patients over periods of 3- to 12-months' observation. However, it may be of great significance that in 18 instances of retinopathy on rutin therapy from 10 to 12 months, there has been no decrease in vision and little or no change in the retinopathy. No effect on the blood pressure, bleeding time, platelet count, and so forth, was observed.

Report of cases

The fundus photos (figs. 1 and 2) will best illustrate the type of lesion with which we were generally dealing.

Case 1. J. D., a white woman, aged 54 years had been a known diabetic for 18 years. Small doses of insulin were employed for the last six months only.

At the time of her original eye examination in December, 1943, a mild degree of retinal angiosclerosis and a fairly marked retinopathy were noted. The fundus picture has remained essentially unchanged and corrected vision, which was recorded as: O.D., 0.1; O.S., 0.3, in 1943, was noted to be: O.D., 0.1; O.S., 0.2−1 in November, 1946.

On May 9, 1946, the blood pressure was 154/84 mm. Hg, and the capillary fragility was 101. A daily dose of 120 mg. of rutin was prescribed. On June 3, 1946, capillary fragility measured 32. Only 10 petechiae were present on testing the capillary fragility on July 23, 1946. After employing no rutin for 10 days the fragility was found to be 44 on September 12, 1946. The last test, on November 7, 1946, after the resumption of rutin therapy, revealed 32 petechiae.

Case 2. A. E., a white woman, aged 54 years, was the private patient of Dr. E. V. L. Brown. She had been a known diabetic for 10 years, under insulin therapy. When first examined in July, 1946, the right fundus presented the picture of an old occlusion of the central retinal artery. There was marked retinopathy of the left eye. Vision was: O.D., perception of light; O.S., 0.2−1, with correction. The blood pressure was 138/74 mm. Hg, and the capillary fragility 18. She was given 120 mg. of rutin daily and on reëxamination on August 19, 1946, the capillary fragility had dropped to zero. When the patient returned on October 17, 1946, she related that she had exhausted

her supply of rutin one month previously. A determination of the capillary fragility revealed 25 petechiae. Rutin was resumed and on November 14, 1946, the fragility was 8 petechiae. At this time vision was: O.D., none; O.S., 0.2, with correction.

In addition to these patients with diabetes mellitus, 36 individuals with a wide variety of ocular and general disturbances have been studied.

Three young men who had experienced recurring hemorrhages into the vitreous, so-called Eales's disease, presented no abnormalities on general physical examination and laboratory studies were negative in two. In these two, capillary fragility was increased to 26 and 32 respectively and, after rutin, has fallen to 16 in each. In the third instance, the prothrombin time was reduced to 60 percent but responded promptly to vitamin K. The capillary fragility of this third patient measured 6 in June, 1946, when he was given rutin, which he has continued, and was reduced to zero when tested three months later. This patient has experienced no recurrence of vitreous hemorrhage during the last six months; whereas during the previous two years bleeding recurred once in six weeks on the average. The period of observation of the other two patients has been limited but one of them has recently experienced a recurrence despite daily doses of rutin of 160 mg.

Of interest are two adults found to have

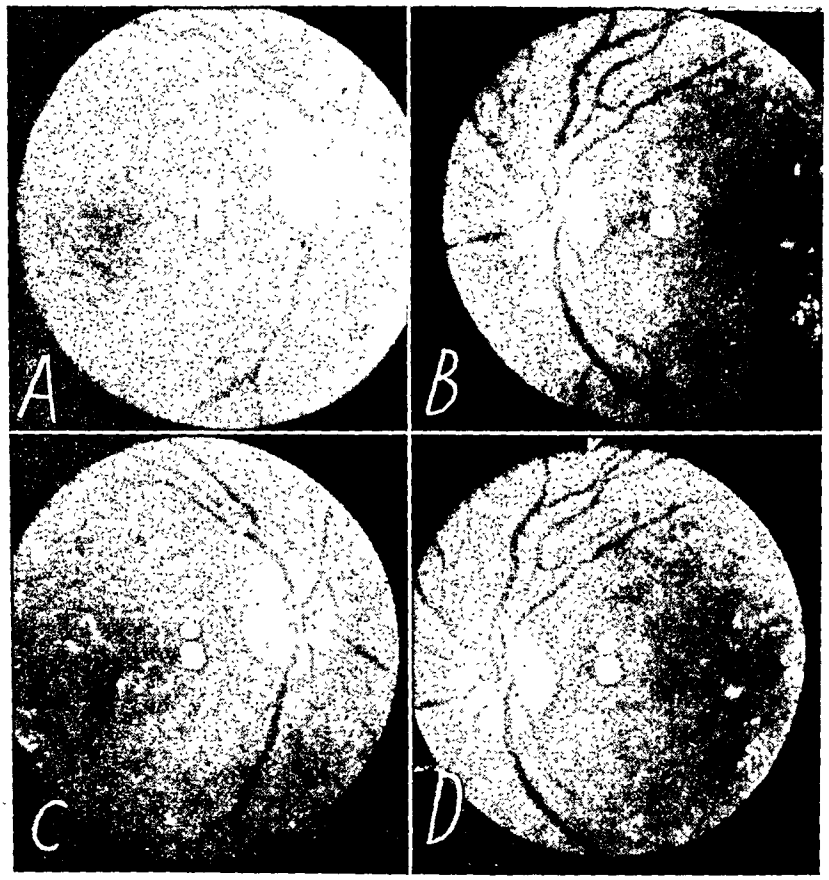


Fig. 1 (Donegan and Thomas). *Case 1.* A white woman, aged 54 years, had been a known diabetic for 18 years. On May 9, 1946, before beginning treatment with rutin (A) fundus of the right eye with capillary fragility equaling 101 and vision, 0.1. (B) Fundus of the left eye at the same time, with capillary fragility equaling 101 and vision, 0.2—1. (C) Fundus of the right eye and (D) fundus of the left eye six months after beginning treatment with rutin. Capillary fragility is 32; vision: right eye, 0.1; left eye, 0.2—1.

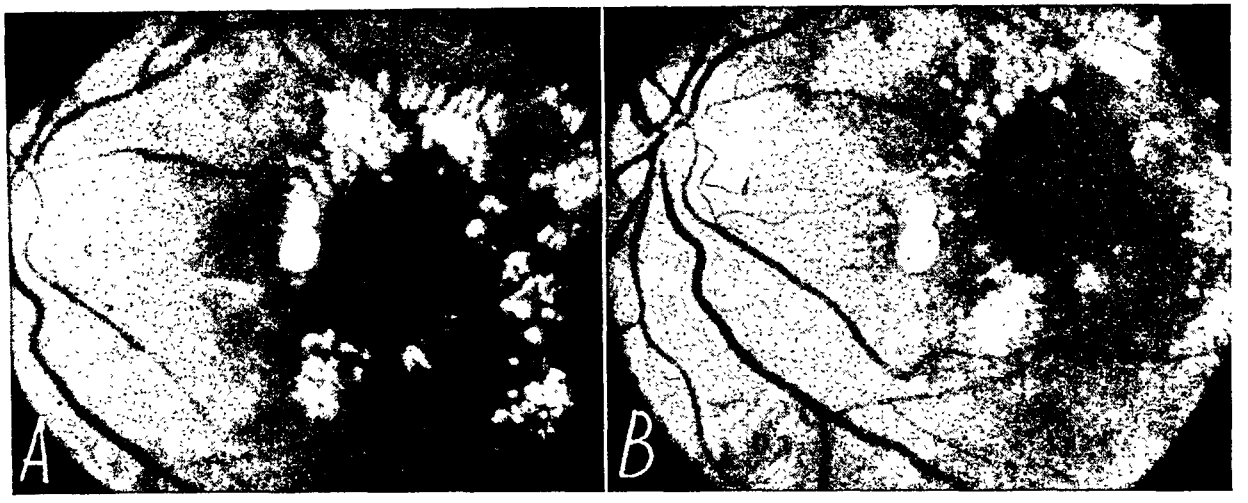


Fig. 2 (Donegan and Thomas). *Case 2.* A white woman, aged 54 years, had been a known diabetic for 10 years. (A) The fundus of the left eye before rutin therapy was begun; capillary fragility is 18; vision is 0.2—1. (B) Fundus of the left eye five months after beginning of treatment with rutin. The capillary fragility is 4; the vision is 0.2.

unilateral macular edema, with corresponding slight reduction in vision and relative central scotomas. The first, a white woman, aged 39 years, with mild vascular hypertension had noted slight blurring of right central vision for six weeks prior to examination. Except for the circumscribed area of edema in the right macula, the fundi and retinal vessels were normal. Her blood pressure was 150/90 mm. Hg, and the capillary fragility measured 81 on May 9, 1946. Rutin (160 mg.) daily was prescribed and seven days later she reported that the vision had cleared completely. Examination revealed only a few minute, yellow dots in the right macular region. No central scotoma could be elicited and the petechial index was 16.

In the second case, that of a 38-year-old white man, the history was similar and examination revealed a circumscribed area of edema in the left macula, with a corresponding relative central scotoma. General physical examination was essentially negative and the blood pressure was 112/72 mm. Hg. Only two petechiae were found on testing the fragility but 160 mg. of rutin were prescribed. Two weeks later he reported that vision in the left eye had returned to normal, and reëxamination revealed no central scotoma. The left macula appeared normal except for three tiny yellow dots. At this time the capillary fragility was zero.

Two of three patients with high myopia and macular hemorrhages had normal capillary fragility, while one presented 63 petechiae after application of the cuff pressure. The fragility decreased to 16 after rutin therapy but no significant improvement in vision or the fundus picture was noted in this patient nor in the other two.

No improvement in vision nor in the ap-

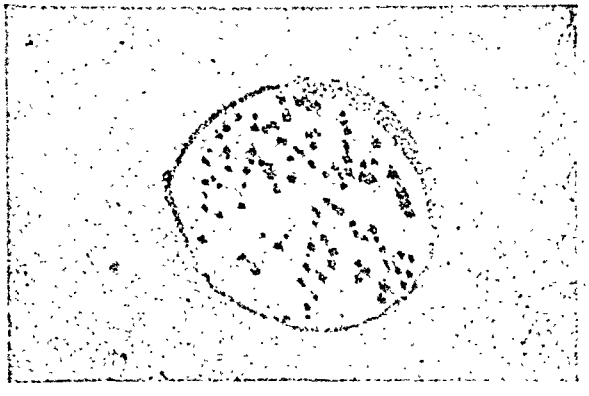


Fig. 3 (Donegan and Thomas). Demonstrating an abnormal number of petechiae in a 2.5-cm. circle in the antecubital fossa after application of the blood-pressure cuff for five minutes at a pressure midway between the previously determined systolic and diastolic pressure.

pearance of the retina was found after rutin therapy in two cases of occlusion of branches of the central retinal vein.

However, one patient, a 72-year-old white woman, suffering from mild generalized arteriosclerosis and hypertension experienced a sudden loss of left vision which was attributed to occlusion of one of the disc vessels. A remarkable recovery of vision and coincident clearing of the edema and petechial hemorrhages took place under rutin therapy, while the capillary fragility dropped from 46 to zero.

No increase in general capillary fragility was demonstrable in three individuals with central choroiditis or in two patients with disciform degeneration of the macula, and no improvement in vision occurred after administration of rutin.

The remaining 20 patients studied were hypertensive and arteriosclerotic individuals with a heterogenous collection of retinal complications. Capillary fragility was abnormally increased in all of these and was generally reduced after the administration of rutin. In numerous instances favorable changes in the retinal complications were observed after institution of rutin therapy.

In summary, it would seem that our findings are similar to those of Friedenwald and Foxworthy, who recently found the capillary fragility generally increased in diabetes mellitus, and even more markedly increased in diabetic patients with retinopathies. An increased capillary fragility in vascular hypertension, as reported by Griffith and Lindauer and by Shanno, was also demonstrated in our small series. The general capillary fragility was almost universally reduced by the ingestion of rutin in 51 patients.

Although no significant improvement in vision or decrease in the extent of retinopathy was observed in 25 patients with diabetes mellitus, we feel that the subject warrants further study. The retinal lesions in diabetes mellitus are noted for their chronicity and inertness, and in the patients included in this study the retinopathy was marked and undoubtedly irreversible.

Conclusions

1. Capillary fragility was found to be abnormally increased in arteriosclerosis and hypertension, to a greater extent in diabetes mellitus, and most markedly in diabetics with retinopathies.

2. Rutin has been found to decrease capillary fragility, but not to normal levels in diabetics with retinopathies.

3. Although no significant improvement in vision or decrease in retinopathy was observed in diabetes after rutin therapy, it may be significant that no loss of vision or increase in retinopathy occurred during a period of 10 to 12 months' treatment.

4. Rutin appears to be of benefit in the treatment of Eales's disease and central serous retinopathy.

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MILD GLAUCOMA*

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The classification of glaucoma into acute, chronic congestive, and chronic simple forms is based on the clinical course of average typical cases. It does not take into account, however, the degree of severity of the disease. The division of the cases into narrow- and wide-angle types suffers from a similar inadequacy.

To the patient and his family, it is more important to know the prognosis of his disease than to receive an accurate diagnosis. In a series of 373 cases of primary glaucoma,† we observed 40 patients in whom the disease remained unusually mild throughout the entire course. Several of these patients were observed for many years. Some of the cases were discovered accidentally on routine examination, others were diagnosed because of the presence of glaucoma in other members of the family, while still others complained of mild symptoms of glaucoma.

In these patients the ocular hypertension is not very high, and generally is well tolerated. A good response to miotic therapy is the rule. The fields show no deterioration during the entire period of observation, and the fundi and vision remain normal.

Those cases in which the elevation of tension was the only sign of glaucoma were included if a provocative test or pupillography, or both, gave a positive result. Brief histories of 16 of these cases are reported in this paper. In addition to these, there are several patients in our series who showed mild glaucoma in one eye, and a severe or moderately severe form in the other. One such case (Case 17) is included in this paper.

CASE REPORTS

Case 1. Lottie C., aged 60 years, was told 25 years ago by an eminent ophthalmologist that she had glaucoma. She has had recurring episodes of ocular discomfort and blurring of vision. Tonometric readings have varied between 20 mm.‡ and 35 mm. in both eyes. The Knapp adrenalin test was positive in 1922 but homatropine failed to elevate the tension. Her anterior chambers and angles are intermediate in depth. She is a moderate hyperope. Her visual acuity has remained 20/20 in the right eye and 20/25 in the left eye over the past 18 years of observation. Visual fields and fundi are normal. The pupillographic curve is similar to that found in primary glaucoma. Pilocarpine (½ to 1 percent) relieves symptoms. Her brother and father suffered from glaucoma.

Case 2. Samuel D., a 64-year-old lawyer, was first seen in 1927 when he complained of intermittent pain in his eyeballs. Tension was normal at that time. In 1934, he saw colored halos around lights on three different occasions. The tension was still normal in both eyes. These symptoms continued at intervals. In addition, there was blurring of vision especially after near work and card playing. The attacks occurred at varying intervals, more commonly in the left eye, and were relieved by 1-percent pilocarpine. The tension was measured frequently over a period of 18 years and was found to be below 30 mm. except on three occasions. In 1939, the tension in the left eye was 33 mm. In 1943 the tension was 36 mm. in the right and 45 mm. in the left. Similar tonometric readings were obtained in 1945. His vision has remained 20/20 in each eye. The left eye is emmetropic while the right

* Presented before the New York Academy of Medicine, Section of Ophthalmology, October 20, 1947.

† Many of these cases were originally patients of the late Dr. Mark J. Schoenberg.

‡ All tonometric measurements were made with the Schiøtz tonometer and readings refer to the 1924 graph according to which 30 mm. Hg represents the upper limit of normal.

eye takes a −0.50D. cyl. ax. 180°. Fundi and fields are normal. His anterior chambers are deep and angles are wide. Pupillography showed a curve similar to that found in primary glaucoma. Thus it was not until 16 years after the onset of symptoms that a significant elevation of tension was discovered.

Case 3. Samuel F., a 55-year-old physician, began to complain of tearing, blurring of vision, and halos in 1931, three months after a golf-ball injury to the left orbit. The symptoms recurred intermittently for 10 years; yet at no time was the tension found to be elevated even though he made frequent visits to an ophthalmologist. If he used pilocarpine before a movie, he could prevent the subsequent appearance of halos. Between March, 1942, and October, 1943, the tension of his left eye was found to be 36 mm. on four different occasions. His right eye showed an elevation to 33 mm. on only one occasion. The symptoms were readily controlled by pilocarpine in dilutions as low as ½ percent. He has been suffering from left-sided familial migraine since 1913. The chamber angles are narrow. Vision of the right eye is 20/20 with a +4.0D. sph. ⊂ +2.5D. cyl. ax. 100°; and that of the left eye is 20/20 with a +3.5D. sph. ⊂ +2.75D. cyl. ax. 70°. Fundi and fields have remained normal. Pupillography shows curves similar to that found in primary glaucoma.

Case 4. Sarah A., aged 63 years, was first seen in 1937 when she complained of occasional blurring of vision. Examination revealed bilateral incipient cataracts. The fundi were normal and the tension was 26 mm. in each eye. The vision of the right eye was 20/20 with a +0.50D. sph.; and of the left eye, 20/30 with a +0.25D. sph. ⊂ +0.25D. cyl. ax. 180°. She was advised to use scopolamine (1/5 percent) three times a week in each eye. For nine months, while using the scopolamine, she was seen on several occasions and her tension was always below 26 mm. Hg (Schiøtz). She stopped medication and had no subjective symptoms, except occasional blurring of vision, for the next eight years. In May, 1945, in the course of a routine examination, her tension was 33 mm. in the right and 31 mm. in the left eye. One month later, it was 49 mm. in each eye, but dropped to 28 mm. one hour after the instillation of 2-percent pilocarpine. At this time, the patient was going through emotional stress. Pilocarpine (1 percent), used twice daily, has controlled the tension to date. Chamber angles are wide. Fundi and fields have remained normal. This patient has nerve deafness and obesity. She is one of six siblings of a consanguinous marriage (first cousins). There are no other cases of glaucoma in the family. However, one brother, her mother, maternal grandmother, and several other members of her mother's family had defective hearing. Her mother also had diabetes.

Case 5. Carrie K., a 62-year-old musician, was first seen in 1929 on routine examination. Her vision was 20/20 in each eye with +0.50D. sph. Tension and fundi were normal. She was seen at regular intervals, and it was not until August, 1944, that the tension in her left eye was found to be elevated to 33 mm. She was not given any medication. At the next visit, one month later, the tension was 40 mm. in the left eye and 28 mm. in the right. She was placed on 1-percent pilocarpine, two times a day. Her tension has been below 30 mm. up to the present time. Vision, fundi, and fields have remained normal up to the present. Pupillography shows a curve similar to that found in primary glaucoma. The patient does not complain of any ocular symptoms, except for tearing of the right eye which is due to partial obstruction of the lacrimal duct. She is a highly sensitive and a high-strung individual.

Case 6. Fay L., a 55-year-old housewife, was first seen in September, 1942. For two years previously, she suffered from eye-strain and sensitivity to light. She would fatigue easily and could not do her work.

A diagnosis of glaucoma was made at a hospital clinic in February, 1942. When she first saw Dr. Schoenberg, she was using miotics three times a day in each eye. She was also being treated for early menopausal symptoms and obesity. Vision was 20/20 in each eye with +0.25D. cyl. ax. 180°. Tension was maintained below 30 mm. in both eyes with 1-percent pilocarpine, three times a day. On one occasion (November, 1943) the tension in the left eye was 41 mm. and in the right 35 mm. Vision, fundi, and fields have remained normal. Pupillography, in 1942, showed a curve which contained elements similar to those found in glaucoma in addition to features suggestive of other neurologic disturbance.

Case 7. Suzanne M., a 66-year-old housewife, has been under observation since 1925. She has never had any ocular complaints. In June, 1945, routine tonometry gave a reading of 39 mm. in each eye. No treatment was started because she was advised to have a pupillographic examination. The patient left town and reported again in December when the tension was found to be R.E., 35 mm. and L.E., 41 mm. She went south and on her return visit in March, 1946, the tension was 36 mm. in each eye. Pupillography at this time revealed a curve which combined the usual pupillographic findings in cases of glaucoma with those of essential hypertension. She was then placed on 1-percent pilocarpine, twice a day. Her tension now fluctuates between 26 mm. and 33 mm. No symptoms referable to glaucoma have been experienced. Fundi and visual fields have remained normal up to the present. Vision is 20/20 in each eye with +0.50D. cyl. ax. 180° for the right eye; and +0.50D. sph. for the left. Gonioscopy shows wide angles. She developed diabetes in 1944 and also suffers from mild essential hypertension.

Case 8. Lillian R., a school teacher, aged 60 years, has been followed since 1931. She had no ocular symptoms until 1941 when she complained of eye fatigue after reading. Routine tonometry revealed tension of 28 mm. in each eye. In 1943, the tension was 36 mm. in each eye. Pilocarpine (½ percent) was prescribed but patient used it very irregularly. In 1945, the tension was again 36 mm. in the right eye and 34 mm. in the left and has remained at about 30 mm. Fundi show shallow cupping. Vision has remained 20/20 with +2.50D. sph. on each eye. Fields have remained normal. The patient also suffers from essential hypertension, diabetes, and obesity. Her mother, four sisters, and two brothers have diabetes. She also suffers from nerve deafness of the left ear.

Case 9. Carrie N. was first seen in 1921 at the age of 35 years. In 1924, she had occasional blurring of vision and ocular discomfort in the left eye, especially in bad weather. The tension was normal at this time. The Knapp adrenalin test resulted in mydriasis, generalized vasoconstriction, and hysterical crying. The jugular compression test was positive in the left eye but failed to raise the tension in the right eye. Homatropine failed to raise the tension; however, pilocarpine lowered tension from 26 mm. down to 14 mm. Elevation of tension was first noted in the left eye in 1928. Although the tension was normalized by pilocarpine, the symptoms persisted. Iridencleisis on the left eye, in 1941, controlled both symptoms and tension. The right eye remained normal until 1944 when the ten sion was 36 mm. Vision has remained 20/15, O.U. She has a moderate degree of hyperopia. Anterior chambers are shallow. Fundi and visual fields have remained normal. She suffers from asthma and essential hypertension. The pupillographic curve was similar to that found in primary glaucoma. Her mother, sister, and several other members of the family suffer from glaucoma.

Case 10. Rosa L., a sister of Carrie N. (Case 9), was first seen in 1921 at the age of 45 years. Because of her symptoms of recurrent blurring of vision of the right eye and a history of glaucoma in her mother,

she was carefully watched for glaucoma. Except for a positive reaction to the Knapp adrenalin test, there was no clinical evidence of glaucoma until 1927 when an elevation of tension to 42 mm. was noted in the right eye and to 36 mm. in the left. Miotics controlled the tension. Homatropine and ephedrine used as provocatives failed to raise tension significantly. Vision has remained 20/20 in each eye with −3.0D. sph., O.U. The fundi and fields were still normal when last examined in October, 1946.

Case 11. Gussie F., a 64-year-old woman, had an attack of acute glaucoma in 1932 at the age of 49 years. The attack subsided under miotics, but eight months later she suffered from another episode of congestion in the left eye. In 1933, she had another attack. This one responded to miotics, but she continued to have frequent elevations of tension with mild congestive symptoms until 1942 when a severe congestive attack necessitated iridencleisis. Tension in the right eye remained normal until 1945 when it was found to be 36 mm. on two separate occasions. She had no symptoms in this eye. Vision has remained 20/20 with +1.5D. cyl. ax. 90°, O.U. Fields and fundi have remained normal. Her sister has glaucoma.

Case 12. Norma P., aged 49 years, began to see colored halos in 1940. In 1941 she was refracted by another ophthalmologist who told her that her eyes were normal. She came under the observation of Dr. Schoenberg, in 1943. In view of the symptoms and the fact that her sister (Gussie F., Case 11) suffered from mild glaucoma, the patient was kept under careful observation. Nevertheless, a rise of tension was not observed until five months later. At this time the tonometric reading of the left eye was 43 mm. Under pilocarpine the tension dropped to 25 mm. on the following day. Pupillography showed a curve in both eyes similar to that found in glaucoma. The right eye has remained normal. Vision is: R.E., 20/25 with a +2.0D. sph. ⊂ +1.0D. cyl. ax. 160°; L.E., 20/20 with a +1.25D. sph. ⊂ +1.5D. cyl. ax. 180°. Fields and fundi have remained unchanged.

Case 13. Celia H., a 64-year-old housewife, began to complain, in 1937, of intermittent colored halos and pain around her right eye, especially after emotional excitement. A diagnosis of glaucoma was made by another ophthalmologist. Since the symptoms were not controlled by miotics, this physician advised surgery. She consulted a second ophthalmologist, but did not tell him her history. He found the tension to be normal and instilled homatropine in her right eye. This was followed by an acute congestive attack in the right eye. She responded to miotic therapy. The left eye has remained normal. Vision is 20/30 in the right eye with a +7.0D. sph. ⊂ +1.0D. cyl. ax. 140°, and 20/30 in the left eye with a +5.5D. sph. ⊂ +0.75D. cyl. ax. 170°. The anterior chambers are shallow and both angles are narrow. Fundi and fields have remained normal.

Case 14. Regina B., a 67-year-old journalist, first noted a heaviness and blurred vision in her right eye, in 1934. The symptoms followed closely upon news of the revolution in Vienna where her family was living. She made her own diagnosis of glaucoma because her cousin suffered from the disease. Tension in her right eye fluctuated between 18 mm. and 33 mm., while that in the left eye measured constantly below 25 mm. Vision has remained 20/20 in her right eye with +4.5D. sph., and 20/70 (amblyopia ex anopsia) in the left eye with +5.0D. sph. Fields and fundi are normal. The course of the glaucoma in this case is very similar to that of her cousin, Celia H. (Case 13).

Case 15. Rachel G., aged 72 years, has been followed since 1934. Aside from mild retinal arteriosclerosis and incipient cataracts, her eyes were found to be normal. In January, 1947, she complained of frontal headaches of one month's duration and occa-

sional blurring of vision. She has slight anisocoria, the right pupil being 4 mm. and the left 3½ mm. Slight cupping of the lower border of the right optic disc was noted, but both discs were normal in color. Vision in the right eye was 20/40 with a +3.5D. sph.; that of the left eye was 20/30 with the same correction. Peripheral fields and blind spots were normal. Tension was R.E., 35 mm.; L.E., 28 mm. Gonioscopy showed wide chamber angles. A lability test showed an increase in the intraocular pressure from 26 mm. to 36 mm. in each eye. Pilocarpine (1 percent) relieved the symptoms and lowered the tension to 22 mm. This case is an example of *early* glaucoma. It is too soon to prognosticate the course which the disease will follow.

Case 16. Ada F., a 65-year-old housewife, had an Elliot trephining operation performed on her left eye in 1926 for an advanced chronic simple glaucoma. At that time, the vision and field had already been greatly reduced. Her right eye remained symptom-free until 1937, when she was seen soon after an attack of cloudy vision which had subsided upon the installation of a miotic. While under continuous miotic therapy for the right eye, tension fluctuated between 16 mm. and 30 mm. until 1944, when a tonometric reading of 36 mm. was noted on one occasion. This patient also has diabetes and thyrotoxicosis. Fundus and field of the right eye have remained normal. Vision in the right eye, when last seen in 1945, was 20/20 with +3.0D. sph. ⊂ +2.0D. cyl. ax. 20°. This case illustrates that the course may be radically different in the two eyes.

Case 17. Osias M., a 70-year-old business man, suffered from a spontaneous retinal detachment of the right eye, in 1920. When first seen, vision in the right eye was 20/30 with +1.5D. sph., and that of the left eye, 20/20 with −1.0D. sph. ⊂ −1.50D. cyl. ax. 45°. Ultimately, he developed a total detachment and complicated cataract in the right eye. He was examined at frequent intervals and the ocular tension was always within normal limits. In 1935, the patient complained of discomfort and ocular fatigability in his left eye after close work. Even on this occasion the tension was R.E., 23 mm., L.E., 28 mm. However, one hour after the instillation of one drop of 1-percent homatropine, the tension of the left eye rose to 39 mm. He used ½-percent pilocarpine two times daily and the tension of the left eye fluctuated between 22 mm. and 33 mm. On another occasion, in 1942, 1-percent homatropine raised the tension of the left eye from 28 mm. to 39 mm. He developed lens opacities and index myopia. His corrected vision in 1945 was 20/70, and his fundus showed shallow cupping. Although no pallor of the disc was noted, a slight degree might have been masked by the presence of nuclear sclerosis. The peripheral field remained normal and the central field showed a small Bjerrum scotoma in 1945, 10 years after the diagnosis of glaucoma was made.

Comments

Mild and atypical forms of glaucoma offer a challenge in diagnosis. Many ophthalmologists have, at various times, emphasized the importance of recognizing the disease when signs and symptoms are absent or minimal. Several terms have thus found their way into the nomenclature. Among these are "preglaucoma"[1] and "prodromal glaucoma."[2] These terms are generally used to describe not the course of the disease but a specific stage in its life cycle. The choice of the terms is unfortunate since they imply that glaucoma has not yet become clinically manifest. It is an established fact that any disease may occur in a mild form and remain mild throughout its entire course. Jacobson[3] mentions a case of "prodromal glaucoma" of 28 years' duration. It is obvious that these terms refer, in reality, to clinical glaucoma which is either early or mild, or both.

An example of true preclinical glaucoma

is the normal eye in a monocular case. Five cases in our series showed a time difference of 8 to 15 years in the onset of glaucoma in the two eyes. In some instances provocative tests such as the Schoenberg[4] jugular compression test were negative in the normal eye. However, in all monocular cases pupillography showed a similar curve for both eyes.[5]

Another example of preclinical glaucoma is the glaucoma-free interval in the acute and chronic congestive forms. In several cases there was a time interval of more than five years between congestive attacks in the same eye. In one case, the left eye remained apparently free from glaucoma following an Elliot trephining operation until 18 years later, when a congestive attack occurred in the same eye.[6] Provocative tests may be negative during this interval. The glaucoma-free intervals should not be confused with the stage which follows a congestive attack, when the tension is often lower than in the other eye. One of our patients who complained of recurring attacks was considered a hypochondriac for one year by several ophthalmologists, because they always found the tension to be low normal. The subsequent course proved that he had chronic congestive glaucoma. If due credence is given to the patient's subjective symptoms, a diagnosis of glaucoma will be made earlier.

The best way to study the preclinical phase of glaucoma is to utilize normal individuals. Since the incidence of the disease in glaucoma families is greater than in the general population, a study of the preclinical stage of glaucoma may be facilitated by limiting one's self to the unaffected members of these families.

In a study of 30 such families from a genetic point of view, it was found that certain individuals, while themselves clinically normal, transmit the disease to their offspring. Since the inheritance is of the dominant type, one of the normal parents must of necessity carry the gene for glaucoma and may therefore be considered to have "genetic glaucoma." Thus genetic glaucoma is one type of preclinical glaucoma.

Pupillographic studies are now being carried out to discover whether pupillography may be an aid in the recognition of such preclinical cases. Three out of 14 children of glaucoma parents showed a curve similar to that found in primary glaucoma. In the general population, the finding of such a curve is extremely rare.

It is obvious that the terms "preglaucoma" or "prodromal glaucoma" should not be used in referring to the clinically established disease. The terms "early glaucoma" and "mild glaucoma," however, are descriptive of the clinical behavior of the disease. It is true that, in the early stage, it is not always possible to predict the future course which the disease may take. The case may be regarded as an early glaucoma until the physician is relatively certain that it is going to continue as a mild case. Of course, a certain number of these cases may later become more severe.

The term "mild glaucoma" was deliberately chosen because in trying to classify these cases in the conventional manner, we found it impossible to evaluate the symptomatology. If patients have symptoms of occasional bluring of vision, slight ocular discomfort, tearing, occasional halos, and difficulty in reading, are we justified in labelling them as chronic congestive glaucoma, even though congestion of the eye is never observed either by the patient or by the physician? There are other cases which have no symptoms nor loss of field and yet show fluctuations in tension. They cannot be unqualifiedly placed in the same category as a typical case of chronic simple glaucoma. In mild glaucoma conventional classifications break down and one has to identify the case according to its clinical behavior.

The diagnosis of glaucoma in such cases is often extremely difficult. Tonometric measurements form part of the routine examination in this office in all patients over

40 years of age. Tensions of 30 mm. or over are considered suspicious and warrant further investigations by means of provocative tests and pupillography. Of course, the reliability of the tonometric readings depends on the proper technique, care of the instrument, and accurate calibration. More important, however, than the numerical reading, is a difference of tension in the two eyes. We agree with Downey[7] that a difference of 4 mm. between the two eyes is significant; wide fluctuations in tension over a period of time are very suggestive even if the tension never exceeds 30 mm.

Among the provocative tests, we consider the lability test[8] and the water-drinking test[9] as the most reliable ones. A history of glaucoma in the family should make one less ready to dismiss the patient's symptoms even in the absence of objective signs. Such patients form excellent material for the study of the earliest phases of the disease. Pupillography has proved a useful adjunct in the diagnosis of a doubtful case.

If a case appears to have a mild form of glaucoma, it is not necessary to rush in with miotic therapy. It may be of benefit to the patient, and it certainly is to the advantage of the physician, to observe the case without masking its course by treatment. Placebos may be useful for psychologic reasons. Many patients are labelled as glaucomatous on the basis of one abnormal tension reading and are told that they must use drops for the rest of their lives.

Even if a patient is known to have mild glaucoma, it may be advisable for him to abstain from miotics as long as the symptoms are minimal and the fields show no signs of deterioration. It is worth mentioning that in some patients, the symptoms are even aggravated by the use of pilocarpine or other miotics. Since the earliest changes in the field occur in relation to the angioscotomas, it goes without saying that the fields should be carefully plotted on a tangent screen or stereocampimeter with small test objects and under standard conditions. We are using a tangent screen without markings from which the field is transferred by means of a pantograph.[10] (See this issue of the JOURNAL page 728.)

As in all forms of glaucoma, one can learn a great deal about these mild cases through long observation. The cases presented have been chosen with this in mind. For example, some patients tolerate moderately elevated tension for relatively long periods of time without showing any symptoms, ophthalmoscopic signs, or loss of field. We have observed such instances even among the more severe forms of glaucoma. Can ocular hypertension within certain limits be regarded as a compensatory mechanism which serves a useful purpose in maintaining the normal function of the eye? This point has been considered at greater length elsewhere.

It is obvious that surgery has no place in the treatment of a disease which runs such a mild course that none of the visual functions are impaired. Some of the cases, indeed, serve as controlled experiments. Several patients who suffered from glaucoma of equal severity in both eyes had an operation on one eye only; yet the disease followed a similiar course in both eyes. In general, it may be said that any statistical study aimed at evaluating the role of surgery in glaucoma should take into consideration the degree of severity of the disease prior to surgery.

A form of mild glaucoma which was not included in this paper is the syndrome of recurrent glaucomato-cyclitic crises.[11] This is a form of recurring attacks of unilateral glaucoma with mild cyclitic signs. It is probably a clinical entity and may be regarded as intermediate between primary and secondary glaucoma.

We have already referred to the fact that in many instances one eye ran a severe course while the other eye followed a mild course. Even among glaucoma patients in general, the two eyes may occasionally vary in the type as well as the severity of the disease.

Our experience with mild glaucoma is not unique. These cases are a part of the everyday practice of ophthalmology. The physician's and patient's attitude toward glaucoma is naturally colored by the dramatic experiences with severe cases. It is well to think of mild glaucoma. It may, at times, prove of great psychologic value for the patient to know that the diagnosis of glaucoma is not incompatible with a good prognosis.

Summary

1. In some cases of glaucoma, the disease is so mild that the fundus, fields, and central vision remain unaltered for many years.

2. Of 373 cases of glaucoma, 40 had the mild form. Seventeen case histories are reported in this paper.

3. Diagnosis is made by prolonged observation, provocative tests, and pupillography. Special attention should be given to the patient's symptoms and hereditary history.

4. Patients suspected of glaucoma should be very carefully studied before a definite diagnosis is made. An attempt should be made, whenever possible, to determine the degree of severity of the disease before instituting miotic therapy.

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A COMPARISON OF ANISEIKONIC TEST INSTRUMENTS AND PROLONGED INDUCTION OF ARTIFICIAL ANISEIKONIA*

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Aniseikonia can be produced artificially in any normal individual by the wearing of afocal glasses which by different lens thicknesses and base curves will magnify the image seen by one eye more than the other. The unequal images produced will interfere with fusion, cause subjective distortion of objects in space when perspective and rectilinear shapes are absent, and if the difference in size is more than approximately 5 percent, fusion and stereopsis are prevented altogether. Lesser differences will cause eyestrain in certain individuals who are unable to maintain suppression under all circumstances. Suppression of parts of an image helps to eliminate the false stereoscopic clues in favor of the more accurate monocular clues in such individuals. Many who have anisometropia or unequal or oblique astigmatic refractive corrections, or have different-sized eyes, have such unequal, yet highly acute, ocular images. Some of these persons will never have comfortable vision until the images are made equal, or one eye is occluded sufficiently to allow continuous suppression.

EXPERIMENTAL PROCEDURE

These experiments involved wearing afocal glasses which magnify in the vertical meridian (axis 180°) of one eye for periods of 25, 37, and 23 days. The final experiment involved oblique aniseikonia, and the lenses were worn for 28 days. Glasses in each instance were worn continuously every waking moment, and measurements were taken twice a day on the test instruments.† The experiments provide evidence about the following questions:

1. How does an individual react subjectively and functionally when suddenly and persistently forced to cope with binocular images which do not match?

2. What is the nature of the subjective and measured adaptation to artificially induced aniseikonia? Will the binocular organization change to promote fusion?

3. How does the space eikonometer[2] correlate with the ophthalmo-eikonometer[3] in measuring artificial aniseikonia? Why is the simple frontal plane alignment[4] unsuitable as a diagnostic test?

4. How sensitive and precise are the two standard instruments? Do they over- or under-estimate the error?

5. What is the effect of homatropine and eserine on the measurement of artificial aniseikonia?

THE AXIS-180° EXPERIMENT

Figure 1 summarizes the first experiment. The subject is the writer, whose eyes are normal except for slight myopia (O.D., —0.75D. sph. ⌒ +0.25D. cyl. ax. 90°; O.S., —0.50D. sph. ⌒ + 0.25D. cyl. ax. 90°) for which he had not been wearing glasses. Aniseikonia, measured without glasses many times before and after the experiment, is: Axis 90°, O.S., 0.4 percent; axis 180°, O.S., 0.8 percent. This means that to equalize the images of the two eyes, the whole left image must be magnified 0.4 percent, and the axis 180°, an additional 0.4 percent. The lines on

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† The writer acknowledges the aid and direction of Kenneth N. Ogle, M.D., and Robert E. Bannon, B.S., of the Dartmouth Eye Institute in these experiments, performed between February 4, 1946, and July 25, 1946. He also thanks Ethel Jean Babbitt, O.D., who was the subject in the experiment of Figure 4. This work differs from that of Herman Burian, M.D., in 1943,[1] in that the size lenses in his experiments were worn at axis 90° instead of axis 180°, and were worn a maximum of 14 days.

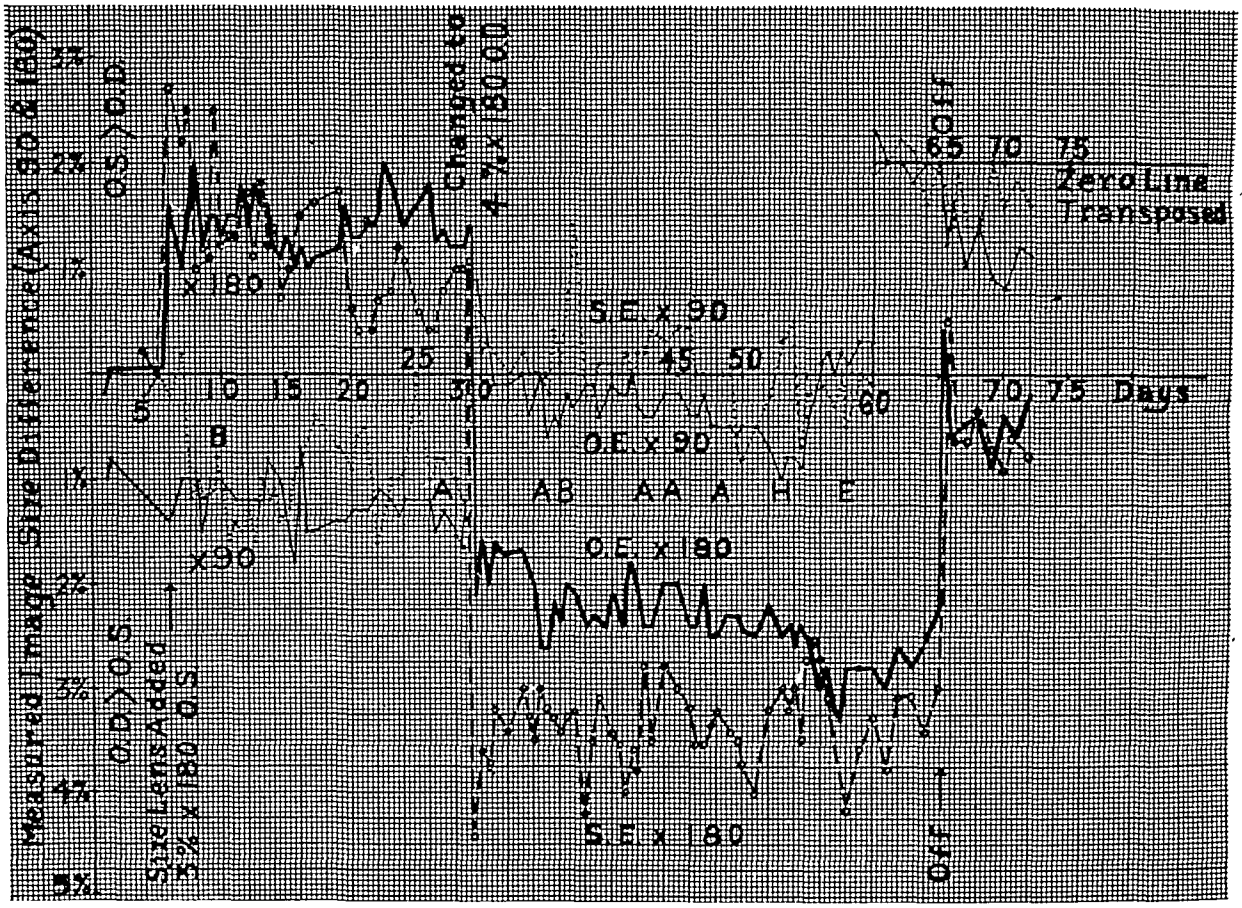


Fig. 1 (Miles). The differences in the size of the images of the two eyes as determined by the ophthalmo-eikonometer (O.E.) at 20 feet and the space eikonometer (S.E.) at 10 feet with the subject (P. W. M.) wearing a meridional size lens of 3.0 percent at axis 180° before the left eye for 25 days, then 4.0 percent at axis 180° before the right eye for 37 days. (A) indicates headache. (B) indicates subjective adaptation to distortion. The heavy lines indicate axis 180° measured, the fine lines, axis 90°.

the graph record this figure: the magnification required over the other eye to equalize the images. The O.S. > O.D. means that under the test conditions, the left image has been found larger than the right in the two meridians the amount specified on the graph.

The graphs may be better understood by referring in Figure 2 to the four diagrams, "P" to "S." "P" shows diagrammatically a stereoscopic card where a tall right image is presented for fusion with a square left image. Obviously, magnification of the left image, axis 180°, is required to equalize the images. Below the abscissa, right images are too large, and above the abscissa left images are too large.

In Figure 1, the abrupt change in the two heavy lines indicates the changes in axis-180° aniseikonia according to the space eikonometer (S.E.) and the ophthalmo-eikonometer (O.E.) when aniseikonic glasses were put on, the fifth day. These glasses were afocal, but the left lens was three times thicker than the right, and was "bent" on the 180° axis so that the upper and lower edges approached the face. This magnified the image seen by the left eye 3.0 percent in the vertical meridian. Neither lens worn blurred the vision perceptibly. Visual acuity at 20 feet was: O.D., 20/25; O.S., 20/20.

Subjective findings with axis-180° aniseikonia

Immediately, there was distortion of surrounding objects, but no particular discomfort. The desk top tipped down toward the right. At dinner the first evening, I dis-

covered an inability to pass a plate of peas. The plate was held 15 degrees off the horizontal. On walking, there was some tendency to try to adjust to the slope visualized, when the feet could much better take care of themselves. A level lawn seemed to slope level. Worse yet, it was impossible to fit a trial frame on a patient's face without a monocular side view. Minor surgery was done without difficulty.

After about five days, "B" in Figure 1, the distortion was no longer annoying in

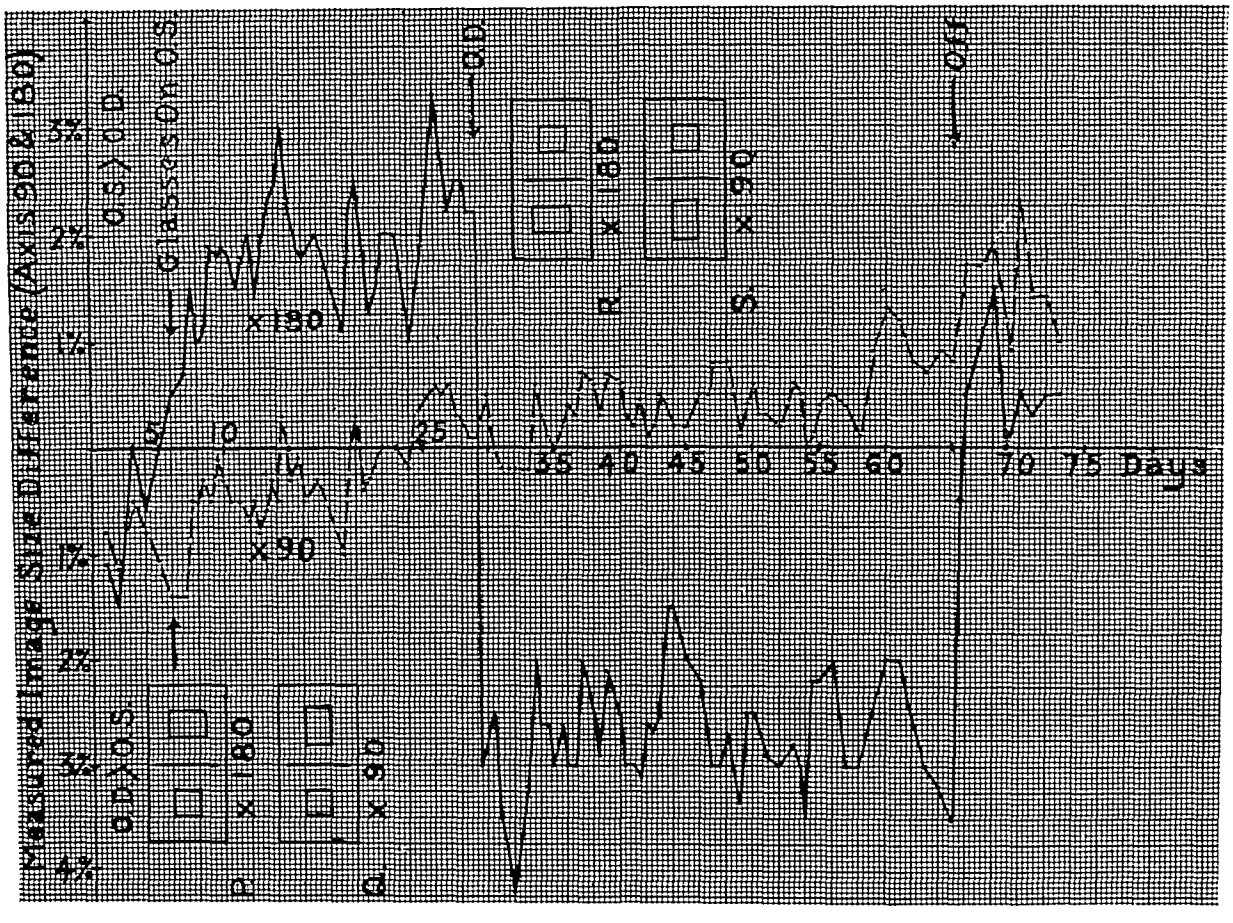


Fig. 2 (Miles). Measurement of axis-90° and axis-180° aniseikonia in the same experiment as in Figure 1, by means of the frontal-plane apparatus (fig. 4). In the axis 180° in subject P. W. M., the test was relatively stable. Axis 90° should remain near the zero line throughout, however. This is the broken line near the abscissa.

up to the left and down to the right for a radius of about 40 feet. More distant lawn was flat, but tipped as it was approached. The left foot appeared smaller than the right and was on a shorter leg. Objects on the right seemed larger and more distant than they were known to be. A wall actually in a frontal plane appeared more distant on the right. Any rectangular object such as a sheet of paper or a magazine appeared trapezoid, larger on the right.

I found it impossible to fix a lampshade ordinary surroundings, but there were occasional mild headaches, points "A." However, when the surroundings contained no perspective or rectilinear detail to increase the probability of mental choice of monocular clues for depth judgments, the distortion returned. For instance, on looking down on a grassy slope, or walking through underbrush, one is forced to depend on binocular clues. A slope was perceived in error as much as 20 degrees. There was a fearful helpless feeling while following a

path through dense underbrush. Branches on the right seemed feet away, but without provocation would approach and strike.

INSTRUMENTS UNDERESTIMATE THE ERROR

In Figure 1, the solid line, axis-180° aniseikonia starts out nearly at zero, but on putting on the glasses on the fifth day, 3-percent axis-180°, left, the image O.S. becomes larger in this meridian than the image O.D. However, the heavy solid line and the heavy dash line (space eikonometer) do not approach a measurement of 3 percent, but fall considerably short. The error was known with certainty, because the glasses worn were tested on the diopto-eikonometer for an eye-wire distance of 9 mm. both at the factory and at the Dartmouth Eye Institute.

The space eikonometer measured correctly the known error at first, but began a progressive undercorrection. The measurement fell in a 25-day period from 2.75 percent to about 0.4 percent, which requires explanation. The space-eikonometer (S.E.) test is based on subjective adjustment of a string target to appear on a frontal plane before the eyes. It is supposedly free of monocular clues, so that judgment is entirely based on stereopsis. Apparently, in this experiment, the adaptation shown was due to some obscure monocular clues which gradually became sure enough to affect final judgment. Stereopsis was given progressively less weight due to memory of its failure in ordinary surroundings.

When the 3-percent lens was removed from the left eye and a 4-percent lens placed axis 180° before the right eye, the adaptation or progressive undercorrection on the S.E. did not take place. In Burian's experiment[1] it was noticed that "the effect of a size lens of 3 percent worn by the two observers H. M. B. and R. E. B. in front of the right eye (10 to 14 days) was reduced by about 50 percent at the end of the experiment, whereas when the lens was worn in front of the left eye, the decrease in effectiveness was only about 20 percent." Burian did not state whether this "adaptation" was limited to readings on the S.E. as in the experiments reported here.

For many years, patients at the Dartmouth Eye Institute have been tested in the "leaf room."[5] This is a box with an open end 6 by 6 feet with a head rest in the center. The box is 7 feet deep, set exactly level with true right angles. The interior is covered with several layers of artificial leaves. Lacking perspective detail and monocular clues, one's judgment of the leaf room depends on stereopsis. One with aniseikonia will state that it is distorted. On placing aniseikonic lenses before the eyes, the end and sides and floor and ceiling all change position. Now, some patients see this distortion with a very weak magnifier before one eye who do not see it when the magnifier is placed before the other. It has been assumed that this is due to dominance. Theoretically, suppression of stereoscopic clues is easier in the recessive eye. These experiments do not confirm this theory. H. M. B. and R. E. B. got adaptation with the lens over the dominant eye; E. J. B. got no adaptation with the lens over the dominant eye. P. W. M. got adaptation with the lens over the recessive but not over the dominant eye.

Moreover, there is no evidence at all of adaptation on the O.E. instrument (solid line fig. 1). This test measures aniseikonia by a comparison of visual angles of about four degrees and requires no use of stereopsis. The adaptation is, therefore, not real. It is due to a change in choice of conflicting monocular and binocular clues in the cerebral centers. Incidentally, monocular clues are more numerous and are given more weight in space judgments than is commonly believed. They include in order of decreasing importance: perspective, overlay, parallax, known size, illumination contrast, position above or below, color, atmospheric haze, and convergence proprioception. Perspective can, under laboratory conditions,

actually predominate over free binocular vision with parallax.

The time factor in aniseikonic tests

In these experiments, perhaps five minutes were spent on the S.E. test, 10 minutes on the O.E., and 25 minutes on the frontal plane apparatus about twice a day. It requires about 10 minutes to get all of the head rest adjustments just right on the O.E., but, once done, the settings can be recorded and duplicated quickly. Adjustment on the S.E. is somewhat simpler. Prof. R. E. Bannon criticized my experiment on the basis that not enough time was taken to measure the full amount of aniseikonia present. He has reiterated for years that one should not be satisfied with the first end point, but should repeat and repeat the test up to an hour or more. Dr. Herman Burian said,[1] "The longer an observer watches a field which is relatively free from perspective factors, the more he frees himself of the memory values of the previous experiences and the more he is apt to give weight to the disparity factors."

The adaptation found in Figure 1 measured on the space eikonometer should not lead to doubts of the instrument's value. The axis-180° adaptation would undoubtedly have disappeared with prolonged testing. Many patients need prolonged testing on this instrument for a different reason. Some, because of aniseikonia or faulty development, have poor sensitivity on the S.E. They do not habitually use stereopsis, and give it no weight in space judgment. Such a patient improves markedly with repeated tests. It is excellent orthoptic training.

Professor Bannon proved his point in the E. J. B. experiment (fig. 3). On the 28th day the measurement had been running along for a week at: O.S., 2.0 percent plus or minus 0.2 percent on the O.E. instrument, when it suddenly went down to 1.6 percent. Her remark that it was adaptation elicited doubt in Professor Bannon. Upon measuring her for an hour, the aniseikonia became 2.6 percent axis 180°, which was more than the 2 percent worn.

Effect of homatropine and eserine

In Figure 1, "H" indicates the use of 2-percent homatropine (3 times daily) in each eye for four days. Plus-2-diopter clip-ons were used for the daily work, but not for measurements. On the O.E., this caused an immediate change in both axis-90° and axis-180° readings, a measurement more nearly the known aniseikonic error by 1 percent in each meridian. Surely homatropine has nothing to do with a memory factor. Immobilization of the lens mechanism or change in the accommodation-convergence ratio may affect the O.E. test. No change was evident in the S.E. test. On the fifth day, eserine ointment was applied, and a myopia of more than 6D. induced. This resulted in a spike not shown on the graph. On the O.E., but not on the S.E., there was more axis 90°, O.D., by 1 percent and less axis 180°, O.S., by 0.75 percent.

Subject E. J. B. found that homatropine for 24 hours did not affect the measurements. She was not undercorrected without it, nor did she show any tendency to adaptation. Her eyes are normal except for myopia: O.D., −2.5D. sph., 20/15; O.S., −2.5D. sph., 20/15. Axis 90° is not recorded in Figure 3, but it ran throughout the experiment (O.S., 0.2 percent plus or minus 0.6 percent on both S.E. and O.E.).

In Figure 1, it can be seen that, while P. W. M. was wearing O.S. axis-180° magnification, the axis-90° reading remained about 1.2 percent, O.D. When the magnification was worn O.D., the axis 90° became about 0.2 percent O.D. This difference is a bit more than experimental error, and is attributed to the induced size effect.[6]

Frontal-plane measurements

Figure 2 shows the aniseikonia as measured on the frontal-plane apparatus. As in Figure 1, the axis-90° line wanders upward, but in a more purposeful way. In

this case, axis 180° is measured quite accurately. The error in axis 90° is evidently due to an increasing amplitude of fusion during the prolonged test, repeated daily for weeks. This can easily be explained by a description of the apparatus and the technique. The accuracy of the method depends on the amplitude of fusion, which is so weak in many patients that the graphic determination of aniseikonia is impossible.

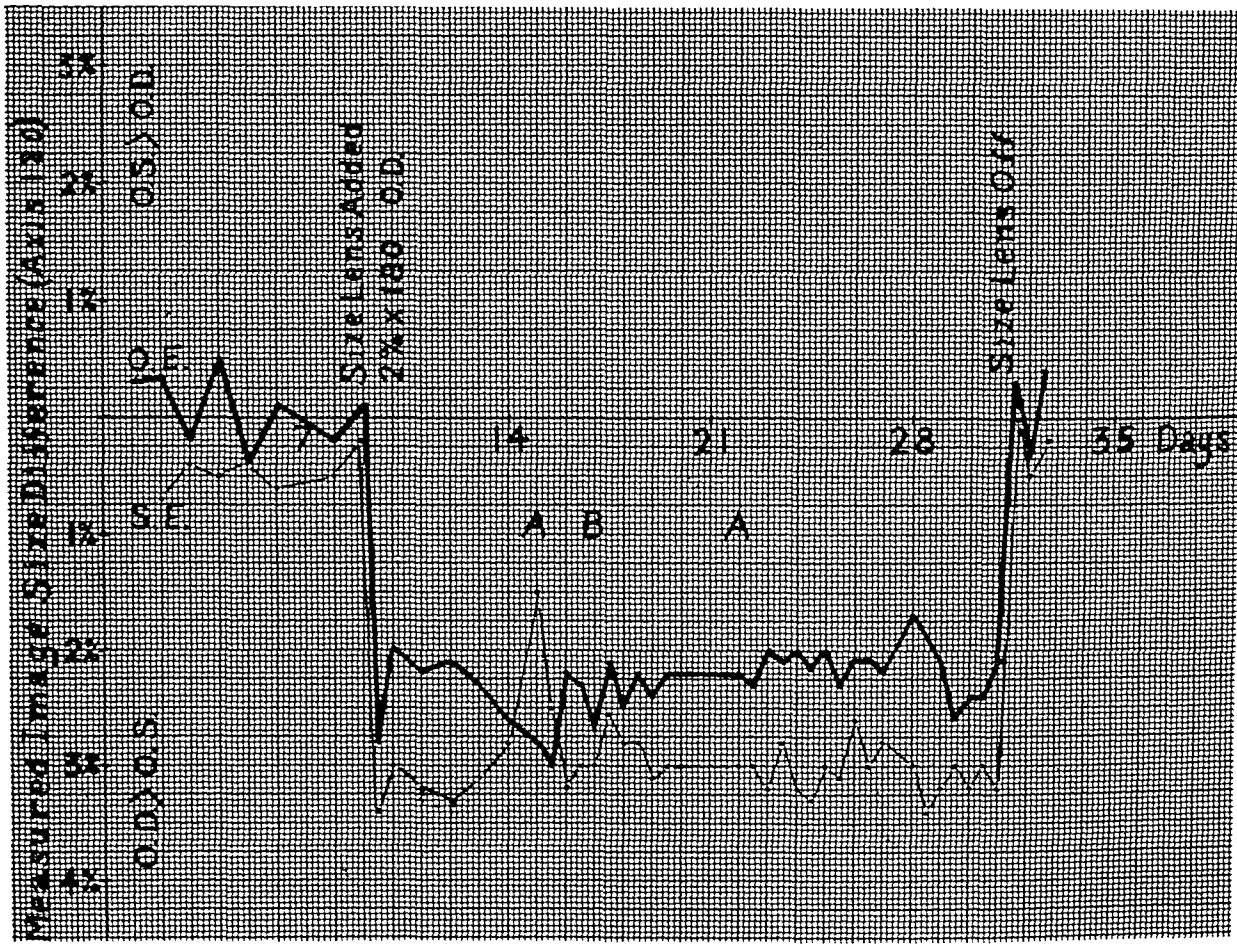


Fig. 3 (Miles). The differences in the size of the images of the two eyes as determined by the ophthalmo-eikonometer (O.E.) at 20 feet and the space eikonometer (S.E.) at 10 feet with the subject, E. J. B., wearing a meridional size lens of 2.0 percent at axis 180° before the right eye. (A) indicates headache. (B) indicates subjective adaptation to distortion.

Figure 4 shows the apparatus to consist of a head holder, dissimilar apertures (to prevent their fusion), a target on glass consisting of irregularly shaped and sized spots arranged along a horizontal line level with the two eyes, with a few irregular spots above and below, seen in peripheral vision, which increase the amplitude of fusion. This target is placed before a white background, so that no outside details exist to affect the judgment as to its position. When axis-90° size is placed before one eye, the dots on that side appear larger and are perceived further away. This axis-90° depth change is geometrical and has been explained frequently in the past.[1] The plane is moved by the subject on a vertical central axis until the two sides of the target appear equidistant. The total absence of perspective clues and minimum of monocular clues makes the setting depend chiefly on stereopsis. The number of degrees the plane is rotated proportional to the percentage magnification in the axis-90° direction up to the limit, about 20 percent.

When axis-180° size is placed before one eye, it has exactly the opposite effect as axis 90°, with equal but opposite rotation of the target plane up to about 6 to 8 percent. This is the induced size effect of Ogle.[6] Stronger magnifications produce less rotation, so that the information—magnification over either eye axis 180° and the rotation of the target plane in degrees plotted graphically—becomes an S-curve. From the center of the S-curve and the slope of the line determined by target rotation due to 2 percent, axis 90° over either eye, aniseikonia is determined.[6]

THE OBLIQUE ANISEIKONIA EXPERIMENT

An analogous experiment was performed on subject P. W. M. with oblique meridional size lenses and is summarized in Figure 5. Tests were made twice daily on the space eikonometer. Only the "delta," the amount of oblique aniseikonia, is recorded here. Axis 90° and axis 180° remained; 0.0 percent plus or minus 0.4 percent, and O.S., 0.8 percent plus or minus 0.7 percent respectively. Oblique aniseikonia is of clin-

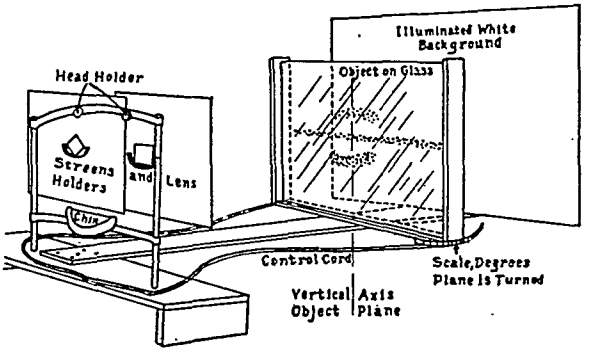


Fig. 4 (Miles). Schematic drawing of the frontal-plane apparatus used for measuring aniseikonia. Size lenses are placed at axis 180° before one eye magnifying from 1.0 to 14 percent, and the object plane is adjusted to appear perpendicular to the median plane of the head.

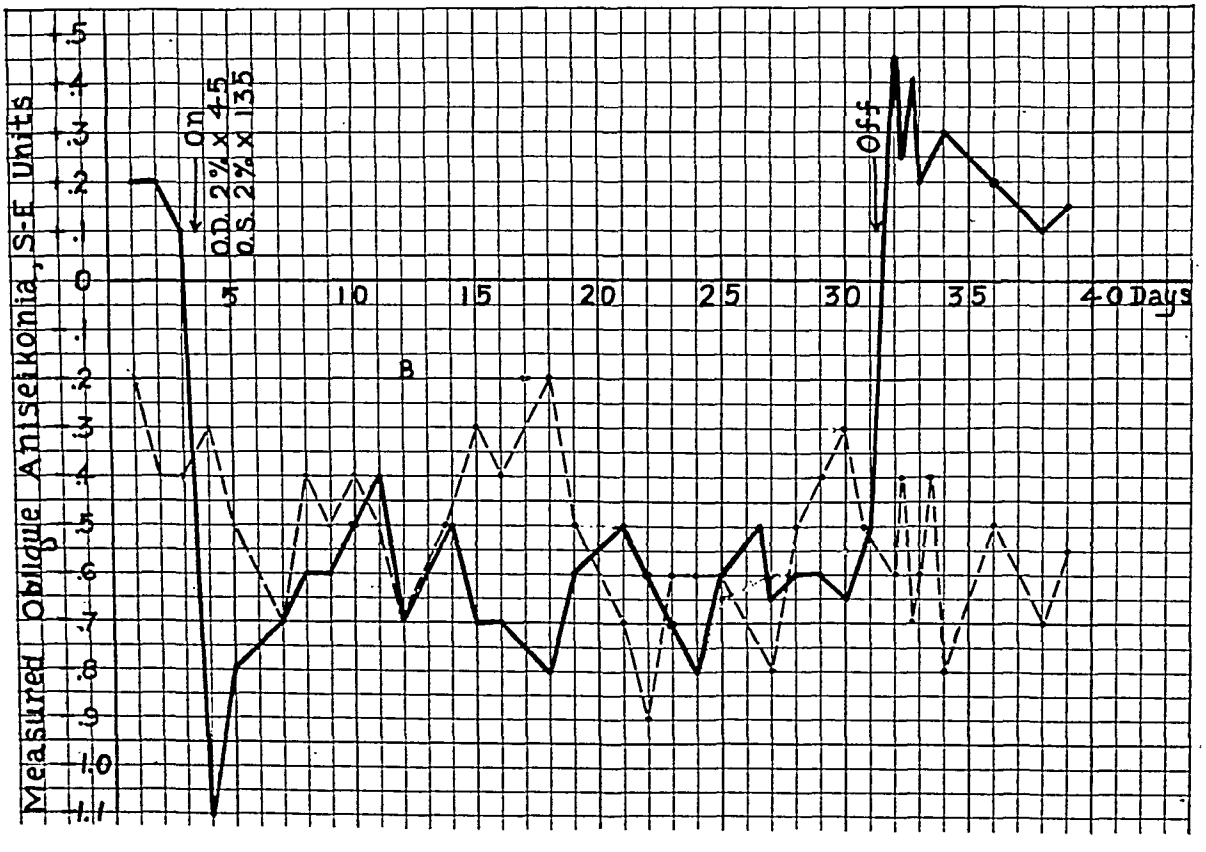


Fig. 5 (Miles). The solid line indicates the amount of oblique aniseikonia in subject P. W. M. when wearing oblique meridional size lenses as measured on the space eikonometer. The broken lines indicate simultaneous cyclophoria in the same units, apparently unaffected by the glasses. (B) indicates when partial subjective adaptation occurred.

ical importance in patents with oblique astigmatism.

In this experiment, the oblique lenses caused much more discomfort than did the axis 180°. The prescription was O.D., 2 percent, axis 45°; and O.S., 2 percent, axis 135°. This is equivalent in its effect on cyclophoria and spacial distortion to a dioptric strength of 2.5D over each eye at the same axes, placed at an eyewire distance of 9 mm. It is well known that patients wearing glasses for such astigmatism are seldom comfortable. The glasses worn in this experiment were afocal, and did not blur the vision.

In Figure 5, the solid line is the oblique aniseikonia as measured on the space eikonometer with actual strings at 10 feet. The broken line is cyclophoria measured in the same units under the same target conditions by means of a half-silvered mirror and additional test targets thereby projected into the scene.[7] It is seen that cyclophoria at the beginning was recorded at −0.2 and −0.4 (degrees total excyclophoria) but increased to about −0.6 percent plus or minus 0.3 percent during the experiment at the same time that adaptation to oblique aniseikonia as expressed by the solid line occurred. The persistence of cyclophoria after removal of the glasses is not understood.

Subjective symptoms

Such glasses, like plus cylinders with axes converging above, put strain on the superior oblique muscles. Each of the 28 days the glasses were worn, there was eye strain with a constant almost overwhelming desire to remove them. The pull on the superior obliques would have been decreased by adjusting the axes nearer either the vertical or horizontal. Adjusting the axes to diverge above would shift the pull to the inferior obliques which are normally much stronger and more efficient. The eyestrain from the experiment was never sufficient to prevent daily work, although concentration and study were difficult.

There was distortion, extreme at first, which was not much improved after a week. Even after 28 days, there was little subjective adaptation. The distortion, like that with axis-180° magnification, was limited to objects within about 40 feet. Geometrically, the distortion (for instance the rotation of a frontal plane in degrees) should increase approximately with the square of the distance.[8] Practically, this increase is not important because beyond about 40 feet monocular clues to depth perception begin to predominate. The question has been raised in the use of the space eikonometer whether the front vertical strings can be made equidistant to the observer without making the rear vertical strings unequal, and vice versa. In practice with the target at 10 feet, the difference is imperceptible. Due to the relatively small interpupillary distance, steropsis itself is limited to from 100 to 600 yards.[9]

At first, buildings and walls looked too tall, and seemed to lean toward me. Persons nearby seemed tall and overbearing with long spindly legs. On looking down at a grassy lawn, I seemed to be standing in a depressed area or trough extending laterally. On standing in a field of barley, this trough was deeper, and on changing the visual direction, the trough rotated causing everything to wave like the surface of the ocean. Walks through the woods were very unpleasant due to a feeling of unreality and even fear. The brush seemed to close in about the head. Persons with claustrophobia should be tested for this type of aniseikonia!

At badminton, I missed the shuttlecock by a foot or more at first. After some practice, I did fairly well.

I did not try to drive the car with these glasses on, but it has been done. A. Ames, Jr., reports,[8] "In driving an automobile . . . there is only the very slightest or no apparent tipping of the road. However, with the glasses one feels elevated, almost as if sailing along 10 or 15 feet above the road." With the meridional size lenses each rotated

90 degrees, "The glasses have the opposite effect, as if one were driving in a child's cart with his feet almost dragging on the road. Contrary to what might be expected, movement of the car enhances these effects."

Additional remarks

These subjective findings are rarely described by patients suffering from aniseikonia until glasses correcting the aniseikonia are worn. Patients then complain of distortion for a day or so. Clinical experience shows that when the full amount of aniseikonia measured on either the ophthalmo-eikonometer or space eikonometer is prescribed, the correction measured again at any later date remains consistent. One need not overcorrect or undercorrect aniseikonia.

Prof. R. E. Bannon told me of an instance "in the old days" when every patient so unfortunate as to have measurable aniseikonia was forthwith corrected by glasses. By some fluke, the size lens was placed over the wrong eye. The patient was I. C. F., Ph.D., who wore about 1.5-percent magnification on the wrong eye, thereby increasing what error she had by 1.5 percent. On reëxamination three years later, she was still wearing the glasses daily, and still showed the 1.5-percent error measured originally.

However, not all healthy individuals can wear experimental size lenses. A young physicist wore my O.S., 3-percent, axis-180° glasses for one-half hour, and went home with a splitting headache that lasted several hours.

Summary and Conclusions

This paper describes experiments in which meridional magnifying lenses were worn for prolonged periods of time. Subject P. W. M. wore 3-percent, axis-180° lens over the left eye for 25 days, changing immediately to 4-percent, axis-180° lens over the right eye for 37 days. Later, he wore O.D., 2-percent, axis 45°, and O.S., 2-percent, axis 135°, for 28 days. Subject E. J. B. wore 2-percent, axis 180°, O.D., for 23 days. With the axis-180° glasses, there was slight discomfort, occasional mild headaches, and marked distortion of objects in space. The distortion disappeared in about five days, except in surroundings devoid of perspective or rectilinear detail.

With the oblique aniseikonic glasses, there there was constant eyestrain and distortion of objects in space which was reduced in ordinary surroundings, but never did completely disappear. Excyclophoria produced during the experiment was measured and was found to increase an amount approximately equal to the amount which measured oblique aniseikonia decreased during the first two days. In other words, the compensation process which decreased subjective distortion involved increase in the cyclophoria.

The adaptation process otherwise is thought to involve a suppression of the objectionable parts of the image of the recessive eye. The parts suppressed are those slightly disparate due to the interpupillary distance. Since this disparity is necessary to stereopsis, this function becomes defective in aniseikonia, and monocular clues are given greater weight.

There is no real adaptation to aniseikonia. When an individual is forced to rely on stereopsis as in the space eikonometer, or when aniseikonia is measured by comparing actual visual angles as in the ophthalmo-eikonometer, aniseikonia is found to remain the same indefinitely.

There is apparently a time factor involved in measuring aniseikonia, which may explain some of the variability and "adaptation" shown in these experiments. In order to measure the total amount of aniseikonia present on either the space eikonometer or the ophthalmo-eikonometer, determinations must be repeated until, finally, memory factors, and habitual favoring of monocular clues over stereoscopic have been overcome.

Use of the space eikonometer is good training to develop stereopsis, since monocular clues are almost entirely eliminated.

In these experiments, the space eikonometer measured a larger portion of the artificial aniseikonia known to be present than did the ophthalmo-eikonometer. In one instance, the use of homatropine cycloplegia made the ophthalmo-eikonometer more accurate. Neither of these findings apply to clinical tests where more time is taken.

640 South Kingshighway (10).

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Historical Miniature

The word "phoria" is associated with a multitude of concepts of binocular coördination. It was introduced by von Graefe to designate potential strabismus. He had observed that, with many pairs of eyes which were obviously free from strabismus, the double images induced by a vertical prism were also displaced laterally.

SIZE OF LINE IN THE MADDOX-ROD TEST*

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This study is one of several (Scobee and Green[1]) concerned with the effect of variables in testing technique on the measurement of heterophoria with the Maddox-rod test. The particular variable studied in this report was that of the size of the line of light as seen through the Maddox rod in measuring heterophoria at a testing distance of 13 inches. It is a well-known fact that different examiners using the same test of heterophoria on the same individual may get different results. In a search for possible explanations of this variation, several possible variables have already been studied. These include: examiner variation, test used and its correlation with the cover test, amount of illumination in the testing room, color of the Maddox rod used, the eye before which the Maddox rod is placed—that is, dominant or nondominant—in performing the test, and individual subject variation from day to day.

METHODS FOR MEASURING

TEST LIGHTS USED

It was believed that since different examiners may use different sized muscle lights at the 13-inch testing distance and produce varying sized lines as seen through the Maddox rod, any possible effect of this size difference should be determined. In the beginning, three test lights were used. One was an ophthalmoscope with a May-type head removed; a second was a flashlight fitted with a solid diaphragm in which a hole 1.0 mm. in diameter had been bored; a third was a Welch-Allen ophthalmoscope with the head removed. The May-type ophthalmoscope gave a broad line image when viewed through a white Maddox rod. The 1.0 mm. light gave a narrow, sharply delimited line. The Welch-Allen ophthalmoscope light had such a comparatively large filament and resulted in so many lines of varying brightness when viewed through the Maddox rod that it had to be discarded because it was too confusing to the subjects.

TESTING DISTANCE

All measurements were made at a testing distance of 13 inches with the testing technique previously described (Scobee and Green[1]). In brief, both lateral and vertical heterophoria were measured at 13 inches with a white Maddox rod placed before the right eye of all subjects. For lateral hetrophoria, a Risley rotary prism mounted on a phorometer (American Optical Company) was placed before the same eye as the Maddox rod; the rotary prism had a total strength of 30 prism diopters and was calibrated in units of 1 prism diopter. For vertical heterophoria, the Maddox rod was used in conjunction with a Stevens phorometer mounted on the same instrument; the prisms were split before the two eyes and had a total strength of 2 prism diopters, being calibrated in 0.2 diopter units. Thirty-two subjects were tested.

* This study was done under a contract with the Office of Naval Research as Project N6onr-202, Task Order I.

† From the Department of Ophthalmology, Washington University School of Medicine, and the Oscar Johnson Institute.

‡ From the Department of Zoology, Ohio State University, Columbus.

Results of measurements

Lateral heterophoria

The average heterophoria was −4.89 prism diopters (exophoria) when the source of the light was large (*ophthalmoscope*) and −4.87 prism diopters when the source of light was small (flashlight). The difference of 0.02 prism diopters is not statistically significant, the standard error of the difference being 0.398 prism diopters ($t = 0.05$, $df = 31$, $P > 0.90$).

Two tests were made of the justification for using the statistical method of comparing a mean difference with its standard error. The first of these was to see if the frequency distributions of heterophoria under the two conditions of large and small sources of light were approximately normal in form. The distributions were shown to be sufficiently symmetrical and bell-shaped to justify the assumption of normality. The second test was to see if the variances of the two distributions were the same within sampling limits. These variances were found to be 25.67 square prism diopters for the large light source and 25.72 square prism diopters for the small light source. The ratio of these two variances, $F = 1.002$, indicates they are not significantly different as judged by the method of Morgan[2] for comparing variances of correlated series.

The heterophoria determinations under the two conditions of large and small light sources are highly correlated, $r = +0.90$. This is sufficiently high to indicate that knowledge of a heterophoria reading made under one condition will be equivalent for most practical circumstances to a heterophoria reading made under the other condition. Of the 32 subjects examined, only one had as much as 6 diopters difference, a shift from −14 prism diopters with the large light to −8 prism diopters with the small light. Two subjects had shifts of 4 prism diopters, one from +4 to +8, the other from −6 to −10. The remaining 29 subjects gave readings with differences of 3 prism diopters or less.

Vertical heterophoria

The average heterophoria was −0.03 prism diopters with a large light source and +0.03 prism diopters with a small light source.

The difference of 0.06 prism diopters is not significant when compared with its standard error of 0.12 prism diopters, ($t = 0.48$, $df = 31$, $P = 0.70 - 0.60$). The correlation coefficient was +0.85 and this is high enough to permit substitution of the large light for the small light reading or vice versa.

The same two tests for the justification of using the above test of significance were made. The distributions were approximately normal in form and the variances, 0.664 and 0.660, were homogeneous.

TABLE 1

Average heterophorias for 32 subjects for two sources of light*

Source of Light	Lateral Heterophoria (in prism diopters)	Vertical Heterophoria (in prism diopters)
Ophthalmoscope (large)	−4.89	−0.03
Flashlight (small)	−4.87	+0.03
Difference	0.02	0.06
Standard error of difference	±0.39	±0.12
Coefficient of correlation	±0.90	±0.85

* Note: − =exophoria; + =esophoria.
− =left hyperphoria; + =right hyperphoria.

Conclusions

There is no significant difference in the measurement of lateral and vertical heterophoria with the white Maddox rod at a testing distance of 13 inches when the size of the line as seen through the Maddox rod is either large or small. This means that any variation in heterophoria measurements in the same individual by different examiners using the Maddox-rod test at 13 inches cannot be considered due to any variation in the size of the line produced by varying sized muscle lights. Such a conclusion seems justified as long as the size of the muscle light used is within the limits of those included in this study.

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REGENERATION OF THE CORNEAL STROMAL CELLS*

I. Technique for destruction of corneal corpuscles by application of solidified (frozen) carbon dioxide

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Regeneration of the cornea has been extensively studied in the past. The origin and mode of replacement of the epithelium, endothelium, and Descemet's membrane is clearly understood.[1,2] There is still, however, a difference of opinion about the origin of the corneal stromal cells. A detailed review of the literature on this subject will be published at a later date. The purpose of this paper is to report the technique of a method for studying the regeneration of stromal cells which appears to be superior to the methods previously used by other investigators in this field.

Previous experimental methods

The essence of the previous methods is as follows. Salzer[3] made incisions into the

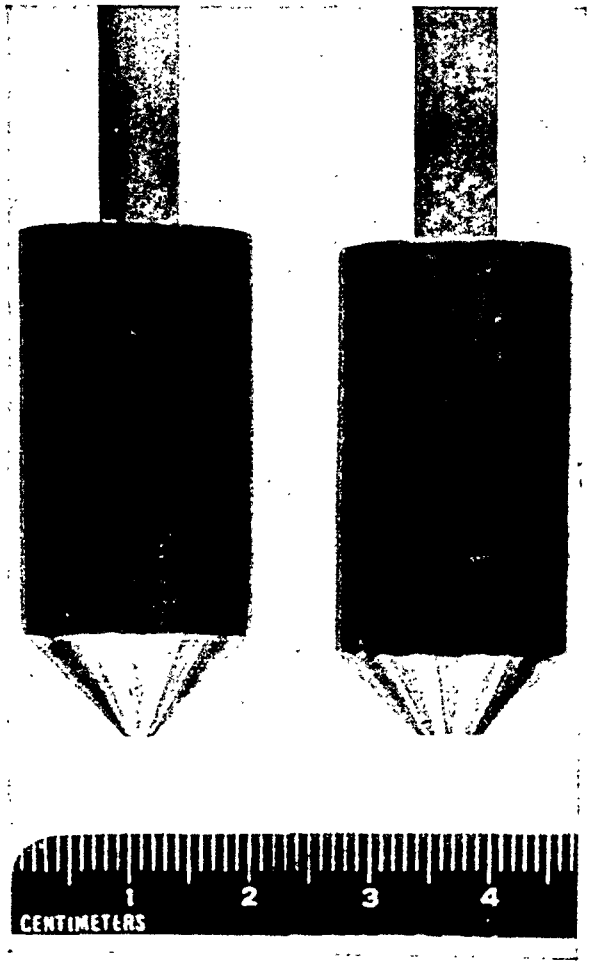


Fig. 1 (Maumenee and Kornblueth). Solid brass applicators.

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cornea with a trephine and concluded that the new stromal cells were derived from the epithelial cells. Hanke[4] made perforating and nonperforating incisions into the cornea with a trephine. Wolfrum and Boehmig[5] used a knife to make nonperforating incisions into the stroma from the posterior surface of the cornea and perforating wounds from the external surface of the cornea. Hanke and also Wolfrum and Boehmig were of the opinion that the newly formed cells were a product of the division of the uninjured corneal corpuscles. Pullinger and Mann[6] destroyed the stromal cells in the center of the cornea by applying a small drop of liquid dichlorodiethylsulphide (mustard gas) to the cornea. The authors could not obtain definite proof, but they thought that the new stromal cells probably were derived from wandering macrophages. While these methods of attack are useful in the studies of the regeneration of the corneal stromal cells, they entail certain disadvantages in studying the regeneration of the corneal corpuscles in clear corneas. External and internal incision into the stroma disrupt the corneal lamellae, allow the ingrowth of epithelium or endothelium, open a portal for the entrance of secondary infection, and destroy only a few stromal

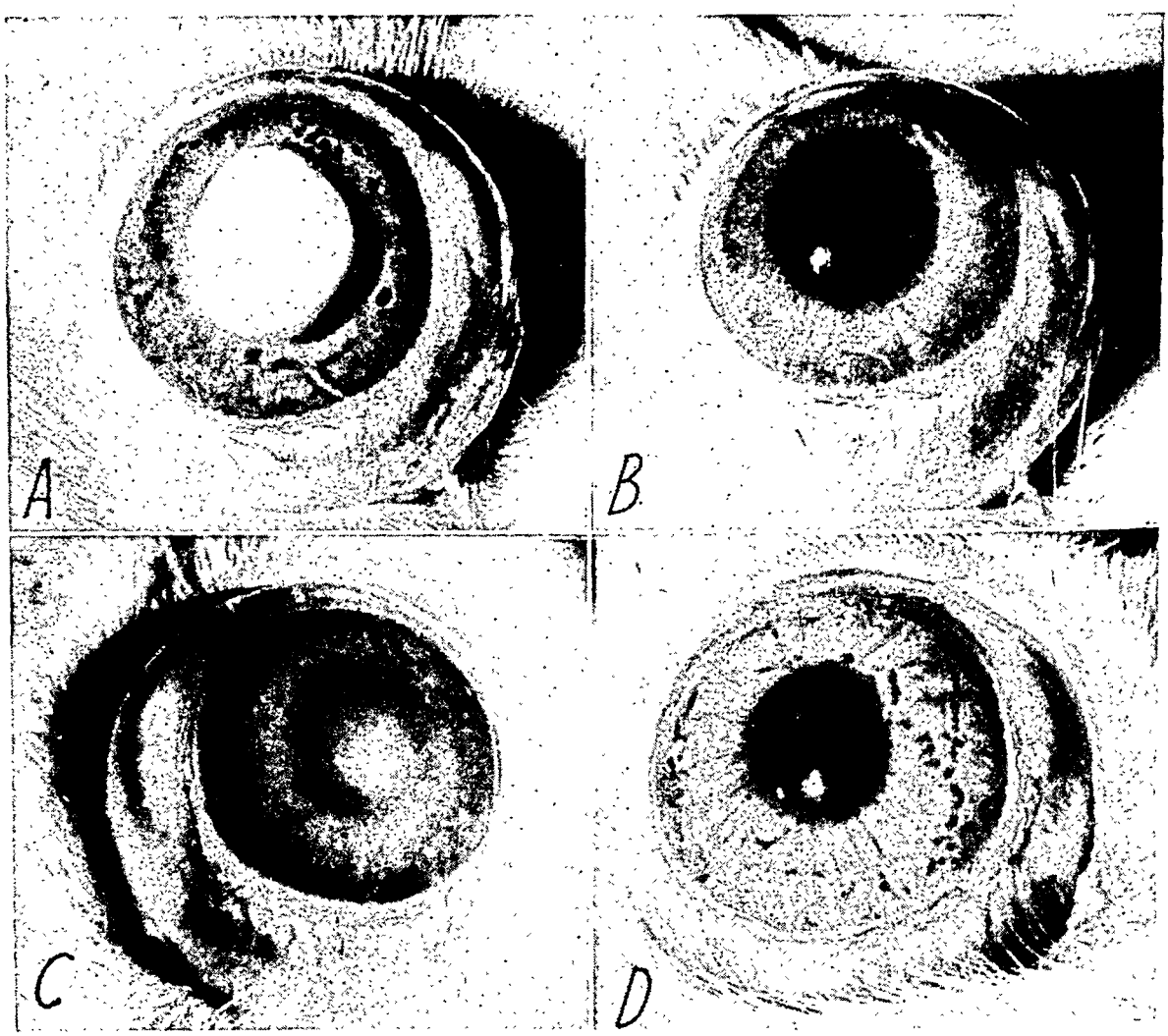


Fig. 2 (Maumenee and Kornblueth). (A) Rabbit cornea immediately after application of brass rod (—78°C.) for 5 seconds. (B) Same cornea 30 seconds later. (C) Same cornea 12 hours later. (D) Same cornea 7 days later.

cells. Lesions produced by liquid "mustard" eliminate these complications, but they also have some disadvantages. Liquid "mustard" is hard to obtain in some laboratories, it produces considerable inflammatory reaction, and the dosage is difficult to control.

Method used in this study

The method here reported consists in destroying the corneal stromal cells without disrupting the corneal lamellae or producing a severe inflammatory reaction.

Materials. The materials used are solidified (frozen) carbon dioxide (dry ice), absolute alcohol, and a solid metal rod. The solid metal rods are used because they are good temperature conductors, they will maintain the desired degree of coldness for a sufficient period of time to allow completion of the experiment, and they will produce a standard area of freezing. In our experiments solid brass rods, 19 mm. in diameter and 45 mm. long, were used. The end of the rod which was applied to the cornea was shaved down so that the area of contact was a circle 2 mm. in diameter on one applicator, and 6 mm. on the other (fig. 1).

The applicators are cooled to −78°C. by immersing them for a short while in a beaker of absolute alcohol containing "dry ice." The alcohol is removed from the applicators with a dry towel before placing them in contact with the cornea.

The animals are given a general anesthesia and the eyes are proptosed from the socket or fixed with forceps so that an accurate application of the rod to the cornea can be made. The lesions may be produced in the center or the periphery of the cornea. The area of the lesions can be varied from a circle, 2 mm. in diameter, to the entire cornea.

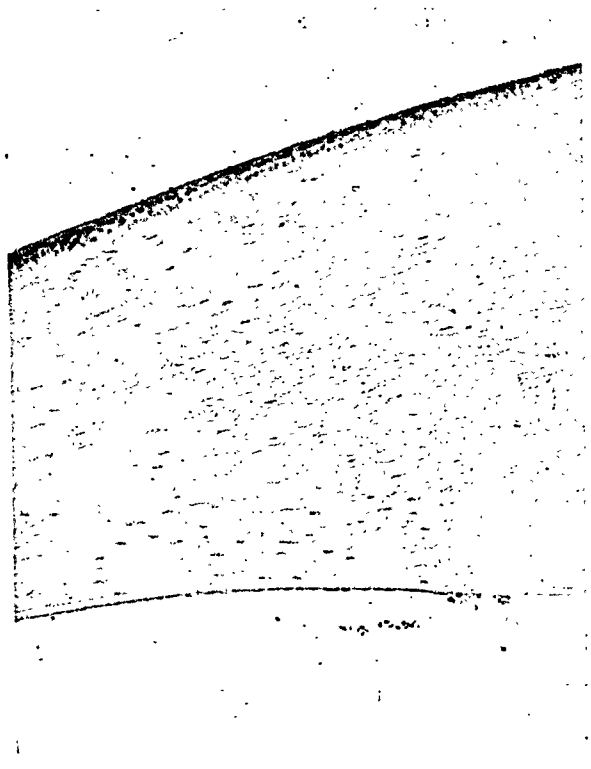


Fig. 3 (Maumenee and Kornblueth). Rabbit cornea 12 hours after application of 6-mm. brass rod (−78°C.) for 5 seconds. This view shows the margin of the lesion. (Histologic section. Hematoxylin-eosin stain. Magnification ×200.)

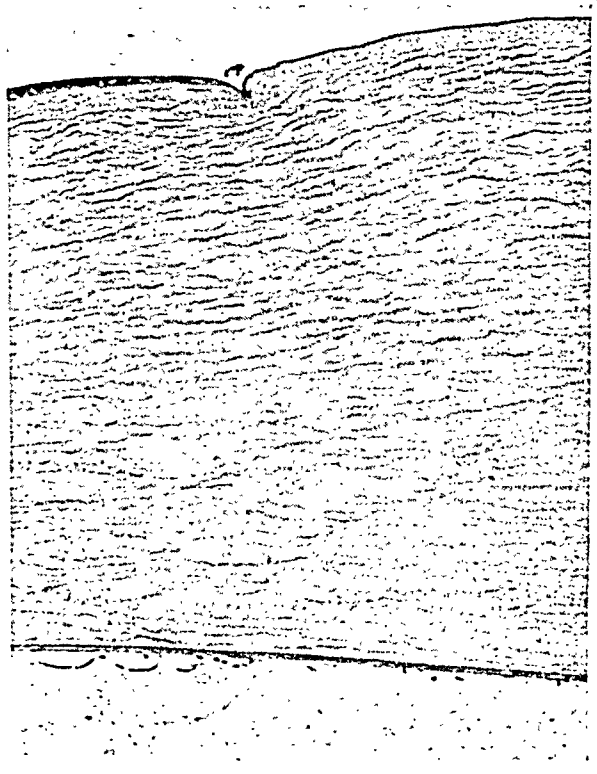


Fig. 4 (Maumenee and Kornblueth). This shows a slightly more central area of the same lesion as in Figure 3.

Application of the brass rod to a rabbit's cornea for 3 to 5 seconds freezes the full thickness of the cornea for 15 to 25 seconds (fig. 2A).

Appearance of cornea. After the cornea thaws it appears clear, although a very slight haze is present (fig. 2B). Two to three hours later the cornea becomes hazy due to edema of the stroma (fig. 2C). This edema persists for a varying length of time depending on the duration and area of the freezing. When the edema subsides, the cornea resumes its normal clarity and appearance on gross and slitlamp examination (fig. 2D). Blood vessels do not invade the cornea following central or peripheral lesions but they do invade the stroma following freezing of the entire cornea. Secondary infection does not occur except in some lesions of the entire cornea where there is persistent edema and eventual sloughing of areas of the stroma.

Histologic study. On histologic examination, all of the cells of the cornea including the epithelial, stromal, and endothelial cells are destroyed in the area that has been frozen. The corneal lamellae, however, do not appear to be damaged by this procedure. Twelve hours after freezing the cornea is edematous, and all remnants of the stromal cells have disappeared in the area of the lesion (figs. 3 and 4). It is remarkable that so few polymorphonuclear cells invade the cornea in spite of the extensive destruction of the stromal cells. After 72 hours most of the polymorphonuclear cells have disappeared from the cornea, and stromal cells show definite replacement in the periphery of the lesion. During the next few days, the stroma assumes an entirely normal appearance on histologic examination.

Summary

It has been found that freezing various sized areas of the cornea to −78°C. for 3 to 5 seconds produces a very convenient lesion for the study of the regeneration of the corneal stromal cells. These lesions do not disrupt the corneal lamellae, are not prone to secondary infection, and cause very little inflammatory reaction. After the lesions have healed the cornea is clear.

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TREATMENT OF PHORIAS IN ADULTS*

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Treatment of phorias in adults is highly important, extremely gratifying in the results obtained, and, due to the wide variety of problems presented, is the most interesting procedure in orthoptic work.

SYMPTOMS OF PHORIAS

The importance of treatment cannot be too highly stressed since the patients in this group suffer the greatest amount of discomfort of any persons having an "ocular muscle imbalance." Frequently the patient so afflicted is the one who goes from "doctor to doctor" with the hope of getting a pair of glasses that will be just right and will relieve the strain, fatigue, or particular discomfort to which he is subject. A thorough case history should be taken and the patient encouraged to talk about his eyes. This will not only make possible a better diagnosis but give the patient confidence and the feeling of being understood which psychologically will aid in relieving his symptoms.

Burning, itching, difficulty in focusing or in altering the focus quickly may be some of the symptoms of heterophoria; while severe headache, especially after close work, even the "one-sided" headache with nausea typical of migraine, may be experienced. Other symptoms can be blurring of vision approximating diplopia or actual diplopia. Some patients complain of nothing but inability to read longer than five minutes.

PROBLEMS IN TREATMENT

The first step in treating phorias is to do a careful refraction under cycloplegic, to be followed at a later visit by a Maddox-rod test on a phorometer and, if possible, a major amblyoscope.

Livingston suggests that heterophoria should be divided into two primary groups: (a) inherent, and (b) acquired; and that it is necessary to speak of that which is (a) symptom free, and (b) symptom producing.

He also states that ocular imbalances and their sequelae follow no happy and consistent pathway. Certainly this is true. A cover test for near may show a deviation of approximately 26-degrees exophoria, yet it will measure only 12 degrees on a Maddox-rod scale, and a patient whose measurements are orthophoric may be found to have several degrees of deviation when the cover test is applied. Measurements may vary in morning and late-afternoon readings and on subsequent days, while three consecutive tests may reveal three widely variant responses. These results, rather than being confusing, should lead to a more comprehensive understanding of this patient's problems, as will be shown later.

After the muscle-balance and fusional-reserve tests, including the near point of convergence have been taken, a decision must be made as to the patient's need for treatment. It is a very simple decision. Phorias are important not because of their degree, but because of the symptoms which may arise from this condition. Therefore, the patient who is "symptom free," regardless of how large the degree of heterophoria, is best left alone. To attempt treatment with the hope of achieving orthophoria, or of preventing future symptoms might well prove disastrous both physically and psychologically by giving him an "awareness" of his condition. However, these same tests

* Presented at the sixth annual meeting of the American Association of Orthoptic Technicians, Chicago, October 12, 1947.

should prove determining factors in the prescribing of glasses.

Prescription of glasses

A hypermetrope with esophoria may, or may not, be fully corrected; whereas, one with exophoria should be undercorrected. A myope with exophoria is more comfortable, as a rule, with full correction although occasionally one is found with a high degree of myopia who will not tolerate this, thus necessitating the sacrifice of vision for comfort. A myopic patient with esophoria will almost invariably experience discomfort for near work which may usually be relieved by the use of bifocals or reading glasses although he is not presbyopic. To disregard the importance of phoria measurements when prescribing glasses may cause one who is orthophoric to become esophoric or exophoric, as the case may be, and may explain the complaint of the patient who later returns saying that although he can "see just fine with the new glasses he cannot stand to wear them." Therefore, it cannot be too strongly emphasized that a careful refraction is the first step in the treatment of heterophoria. Indeed, in some cases it is the only treatment that is required.

Importance of general health

Next in importance is attention to the general health. There is no doubt that the physical condition of a patient may be the dividing line between "symptom free" and "symptom producing" heterophoria. One whose condition has previously not caused symptoms may do so following an illness or peroid of over fatigue. Lack of sleep, toxicity, foci of infection, and especially anemia are all debilitating factors and should have careful attention. Not to be overlooked as a cause for eye discomfort is the habitual use of intoxicants. The prognosis in such cases is good with appropriate treatment, and so far as possible, the elimination of the various causes.

An occupation which requires constant use of the eyes for near work may cause symptoms to a person who previously has been most comfortable. Commercial artists, draftsmen, printers, and bookkeepers are in high number on this list. With "fusional reserve" built up, however, and with correction of the "convergence insufficiency" that is usually acquired in such cases, it is rare for these patients not to be made perfectly comfortable again, and equally rare for it to be necessary for them to change their type of work.

Psychologic problems

The last, and certainly the most difficult problem, is the psychologic condition encountered in some individuals. These patients are the ones referred to earlier in this paper. Their measurements may be small but their symptoms are excessive. The inconsistencies, which are so typical of these patients, must not be confused with those of patients whose readings on the Maddox rod are far less than a cover test would indicate—discrepancies that may be explained by the inherent desire for binocular vision and a large "fusional reserve."

Far from being placid individuals, the patients who present psychologic problems are usually introspective, nervous, and of the anxious type. A frequent factor is unhappiness, either in the home or at work, but whatever the origin of the disturbance, the prognosis is not good unless the underlying cause is removed or at least recognized. Once this is done, these patients usually respond amazingly well to treatment.

Although it does not belong to the heterophorias, there is another condition so closely related in many aspects as to deserve attention. The symptoms are rather vague although the patient is most insistent about not being comfortable either with glasses or without them.

Examination will usually disclose a relatively small refractive error and near orthophoria. Upon closer questioning these patients reveal that they have consulted sev-

eral doctors about their nerves only to be told that they are in good condition. When further pressed for information regarding their eyes, they may state that objects or people will look much closer to them at one time than another, or perhaps smaller and then larger. If taken to a window where they may view a nearby brick wall they may also state that the bricks are not consistent in size and shape. Certainly an aniseikonia test is indicated here and will usually reveal an overall or meridional image size difference of one half to three percent. Correction by an iso-iconic lens is usually successful in "curing" this patient's symptoms. Fusional exercises are also given as aids in stabilizing fusion and increasing the accuracy of stereoscopic vsion.

Aim of treatment

The phorias fall into four groups: esophoria, exophoria, hyperphoria, and cyclophoria. Before considering the treatment for each of these conditions, however, it is well to understand the aim of such treatment.

The aim of treatment is to relieve the patient's symptoms, not to achieve orthophoria. Although orthophoria is achieved in some cases, in other cases the measurements may show little or no improvement.

Maddox stated with regard to the treatment of heterophoria: "It is impossible to make rigid rules, since it is not a disease, but only a symptom to collate with other symptoms, as well as the patient's temperament, and the constitutional blood and nerve state." This being true, I can think of no instance where imagination and a real desire to help may be better displayed, for it must be remembered that one is treating individuals, not types.

Gain patient's confidence

The approach made during the first treatment is all-important. It can mean the difference between success and failure. Devoting a half hour to explaining the patient's particular condition, making him realize that an effort of will is absolutely necessary, assuring him of your understanding and sympathy will require tact and patience but will add much to the prognosis. Prepare the patient for discomfort, including nausea (especially exo's and convergence insufficiencies). After the confidence and coöperation of the patient have been won, follow up by showing enthusiasm when the first positive effects are demonstrated. Not infrequently this may be on the second or third visit.

Exercises for home work

All patients should be given motility exercises for home work—the six cardinal positions plus convergence, with emphasis on their weakest position. A 3-mm. white-headed pin inserted in the top of a pencil is ideal for fixation. Three 5-minute exercise periods a day are more beneficial than one 15-minute period. A fusion-stimulating exercise should also be given. Use a piece of red Kodaloid and a small light, preferably a pencil flashlight, and work from reading distance to infinity. (With the red Kodaloid held over one eye, the light must be seen "single" and pinkish in color). This exercise also aids in breaking up the suppression that occurs in a large percentage of heterophorias and is quite possible in all phorias on certain occasions.

Exophoria treatment

General treatment for exophoria consists of (a) correction of suppression, (b) good N.P.C., (c) prism convergence, and (d) good accommodation.

With a 3-mm. pin in a pencil held at reading distance, hand prisms may be placed (base out) before the eyes until an average of 15$^{\Delta}$ is reached. Each time the prisms are increased (by units of 2$^{\Delta}$) the patient should look alternately right and left, coming back to the pin each time, making sure it is "single and clear." This should be followed by fixing on the muscle light (at 20 feet) and, if possible, a light in the upper right-hand and upper left-hand positions

(about 7 feet high), and the same amount of prism convergence repeated as for near. An addition of 10Δ each week is sufficient, with the maximum of 75Δ reached usually by the seventh week.

Next the patient is placed at a major amblyoscope and careful attention given to suppression—both on convergence and divergence. Use of fusion slides with small central controls are best. Flashing is very helpful, after which convergence may be started. Side movements are important both from the standpoint of suppression and muscle coördination. The Stereo-Orthoptor is particularly well fitted to phoria treatment because of its automatic features. A Worth hand amblyoscope is also very good for homework at this stage because of its hand-eye coördination value.

Hand-eye coördination

Hand-eye coördination is of inestimable value and should be utilized in every possible way. These patients are usually slow to accommodate and change focus, therefore, at about the fourth visit two ink dots should be placed on a pin for home exercise. This requires accommodation as well as convergence (to be seen clearly) and looking from pin to small objects such as door knobs or light switches at distances of 5, 10, 15, and 20 feet builds up accommodation and the ability to change focus quickly.

Also, at about this time, physiologic diplopia should be taught and practiced. Later, it should be followed by bar reading. At the 7th or 8th visit a Keystone stereoscope and base-out cards may be borrowed for home training. The Ortho-fuser is also very good for home training. Usually 12 weekly treatments are required to complete this routine. The patient should have experienced some relief of symptoms early in the training but if treatments are stopped before completion, the symptoms are quite apt to return in a few months. Patients with exophoria are quite often poor readers, have a tendency to transpose, and are sensitive to light. This last, no doubt, explains why many have had tinted lens prescribed.

Standard of cure

At the conclusion of treatment the patient should be reëxamined. Usually the axis will have changed position a few degrees, with a decrease in the sphere—particularly plus but sometimes minus. In many cases of a small refractive error, glasses may be discarded entirely, and frequently presbyopic patients will require less addition. This I do not believe due to an actual change of refractive error (as tested by cycloplegic) but to the better seeing habits and skill developed, with most efficient use of extrinsic and ciliary muscles.

A standard of cure could be: (1) No symptoms, (2) prism convergence (70Δ to 75Δ), (3) prism divergence (7Δ to 8Δ), (4) good N.P.C. (25 mm.), (5) accommodation (Prince rule).

Esophoria treatment

General treatment for esophoria consists of: (a) Correction of suppression, (b) prism divergence, (c) good accommodation.

The esophoric patient usually complains of blurring or diplopia in the distance, with headache and discomfort for reading or near work. Change of focus is slow, probably due to effort of straightening visual axes. A poor near point of convergence also exists in many cases.

The first step in treating this patient is to teach him the difference between "accommodation" and "relaxation of accommodation." This may be done simply and quickly by placing a red glass, or red Kodaloid, before one eye while the patient fixes on the muscle lights (20 feet). Told to "clear" the lights he will find that they go much farther apart (homonymous). When told to relax and "blur" the eyes, the images will be much closer—sometimes even fusing.

After recognizing this fact he is told to see "clearly" while effort is maintained to

fuse the lights. A prism (base out) of the necessary amount to get fusion is placed before one eye. This is decreased, 1Δ at a time, until none is required. Then starting with a prism, 1Δ, base in, increase to an approximate 7Δ, base in. An aid to effort will be gained by having the patient look "up and over," pulling hard, then back at the light when fusion becomes difficult or unstable.

On the major amblyoscope fusion slides are joined at the patient's angle—the patient again having been told to see "clearly." Special attention must be given to suppression and side movements after which divergence is started. Amplitude is usually found to be low, necessitating the teaching of good convergence as well. After a maximum of divergence has been reached—approximately 7Δ—the patient should be taught to disassociate accommodation from convergence. This may be done by inserting −1.0D. sph. and clearing the picture at "O" followed in turn by −2.0D. and −3.0D. spheres.

A Keystone stereoscope with base-in cards is excellent for home use. The Orthofuser or Remy separator may also be used. Physiologic diplopia and bar reading are invaluable aids—both to stabilization and accommodation—but must not be attempted too soon. Divergence is not a natural anatomic feature such as convergence; therefore, progress is much slower and relapses more frequent. The myopic patient presents an even greater problem but may still be considered a good orthoptic risk.

Standard of cure

A standard of cure could be: (1) No symptoms, (2) prism convergence (50Δ), (3) prism divergence (5Δ to 8Δ), (4) good N.P.C. (25 mm.), (5) good accommodation (Prince rule).

Pure hyperphorias

Pure hyperphorias are rare. The patient complains at times of vertical diplopia, is usually nervous, and is more conscious of his cosmetic appearance than either the esophoric or exophoric patient.

General treatment is the same as for the preceding phorias. On the major amblyoscope the patient should join the fusion slides with the least possible vertical adjustment. Again special attention must be given to central suppression, after which supravergence and infravergence are stressed. Both supravergence and infravergence are much improved by good prism convergence and prism divergence. The Orthofuser or a Keystone stereoscope, with both base-in and base-out cards, may be given for home exercise; the use of red Kodaloid is particularly helpful in these cases, with physiologic diplopia and bar reading taught and practiced as early as possible. It is entirely possible to correct a hyperphoria of 14Δ and make the patient comfortable. Many times a hyperphoria of small degree will be found in conjunction with an exophoria or esophoria, particularly the former, in which case, correction of the lateral will usually be all that is needed.

Cyclophoria

Cyclophoria is perhaps the least known and considered of the phorias. Symptoms are headaches, nausea, and possible head tilting.

In all cases of head tilt in which the patient is found to be orthophoric or nearly so, a careful test should be made to determine the possibility of cyclophoria. The Synoptophore is well equipped to detect and measure deviations as well as correct this condition. Fusion slides are joined at the necessary oblique, or torsion angle and the image gradually straightened while fusion is maintained. Hyperphoria may also be found in conjunction with cyclophoria; or, due to the effort to overcome hyperphoria, a resultant cyclophoria may occur. In either case the treatment is the same. Correct the hyperphoria.

Another cause of cyclophoria is oblique

astigmatism and, as Maddox has pointed out, "in uncorrected oblique astigmatism, corrective torsion becomes a life habit." When strong cylindrical lenses are prescribed, care must be stressed not only with regard to the correct axes but to the constant maintaining of proper adjustment.

Convergence insufficiency

Convergence insufficiency is not considered a member of the heterophoria group but deserves special attention as it probably causes more discomfort than any other one condition. It is also, as a rule, one of the easiest to correct. Convergence insufficiency may be acquired by long hours of close work, fatigue, or lack of muscle tone due to ill health. Frontal headaches, tired eyes, and at times an actual aversion to anything requiring near vision, are common symptoms. These patients will be found, in most instances, to be monocular readers. Indeed, many of them are aware of it, either when having it pointed out to them, or by volunteering the information. Certainly one whose near point of convergence is 40 cm. (16 inches) would be unable to maintain fusion.

Suppression —deep suppression—is the main characteristic of this condition and must be borne in mind throughout the entire treatment. It is even advisable to use a red glass, or red Kodaloid, over one eye when taking the N.P.C.

Complete motility exercises should be given in addition to convergence with a pin. Again the red Kodaloid should be used (during convergence) as it is entirely possible to get muscular coördination and continued suppression. The two dots placed on the pin are very good, as an alternate exercise, because these patients need incentive and this in turn helps accommodation. Vergence exercises on the Synoptophore or Stereo-Orthoptor are the same as for a phoria, with particular attention to suppression. Physiologic diplopia and bar reading should be taught as soon as good convergence permits, and last, but of equal importance, is the teaching of voluntary convergence. Usually 4 to 6 treatments are sufficient.

The incorporation of prisms in glasses is a method of treatment which we do not recommend. It has been our observation that an additional amount must be added from time to time and after a few months, or years, the patient is unable to tolerate the added weight and chromatic aberration of prisms strong enough to correct a phoria of any considerable degree. Before starting orthoptic treatment of patients wearing prisms, new glasses are prescribed, without any prism whatever.

A practice which should be given careful consideration is the one of patching where a phoria exists. There is grave danger of a resultant tropia. If you feel that it is absolutely necessary, then a week or 10 days should be the limit of time, with frequent observation.

It has been a very great pleasure recently, either to reëxamine or to talk with patients who were given orthoptic treatments during the past six years. In none have the symptoms returned, except fleetingly when tired, and not one, so far, has required a refresher course.

Conclusions

1. Phorias are important.
2. Phorias respond readily to treatment.
3. The aim of treatment is not orthophoria, but the relief of symptoms.
4. This group is composed of your most satisfied patients.

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TISSUE RESEARCH AND CELL CULTURE OF THE CORNEA

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Although we can be proud of the progress that has already been made in keratoplasty (especially in the use of donor material), our final aim is to create conditions whereby the host cornea will accept the transplanted material completely so that a later cloudiness, which so often develops in transplantations of the same species but of different blood groups, will not mar the end result.

In view of the fact that the literature on keratoplasty reports unsatisfactory results in a majority of cases, it would seem pertinent to question why the implant (of the same species) becomes cloudy and to ask whether or not colloidal chemistry might offer an approach to the problem. It would seem that a study of the chemical and physical (such as swelling) factors of the albumin which form the base of horny tissues might suggest a solution to some of the difficulties of corneal transplantation.

It may be that the donor cornea, especially the cadaver cornea, loses its own specific characteristics under the effect of artificial culture and becomes an indifferent piece of tissue that cannot be changed by later assimilation with the host tissue. As far as I can learn from a study of the literature, the following possibility has never been fully considered.

If the transplant is kept alive by means of slow-growing cell culture, and if the plasma content of the blood of the recipient is increased before the transplant is made, it might be that the original structure of the albumin of the transplant could be so changed that it would gradually become assimilated with the albumin of the host.

Loehlein was of the opinion that if corneal tissue were carefully kept alive by means of culture passages, conditions might be created which would permit a gradual and delicate balance between the host and the donor tissues. Loehlein and Salzer both came to the conclusion that not only did corneal tissue (carefully kept alive) of dead human bodies (in my opinion the best means to accomplish this is through sterile culture) make the best transplants and cause the least reaction with the surrounding tissues, but also that homologous tissue furnishes the most favorable conditions by providing a frame for the gradual regeneration of tissue.

According to Widal, corneal cloudiness results chiefly from "protein shock" or the coming together of two antagonistic colloids. We know that the albumin of the plasma reacts to the sudden introduction of chemicals or to plasma of a foreign type. In his discussion of the so-called "crises of blood types," which led to his observations on the process of protein shock, Widal says: "The shock is not confined to the colloids of the blood; it also exists in all the plasma, making itself felt even in the plasma colloids which constitute our cellular elements."

Widal's highly interesting conceptions of the colloidal processes are not only applicable to the colloids of the blood, but they apply wherever proteins are involved. In my opinion, these observations can provide an explanation of the cloudiness of corneal transplants.

It is now pertinent to mention the changes which it is possible to produce in the chemical structure of albumin and which may account for the assimilation of the donor albumin with that of the host organism.

We learn from the earlier publications of Obermeyer and Pick that the specific grouping of the same kind of albumin molecules is influenced by the various arrangements of albumin atoms. These authors, by introducing nitroiodine and diazo groups, succeeded in changing the so-called "original" structure of the albumin into a "constitutional" one. The "host" organism of the injected animal reacted only upon the changed

albumin in a "specific" manner and while the species characteristic was completely extinct.

Since these structural changes in the albumin molecule depend upon the regrouping of the albumin atoms in the chemical ring, it would be the aim in cell culture for corneal transplantation to produce, by influencing the chemical structure of the molecule, such gradual changes as would be equivalent to an assimilation of both kinds of albumin. Evidence as to whether, as a result of cell culture, this assimilation was taking place would be cloudiness appearing more or less rapidly, for, after all, growth in cell culture means a fundamental transformation.

It would seem that further assimilation could be induced by changing certain physical factors affecting albumin, such as, for example, swelling. So far, the nature of this factor of swelling is not completely understood, but its uniformity in the healthy cornea presupposes the existence of a most accurate and complete method of regulation. The forces which bind together water and the colloidal albumin molecule are extremely great. They represent the so-called swelling pressure or, according to Schade, the colloidosmotic pressure.

In the literature on corneal transplantation, it has been remarked that, only after keratoplasty in interstitial keratitis, has perfect clearing been observed and then with deeply located, thick, cloudy specks. Imre is of the opinion that this is due to colloidochemical changes of the corneal tissue, changes which are reversible.

Thoenes, an investigator of tissue colloids, followed the laws of water binding that had been examined by Rübner, Müller-Thurgau, H. W. Fischer, and Bobertag. He believed that there are changes which have something to do with a progressive growth, and he says, "With progressive growth not only the total amount of the tissue water is diminished, but also a change in the physical structure of the tissue colloids takes place at the same time, leading to a diminution of the water bound to the protoplasm molecules."

These observations lead one to consider the possibility that, through the gradual growth of the cell culture in vitro, it may be possible to create such delicate methods of regulation as the eye afflicted with interstitial keratitis is capable of creating when a keratoplasty is performed upon it.

Another factor—that of the same blood group—which, in my opinion, may play a part in the clouding of corneal transplant has no importance according to the literature on the subject (Loehlein, Salzer, Imre, Nižetić, Magitot, and others).

Cell-culture experiments

The controversy as to whether the corneal graft continues to live as an independent tissue or is replaced by regenerated corneal tissue of the host has never been definitely settled by the ophthalmologists. Loehlein, Salzer, Bonnefon and Lacoste, Leonardi, and others believe that the transplant tissue never remains intact as such, but that it is replaced slowly and gradually by ingrowing tissue from the host. Filatov, Castroviejo, Leoz, Ortin, Ascher, Sommer, and others, however, are of the opinion that the graft, if remaining clear, will continue its existence as independent tissue.

In view of this difference in opinion, it seemed important to watch the growth of the different parts of the cornea. As a preliminary to my attempt to obtain corneal transplants that did not become cloudy, I examined the growth of the different layers of the cornea. Corneas of rabbits, guinea pigs, and chicken embryos were supplied by Dr. Vollmar of the Department of Tissue Research, Forschungs-institut für Chemotherapie, Frankfurt. Cadaver corneas were furnished by Professor Lauchle of the Pathological Institute.

We are indebted to Imre for some good reports on histologic findings in corneal transplants. His histologic specimens show again and again the typical corneal cloudiness. The epithelium is denuded, Bowman's

membrane is not recognizable, the upper layers of the cornea contain hyaline deposits—granular and filamentous calcium deposits—the substantia propria is replaced by coarse, granulated tissue streaked with vessels.

A specimen of clearly healed-in graft is rarely obtained. One specimen of a clear graft, mentioned by Imre, had been removed four weeks after transplantation because the inner layers had become opaque.

Imre says that the epithelial and border membranes were well preserved. The endothelium could be recognized behind Descemet's membrane. The epithelial layer consisted of 4 to 5 rows in those parts of the graft near the border. At the center, however, the epithelial layer consisted of only two rows.

In the cell cultures which I made, it was interesting to watch the growth of the epithelial layer. I was able to obtain particularly fine cultures from rabbit corneas. (Reports of typical cell-culture growth of the epithelium borders of rabbit corneas have been published by Dr. Vollmar.) I was best able to observe the growth of spindlelike fibroblasts in corneal cultures of chicken embryos.

Mention has been made in the literature for tissue research and cell culture of a stage in cell growth intermediate between epithelial cells and fibroblasts. It is supposed that these cells originate from the corneal endothelium. Since, however, I have never been able to find a detailed description nor illustrations of this cell growth, I shall describe my own observations in detail.

The best growth of this intermediate type of cells that I have observed was in cultures of human corneas removed immediately after death (fig. 1). I received these cultures in a sterile state; that is, after the whole conjunctival sac had been washed out with boric-acid solution. It would seem that the boric acid has some growth-inhibiting effects upon the culture, since growth is not so extensive after its use. Because it is necessary to obtain sterile cultures, it might



Fig. 1 (Hoof). Cell culture of a human cornea removed immediately after death. This shows 24-hour growth at 37° C. (Magnification ×130.)

be that better results could be obtained through the use of some chemicotherapeutic agent that would specifically stop the growth of the bacteria without affecting the tissues.

In experimenting with the culture of the corneas of guinea pigs upon plasma of a different species (rabbit), no growth whatsoever took place. When fresh embryonal extract and the plasma of chicken or fresh guinea-pig plasma and a sterile buffer solution were employed for infusion, a surprising growth of the cornea took place.

Microscopic examination of these cultures showed a multitude of shapes. Just as illustrations in a zoology textbook depict groups of Polymedusae, with the freshwater polypi stretching out their tentacles, or the footlike fringes of the Rhizopoda floating around a one-cell Algae, so the microscope revealed the cells in the corneal cell culture moving out of the substantia propria, at first being attached to it like fixed species of Infusoria and later like



Fig. 2 (Hoof). Cell culture of guinea-pig cornea. This shows 48-hour growth at 37° C. (Magnification ×130.)

freely swimming shapes which were small, rounded-off lumps of protoplasm extending themselves.

The growth advanced and kept on moving until the starlike, branched-out cells, with the long and small cores, and the long threads of the cell protoplasm formed a broad circle around the substantia propria. The protoplasm also contained fine granules. Only in a 48-hour culture of guinea-pig corneas (fig. 2) have I seen this protoplasmic picture.

(In their histologic structure, the cells of guinea-pig cornea do not differ greatly from human corneal cells. These typical cells, located in the substantia propria, are represented by clumsy, irregular, and much perforated protoplasm layers, with either broad or long-draw-out, thin anastomoses [Schaffer].)

Comment

These preliminary experiments in tissue culture show the possibility of growth of the parenchyma cells out of the substantia propria. They would seem to substantiate the theory that the corneal graft lives as an independent tissue within the host's cornea, as advanced by Marchand, Fuchs, Filatov, Castroviejo, Leoz, Ortin, Ascher, Sommer, and others.

3 Rheinblick Street.

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COMPARISON OF EYE CONDITIONS AMONG 1,000 READING FAILURES, 500 OPHTHALMIC PATIENTS, AND 150 UNSELECTED CHILDREN*

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This is a comparative study of the eye conditions of 1,000 poor readers, 500 ophthalmic cases, and 150 unselected children. The median ages of the groups were 9 years and 8 months, 11 years and 6 months, and 10 years and 8 months, respectively. The median intelligence quotients for the groups were 102, 103, and 109 in the same order. All of the cases were examined by the same doctor with the same equipment and the same tests. The routine was that of the usual eye examination plus tachistoscopic measurements.

Refractions were made without a cycloplegic in order to permit observation of the pupils' use of their eyes in the reading situation. Careful retinoscopic and subjective refraction was carried out in all cases. The tachistoscopic data were collected with an instrument and method described previously.[1, 2] There is a great deal of variation in the tachistoscopes now in use, particularly in such variables as test types, vocabulary level of test words, object size, reading distance, intensity of illumination, and so forth. Results obtained from different makes of tachistoscopes are not likely to be mathematically comparable and so *tendencies* rather than mathematical values are significant except when instrument and test conditions are identical.

The results of all tests were distributed in each group, and frequency and central tendency were determined for each. This was followed by comparison of the groups.

The poor readers and the unselected pupils exhibited closely comparable frequencies of vision below 20/30, while the frequencies of vision below 20/40 were fairly close but not so much so. Both groups differed widely from the ophthalmic cases, as might be expected. The frequency of amblyopia was somewhat similar in the reading failure and unselected groups but the incidence among the ophthalmic patients was about twice as great for the left eyes as in the other two groups.

The frequency of hypermetropia of one diopter or more was greatest in the ophthalmic group, 7 percent less in the reading-failure group, and approximately 30 percent less among the unselected. The incidence of myopia of one diopter or more was practically the same in the reading failure and unselected groups, while the ophthalmic patients presented twice as high a frequency. The unselected cases exhibited a somewhat higher frequency of hypermetropic astigmatism than the ophthalmic group, while the poor readers displayed a still higher incidence. The step up from group to group was only 2 percent, however, making the frequencies fairly comparable in all groups. The incidence of myopic astigmatism was the same throughout all classifications. Both the reading-failure and ophthalmic groups exhibited frequencies of anisometropia that were quite close and about twice that of the unselected group.

Exophoria of 6 prism diopters or more in distant vision was most frequent among the unselected and least among the reading failures, while exophoria of the same magnitude in near vision was greatest among the reading failures and least among the unselected. Esophoria of a similar amount was slightly more frequent in near vison than in distant vision among the reading failures and the ophthalmic groups, the former displaying lower frequencies at both distances than either of the others. Hyperphoria did not appear in the unselected group but occurred in distant vision only to the extent of 1 percent in the others.

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Convergent strabismus was more frequent among the poor readers than among the ophthalmic cases, while divergent strabismus occurred equally in these two groups. No oblique deviations were noted in either group. No cases of strabismus were encountered in the unselected group. The greatest frequency of fusion deficiency was found among the reading failures. It was less frequent among the unselected and least among the ophthalmic cases.

Right eyedness occurred most often in the ophthalmic group and 11 percent less frequently among the reading failures, with the incidence in the unselected group falling between the others. The incidence of left eyedness was closely similar in the reading-failure and unselected groups, with the ophthalmic group presenting a lower frequency. Ambieyedness occurred as frequently in the poor reading and ophthalmic groups; rather less so among the unselected children.

TABLE 1

FREQUENCY OF EYE CONDITIONS IN READING FAILURE, OPHTHALMIC, AND UNSELECTED GROUPS

Condition	Reading Failures		Ophthalmic		Unselected	
	Right	Left	Right	Left	Right	Left
Number of cases	1000		500		150	
	percent		percent		percent	
Vision						
Below 20/30	35	35	55	57	36	34
Below 20/40	19	19	38	40	13	14
Amblyopia	13	10	15	20	11	12
Refraction						
Hypermetropia of 1D. or more	43	43	50	50	13	12
Myopia of 1D. or more	4	4	8	8	4	3
Hypermetropia Astigmatism of 1D. or more	6	6	2	2	4	4
Myopic astigmatism of 1D. or more	1	1	1	1	1	1
Anisometropia	13		12		6	
Muscular Imbalance qt:	20′	R.D.*	20′	R.D.	20′	R.D.
Exophoria of 6 p.d. or more	4	33	8	31	11	22
Esophoria of 6 p.d. or more	3	4	6	9	9	6
Hyperphoria of 1 p.d. or more	1	0	1	0	0	0
Strabismus.						
Convergent	4		2		—	
Divergent	1		1		—	
Oblique	0		0		—	
Fusion deficiency	22		15		18	
Lateral dominance						
Eyedness						
Right	58		69		61	
Left	36		25		38	
Ambi	6		6		1	
Handedness						
Right	79		83		88	
Left	18		14		12	
Ambi	3		3		0	
Speed of recognition						
Below Q_1 of unselected cases, i.e., retarded						
Word recognition	49		17		25	
Object recognition	22		18		25	
Intelligence quotient below 90	24		11		6	

* R. D. = reading distance.

On the other hand, right handedness was less frequent among the poor readers, slightly more so in the ophthalmic group, and most frequent in the unselected classification. Left handedness occurred most often among the poor readers, least often among the unselected, while the incidence in the ophthalmic group fell between the others. Ambidextrousness was equally frequent among the poor readers and ophthalmic cases, but it failed to appear in the unselected group. Thirty-two percent more poor readers than ophthalmic cases, and 24 percent more poor readers than unselected cases exhibited significant degrees of retarded speed of word recognition. Important retardation in the speed of object recognition occurred most frequently among the unselected, slightly less so among the poor readers, and still less so among the ophthalmic cases.

The measure of central tendency used in this study was the median. The ophthalmic group presented a slightly lower median visual acuity than the other two groups in which the medians were equal and at the normal level. The median amblyopia was the same in all groups.

The unselected and ophthalmic groups presented equal medians for hypermetropia while the other group exhibited a 0.25D.-less median hypermetropia. The median myopia was approximately equal in all groups. Hypermetropic astigmatism occurred to a greater median degree in the ophthalmic

TABLE 2

CENTRAL TENDENCY OF EYE CONDITIONS EXHIBITED IN READING FAILURE, OPHTHALMIC, AND UNSELECTED GROUPS

Condition		Median of Reading Failure Group	Median of Ophthalmic Group	Median of Unselected Group
Age		9 yrs., 8 mo.	11 yrs., 6 mo.	10 yrs., 8 mo.
Visual acuity (Snellen)	O.D.	20/20	20/30	20/20
	O.S.	20/20	20/30	20/20
Amblyopia	O.D.	20/50	20/50	—
	O.S.	20/50	20/50	—
Refraction				
Hypermetropia	O.D.	0.75D.	1.00D.	1.00D
	O.S.	0.75	1.00	1.00
Myopia	O.D.	1.00	1.00	1.00
	O.S.	1.00	1.00	1.25
Hypermetropic astigmatism	O.D.	0.62	1.00	0.62
	O.S.	0.62	1.25	0.62
Myopic Astigmatism	O.D.	0.50	0.62	2.00
	O.S.	0.50	0.50	1.25
Muscular Imbalance				
Exophoria	20 ft.	4P.D.	4P.D.	3P.D.
	R.D.*	6	6	3
Esophoria	20 ft.	3	4	2
	R.D.*	4	6	2
Speed of recognition				
Object		0.0033 sec.	0.0100 sec.	0.0033 sec.
Word		0.0100	0.0050	0.0033
Intelligence quotient		102	103	109

* R.D. = habitual reading distance.

group as one might expect, while the other two classes presented equal and somewhat lower medians. The median myopic astigmatism was markedly higher in the unselected group, while the medians in the two other groups were considerably, lower and very close to one another. In distant vision, the median exophoria was very close in all groups, but in near vision the reading failures and the ophthalmic cases presented medians that were twice as great as that of the unselected group. The median esophoria in distant vision was highest in the ophthalmic group, lowest in the unselected group, with that of the poor readers exactly between the others.

The median speed of word recognition was lowest among the reading failures and highest among the unselected, while the median speed of object recognition was equal and at the upper level in the reading failure and unselected groups but at a considerably slower level in the ophthalmic group. The latter exhibited a faster median speed of word recognition than of object recognition, suggesting that many of these people may have recognized the words by minimal cues without seeing them discriminatingly. The faster median speed of object recognition than of word recognition among the poor readers, on the other hand, suggests that language difficulty and unfamiliarity with word form may have influenced the scores of these pupils.

A difference of 10 percent in frequency was regarded as significant. Applying this more or less arbitrary standard it was found that the poor readers exhibited more frequent hypermetropia of one diopter or more, more exophoria of 6 prism diopters or more at the reading distance, greater retardation in the speed of word recognition, and more frequent intelligence quotients below 90 than did the unselected. This group also displayed more frequent left eyedness, more retarded speed of word recognition, and more intelligence quotients below 90 than did the ophthalmic group. As would be expected, the latter group exhibited a greater frequency of low vision than either of the others and a higher incidence of hypermetropia of one diopter or more, of anisometropia, and of exophoria at the reading distance than did the unselected group, being closer to the poor readers in these areas.

The differences between the medians of the various measurements in the three groups were not great. The ophthalmic cases presented a slightly lower median visual acuity than either of the others as might be expected. The difference in the medians of the various refractive conditions were less than one diopter except in myopic astigmatism, where the unselected group presented a somewhat higher median. The difference between the medians of the various phoria measurements ranged up to 3 prism diopters. It is noteworthy, however, that the poor-reading and ophthalmic groups presented medians of 6 prism diopters of exophoria at the reading distance as against 3 prism diopters among the unselected cases. This, as well as the higher frequency of the condition at the reading distance in the same groups, supports earlier findings.[3, 4]

The difference in medians of the speed of object and word recognition in the three groups ran about as one would expect, the medians for the poor readers and the unselected children being equal and high for object recognition, while that of the ophthalmic group was slower. The median speed of word recognition was slowest among the poor readers, faster but still retarded among the ophthalmic cases, and at a satisfactory level in the unselected group. The differences in median intelligence quotient in the three groups were too small to be important.

Conclusions

This study indicates that, for the present group at least, hypermetropia, exophoria at the reading distance, retarded speed of word recognition, and intelligence quotients below 90 occur more frequently among poor readers than in the other groups tested but

that the median amount of defectiveness is not appreciably greater in any of the groups. This is in line with the clinical observation that reading failures are often troubled to a greater extent than others by such handicaps as low degrees of hypermetropia and other eye defects.

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SLEEP WITH HALF-OPEN EYES (PHYSIOLOGIC LAGOPHTHALMUS)

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I spoke once in Shanghai with a Chinese colleague about my paper in which I described the diminished resistance of the cornea due to general disturbances of nutrition (Am. J. Ophth., 30: 721-727 (June) 1947.) and to intoxication, and we spoke about the bad consequences of a slight lagophthalmus, when the general condition of the patient is poor. Prof. C. H. Chou then told me that many people in China sleep with half-open eyes and that his son has his palpebral fissure open from 3 to 4 mm. and that the cornea is also exposed. The globe sometimes turns around during sleep. Prof. C. C. Ho, head of the eye department of the Red Cross Hospital, who was listening to our conversation, declared with a smile that his lids did not close during sleep but that his cornea was not visible.

Even in the old Chinese history we find a narrative of the physiologic lagophthalmus of the Chinese.

In the time of the three kingdoms (230-264 A.D.) there lived a general, Chang Fei, whose habit was to keep his eyes open when he was fast asleep.

One day, he ordered a group of tailors to make 3,000 suits of uniforms in mourning fashion for his troops on account of the death of his "sworn brother"—the famous general Kwan Yu. This arduous task was assigned to be finished within a limited time of three days.

It was physically impossible to execute the order within such a short space of time, but General Chang insisted that it must be done or, failing this, all the tailors would be put to death. The tailors saw that death was inevitable and became desperate. They took council together and decided to assassinate the general and bring his head to the enemy, as the only way to save their own lives.

During the next night, two tailors made an attempt on the general's life. When they sneaked into his bedroom, to their great surprise, they found the general in his bed, rolling his widely opened eyes. They beat a hasty retreat, thinking that he was awake. A few minutes later they heard the general snoring loudly. The assassins entered the general's room again and purposely made some noise in order to see whether he was asleep or not. As he was not disturbed by the entry of the assassins, the two tailors stabbed the general several times, with fatal result.

The turning of the globe and cornea described in this story is the same as that seen in the son of Professor Chou, who moves his eyes, apparently to moisten the cornea and thus to hinder its desiccation.

In Nanking, I found that the wife of Dr. Chang, one of the assistants of the eye department of the Central Hospital, does not close her eyes entirely during sleep; apparently this happens not only in deep sleep during the night, but also when she takes a nap after lunch. The eye fissure during sleep is

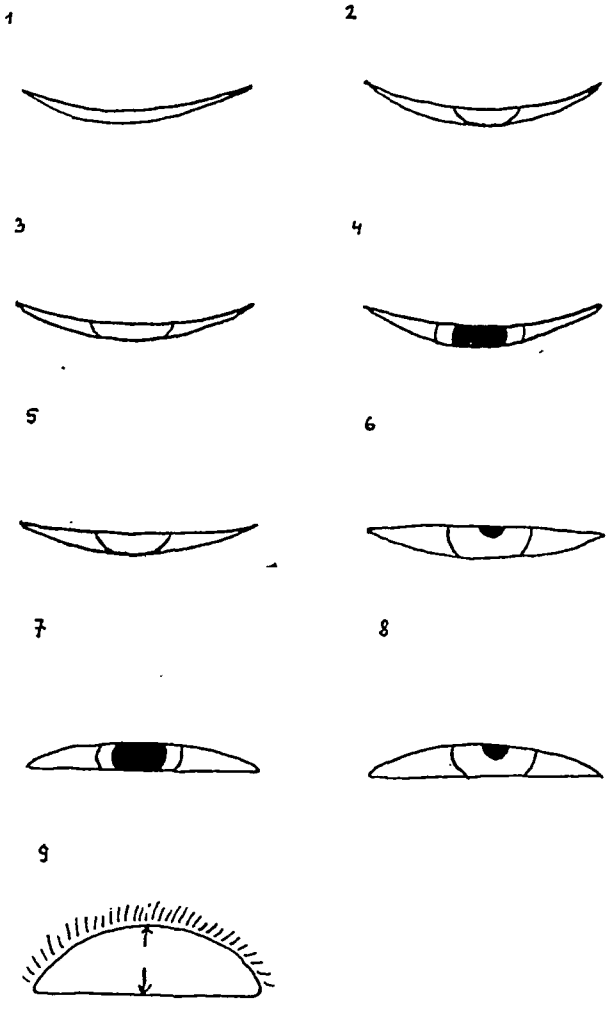
* UNRRA-WHO, Shanghai.
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2- to 3-mm. wide and shows the lower third of the cornea.

Since this phenomenon appeared to be rather frequent I asked Dr. F. C. Wu, assistant of the Ophthalmological Department of the Shanghai Army Hospital to examine during the night a large group of students who live in the Army Medical College.

Examination of students

Dr. F. C. Wu. I examined the palpebral fissures of 500 healthy young Chinese students of the Army Medical College (aged 20 to 30 years) during their sleep. They were free of any pathologic factor which could affect the closure of the lids, such as scars of the lid, facial paralysis, thyrotoxicosis, and so forth.



Figs. 1 to 9 (Fuchs and Wu). Appearance of various degrees of lagophthalmos is shown in Figures 1 to 8. Diagram of tarsus height is shown in Figure 9.

Of these 500 cases 23 (4.6 percent) had their lids open 1 to 2 mm. during sleep and two cases (0.4 percent) had their lids open 3 to 4 mm. during sleep.

In the first group four different positions of the cornea were observed: (1) In 4 cases the cornea was not visible (fig. 1). (2) In 10 cases the lower margin of the cornea just touched the border of the lower lid (fig. 2). (3) In 3 cases about 1 mm. of the cornea was covered by the lower lid (fig. 3). (4) In 6 cases the central part of the cornea and parts of the pupil were not covered and were visible in the palpebral fissure (fig. 4).

As these cases show, a considerable number of persons with lagophthalmus do not show Bell's phenomenon during their sleep. The pupil is apparently not always narrow, as physiologic textbooks would lead one to believe.

In the second group of two students with palpebral fissures opened 3 to 4 mm. during sleep, the first student, aged 25 years, revealed an open fissure of 3 mm. on the right. The lower edge of the cornea touched the border of the lower lid (fig. 5). The left eye was exposed 4 mm. during sleep, the lower part of the pupil was visible, and the lowest millimeter of the cornea was covered by the lower lid (fig. 6).

The second student, 23 years of age, had both eyes open to an extent of 3 mm. The middle of the cornea and pupil were visible; about 2 mm. of the lower cornea was covered by the lower lid (fig. 7).

Later on, a third student, aged 20 years, was found to have a lagophthalmus of 3 mm. in both eyes during sleep. A small piece of the pupil was visible and about 1 mm. of the lower cornea was hidden by the lower lid (fig. 8).

Comment

Dr. A. Fuchs. From the report of Dr. Wu and the three eye doctors, Professor Chou,

Professor Ho, and Dr. Chang, it is clear that, in a considerable number of cases, the lids are not closed during sleep, a condition of which I have not heard anything in Europe. The frequency is emphasized when in addition to the statistics of Dr. Wu, it is known that three ophthalmologists have the condition themselves or in a member of their families.

Two possible causes of this physiologic lagophthalmus have to be considered: (1) a shortness of the upperlid, as is seen in cases of congenital familial ptosis. Nothing of this nature could be recognized in the eyes of the eye doctor and the son. It is also certain that these people close their eyes in a normal way during day.

A second possibility would be that (2) the facial nerve does not have a sufficient and constant effect on the musculus orbicularis. It is known that in unconscious persons, the relaxed middle position of the lids leaves part of the palpebral fissure open. During sleep, a special tonus or spasm of the orbicularis must be present, just as a tonus of the sphincter of the rectum and of the urinary bladder is physiologically present.

TABLE 1

HEIGHT OF UPPER EYELID IN 100 CHINESE

Sex	No.	Age	Eyelid Height		
		(Aver.)	Max.	Aver.	Min.
Female	10	25.6 yrs.	9.5 mm.	8.25 mm.	6 mm.
Male	90	26 yrs.	9.5 mm.	7.95 mm.	6 mm.

ROLE OF TRACHOMA SCARS

After examining several hundred cases of trachoma in China, I was astonished to find that the characteristic scars of trachoma in the sulcus subtarsalis, usually illustrated in European textbooks, are by no means common in China. More frequent is another type of trachoma scars which come from the upper edge of the tarsus and from the fornix and radiate like flames into the tarsal conjunctiva. The following possible causes of this type of trachoma scars suggested themselves:

1. That the blood vessels, which perforate the middle part of the tarsus and supply the tarsal conjunctiva, are not present in the lids of the Chinese. One assumes that the infiltration of the submucosa advances along these vessels into the tarsus and so causes the typical scars in the sulcus subtarsalis.

Since an anatomic examination of the lids was not possible, I was not able to pursue this probability.

2. Possibly the height (fig. 9) of the tarsus is much smaller in China than in Europe. If the tarsus is less high, it would be easy to understand the absence of the scar formation in the sulcus subtarsalis and the boat-shaped distortion of the tarsus so characteristic of trachoma in Poland, Russia, and the Near East.

Since the shortness of the tarsus could play a considerable rôle in physiologic lagophthalmus, I begged Dr. Wu to examine a number of students and measure the height of the tarsus.

TABLE 2

VARIATIONS IN HEIGHT OF UPPER TARSUS

Height	Percent of Subjects
6 mm.	3
6.5 mm.	2
7 mm.	11
7.5 mm.	20
8 mm.	31
8.5 mm.	16
9 mm.	13
9.5 mm.	4

Examination of tarsus

Dr. F. C. Wu. The height of the upper eyelid in the Chinese (fig. 9) was examined in 100 normal persons—90 males and 10 females. The results are shown in Tables 1 and 2.

A tarsus of 6 mm. was present in two men and one woman. A 9.5-mm. tarsus was present in two men and two women. The average height of the upper tarsus in Chinese is apparently between 7.5 and 8.5 mm. The incidence of high tarsus is apparently greater in women than in men.

In three cases of lagophthalmus during sleep, in which the patients showed an opening of 3 mm. or more, the upper tarsus measured 8.5 mm. in height in two cases and 9.5 mm. in one case.

Conclusion

Dr. A. Fuchs. Apparently the upper tarsus in the Chinese is less high than the tarsus of European people. Examination of 10 Europeans residing in China showed only one 7.5-mm. measurement and several of 9.5 mm. and 10 mm.

Certainly this little difference in height of the upper tarsus cannot be the cause of the physiologic lagophthalmus of the Chinese, since the upper tarsus of the three persons with open palpebral fissures of 3 mm. and more had a tarsus height which was maximum.

From this it would seem that the second supposition—that the tonus of the orbicularis is weakened during sleep—is more probable. Since the cornea is exposed, it is interesting to conjecture why the cornea does not become desiccated. The cause may be that these globes, when the Bell's phenomenon is not active, are rolling during sleep and so moisten the cornea. The story of the Chinese general, Chang Fei, and the observations of Professor Chou, who reported that his son makes slow, rotating movements of the eyes during sleep, would seem to substantiate this.

INTRAOCULAR PRESSURE OF NORMAL AND GLAUCOMATOUS EYES AS AFFECTED BY ACCESSORY LIGHT STIMULI*

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The influence of accessory stimuli upon the visual functions has now been safely established. On the basis of the data available it can be assumed that accessory stimuli also affect such an objectively recordable function of the eye as the intraocular pressure.

The present investigation is concerned with the effect of a special accessory light stimulus in the form of illumination of the second eye from a white or colored light source.

I. EXPERIMENTS WITH WHITE LIGHT

METHODS

The patient, reclining on his back, was allowed to adapt himself for 10 minutes to the illumination of the room in which the experiment was to be made. Then, the intraocular pressure of his right eye was measured with a Schiøtz tonometer after it had been anesthetized with a 1-percent dicaine solution.

The light was then switched off, and the patient was left in an absolutely dark room for one hour. After this, one eye of the patient was covered with a black eye shield, and the other eye was illuminated for 30 minutes by means of a special device arranged in the following manner. A cone-shaped tube 40 cm. in length, was suspended over the left eye of the patient. The tube contained at its base a 75-watt frosted bulb. The brightness of the lightest spot of the bulb was equal to about 16 foot-candles. The left eye of the observer had to be fixed on this spot. The illuminating cone had several lateral apertures which reduced the possible effect of temperature.

During the time that the left eye was exposed to the light stimulus, the patient's right eye was repeatedly subjected to tension measurements at approximately 5-minute intervals. The tension of this eye was also measured some 15 to 20 minutes after the elimination of the accessory stimulus; that is, under the initial illumination conditions of the laboratory room.

The experiments were carried out on 35 subjects, 14 of whom had normal eyes, and 21, glaucomatous eyes. The investigative procedure just described was applied to both normal and glaucomatous subjects. The glaucoma subjects were divided into two groups. One group comprised cases of clearly pronounced glaucoma. In the second group were patients displaying prodromal glaucoma, as well as the "normal" eyes of glaucomatous patients.

RESULTS

The results obtained demonstrated that, under the influence of unilateral illumination of one eye, the intraocular pressure of the other eye was reduced. Our experiments likewise showed that the variation in the tension of glaucomatous eyes exposed to light or to dark follows the same general course as that revealed by our experiments on normal eyes.

In glaucomatous eyes, however, the reduction in the intraocular pressure is more sharply pronounced, as a rule. A certain smoothness of the curve, typical of a normal eye, vanishes, giving place to a curve which is not infrequently distinguished by its broken shape.

Typical curves illustrating the drop of intraocular pressure resulting from illumination of the second eye both in normal and glaucomatous observers, are plotted in Figure 1, A and B.

* From the Laboratory for Physiological Optics of the Helmholtz Central Ophthalmological Institute. Head of the laboratory, Prof. S. V. Kravkov; director of the Institute, Prof. A. A. Kolen.

The pupillary reflex does not seem to have any appreciable bearing upon the variation in the intraocular pressure, when the second eye is exposed to light. From 16 experiments carried out upon 12 patients whose pupillary reflexes were eliminated by means of homatropinization, it may be seen that under these conditions the tension of the tested eye is likewise reduced by illuminating the second eye (fig. 2).

The reduction of tension is dependent on the brightness of light acting upon the second eye. Thus, by exposing one eye to a light intensity of 3.3 or 0.28 foot-candles, we obtained, in an average of 26 tests, a maximum drop of tension in the second eye of 2.7, 5, and 9 mm. Hg, respectively. The tests also showed that an increase in the brightness of the light stimulus is accompanied by an increase in the rate of reduction of intraocular pressure in the second eye.

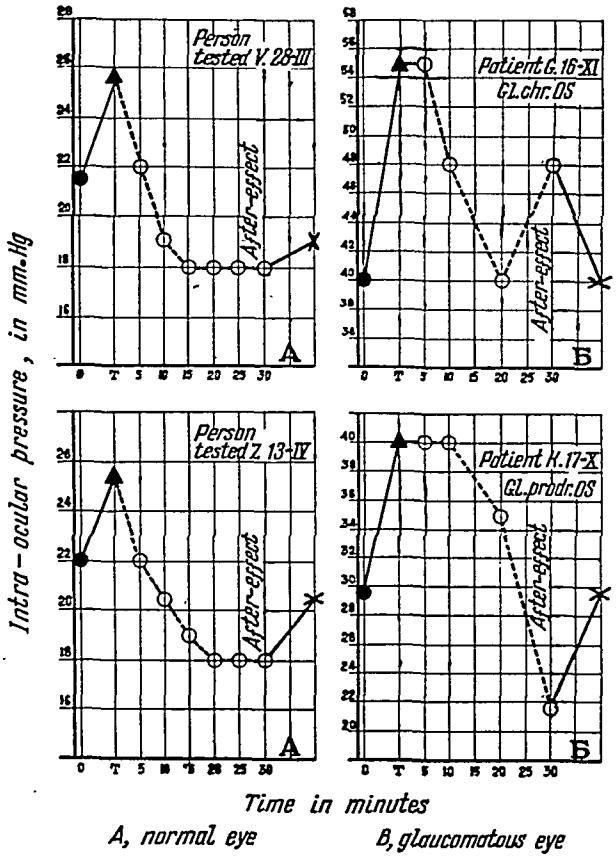


Fig. 1 (Zaretskaya). Intraocular pressure of one eye as affected by illumination of the other eye. Along the ordinate are plotted the values of the intraocular pressure in mm. Hg; along the abscissa, time in minutes. Black circles denote the initial tension found under general illumination of the experiment room; black triangles stand for points corresponding to the level of tension measured after dark adaptation of the eye for one hour; open circles and broken line denote data obtained by *illuminating the second eye for 30 minutes*; a solid line with crosses shows values obtained under initial light conditions, 15 to 20 minutes after exposure has been stopped.

Discussion

The mechanism underlying the influence of dark or light upon intraocular pressure still remains obscure. But the material available does not seem to corroborate the purely mechanical interpretation given this phenomena by certain authors, who ascribe the main role in the changes of tension to the pupil reaction (Grönholm, Seidel).

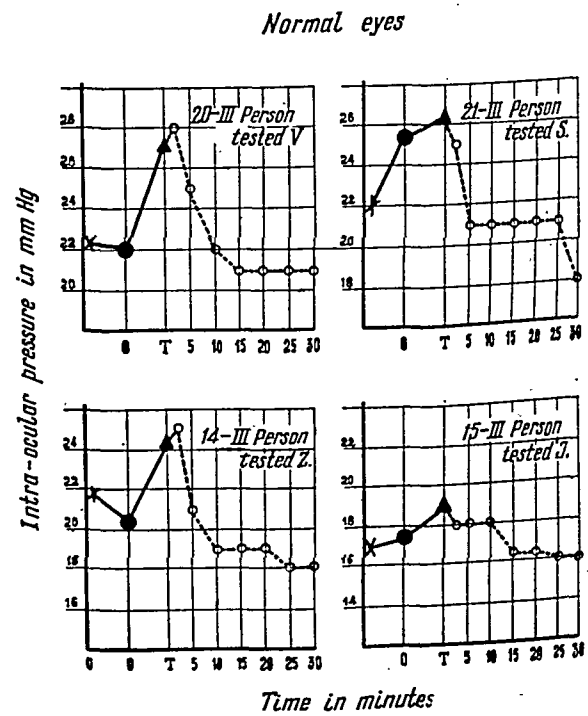


Fig. 2 (Zaretskaya). Intraocular pressure of the right eye as affected by illumination of the left eye. (Homatropine test.) Along the abscissa is plotted time in minutes; along the ordinate, intraocular pressure in mm. Hg. A cross denotes intraocular pressure at the start of measurement; a black circle, tension measured upon instillation of homatropine; a triangle, data obtained after one hour of dark adaptation; open circles and broken line, tension in the illuminated eye.

Feigenbaum's interpretation; namely, that the vascular system of the eye is affected by light through the vasomotors appears more plausible. The action of light may in this case be effectuated through the pituitary body and the vegetative centers whose excitation results in vasomotor reactions involving the optic apparatus, as well.

What are then the decisive conditions responsible in a glaucomatous eye for an increase in its tension, when kept in the dark, and for a reduced tension, when exposed to light?

Most of the authors look for an answer in a definite state of the neurovascular system of a glaucomatous eye; that is, in the so-called neurovascular reflex of Kalfa. This problem has not yet received any definite or satisfactory solution.

II. Experiments with color illumination

Thanks to the experiments carried out by Prof. S. V. Kravkov, it has been established that the green- and red-sensitive apparatus of our vision responds in an opposite way to such vegetative drugs as adrenalin and pilocarpine. It seemed, therefore, consistent to anticipate that the vegetative reactions of the organism will also be different in the case of the eye exposed to red or green stimulants.

Method

The procedure adopted was similar to that employed in our experiments with white light herein described.

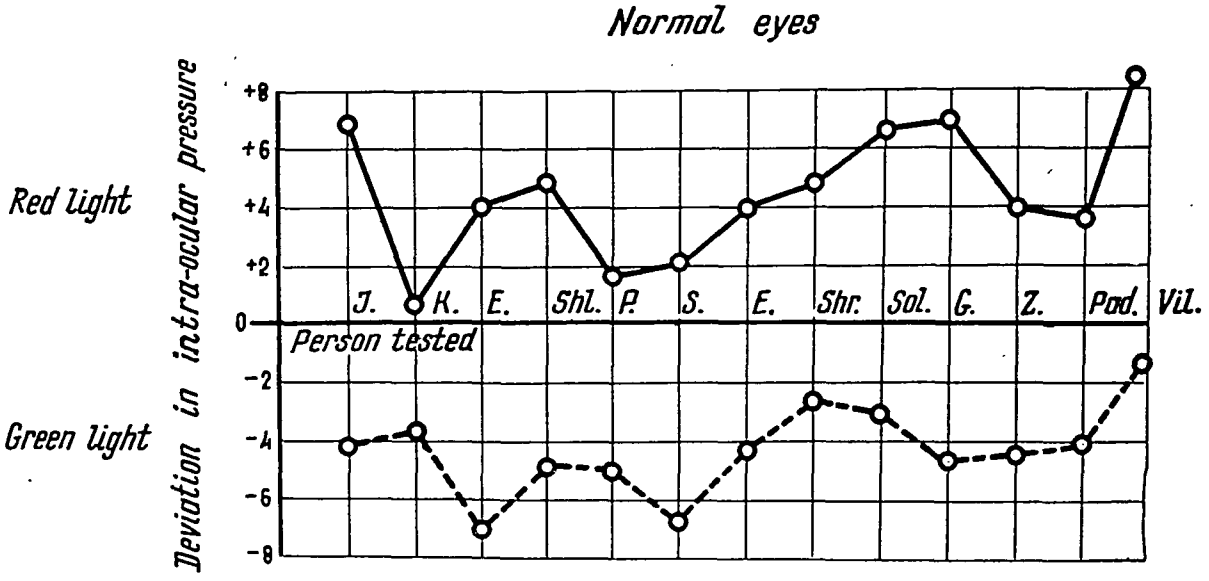


Fig. 3 (Zaretskaya). Effect of light stimulation of the one eye by colored light upon intraocular pressure of the other eye. Along the ordinate is plotted the maximum change in the intraocular pressure (in mm. Hg) from the level of dark adaptation. Along the abscissa are plotted the different persons tested. Circles and the solid line denote changes in intraocular pressure obtained by stimulating the other eye with red light; circles and the broken line, the results for the green light.

A 150-watt incandescent lamp served as a source of light stimuli. It was placed in a special pasteboard cone 40-cm. long, adjusted to the eye of the person tested, and supplied either with a green or a red gelatine filter. The green filter was transparent for rays approximately within the range of 433 to 586 mμ; the red filter for 578 to 720 mμ. Both the red and green light were equal in brightness.

The eye of each observer was exposed for 30 minutes, one day to red light, another day to green light. The experiments were carried out on 17 persons with normal eyes and on 25 glaucomatous patients.

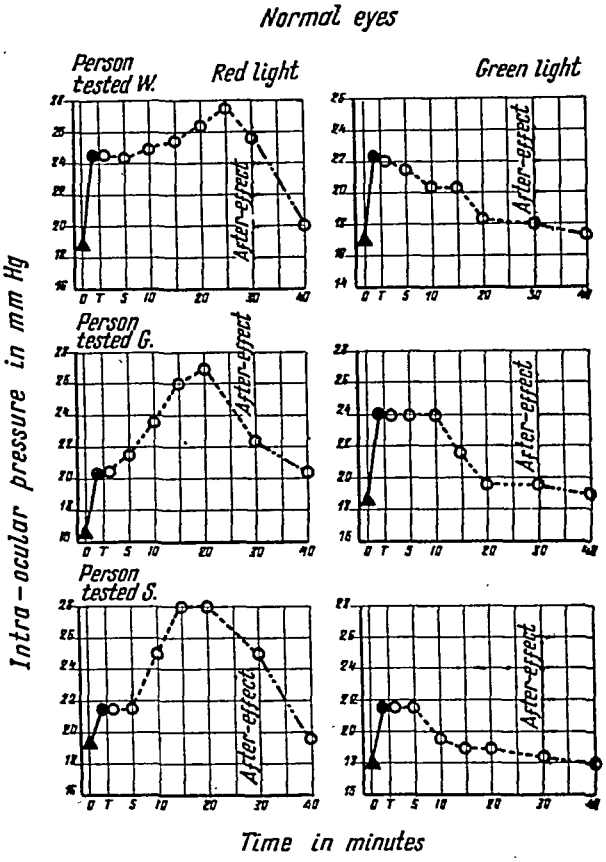


Fig. 4 (Zaretskaya). Curves of intraocular pressure (red or green light applied to the other eye). Along the ordinate are plotted the values of intraocular pressure in mm. Hg; along the abscissa, time in minutes. Triangles denote the initial pressure measured under general illumination of the room; black circles show the level of pressure with dark adaptation of the eye; open circles and broken line are readings obtained when the second eye was exposed either to red or green light; circles and dotted line show tension values found after stopping exposure of the second eye to the light stimulus (that is under the initial illumination conditions).

Results

The experiments with normal subjects showed the reaction of the intraocular pressure to be a reverse one, according to whether red or green light was employed.

The exposure of the second eye to green light brought a reduction of the intraocular pressure of the investigated eye; with the red light, the effect was reversed (fig. 3).

A similar picture of a reverse reaction to the red or green light is offered by Figure 4, which shows individual curves plotted for several patients tested by us.

As borne out by Figure 4, the curves obtained with red or green light show a different run.

Comment

Glaucomatous eyes display a well-pronounced specific reaction of their intraocular pressure for the same color stimuli. Thus, in all experiments carried on by us an appreciable reduction in tension was observed when the second eye of the subject under test was exposed to green light; the hypotonic effect in experiments with glaucomatous eyes was much stronger, however, than in experiments with normal eyes.

The hypotonic effect of green light appears still more conspicuous if compared to the effect of white light even of a higher brightness applied to the same glaucomatous patients (6 subjects) for sake of experimental control.

Table 1, as well as Figure 5, substantiate this observation.

Patients with a sharply pronounced form of glaucoma display a conspicuous deviation

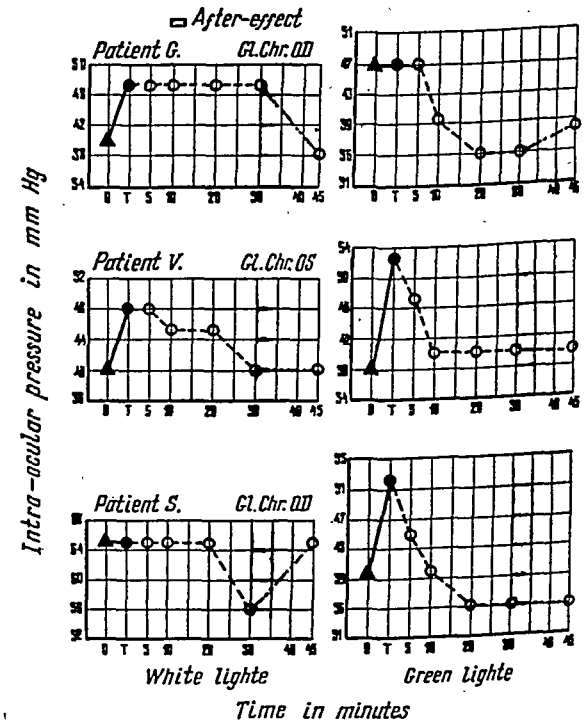


Fig. 5 (Zaretskaya). Intraocular pressure of one eye when the other eye is illuminated with green or white light. (For chart details, please see legend of Figure 4.)

TABLE 1

INTRAOCULAR PRESSURE IN GLAUCOMATOUS EYES AS AFFECTED BY WHITE OR GREEN LIGHT STIMULI

No.	Patient	Diagnosis	Tension Deviation in mm. Hg. Under Exposure of the Other Eye to	
			White Light	Green Light
1	F	Glaucoma chron.	−5,0	−10,5
2	S	" "	−6.0	− 5.5
3	G	" "	0	−12,5
4	V	" "	−8.0	−13.0
5	R	Glaucoma absol.	0	− 8.5
6	Sa	" "	0	−17.0

from the normal in the reaction of their intraocular pressure to red light. In normal subjects, however, the stimulation of the one eye with red light almost always results in a rise of the intraocular pressure of the second eye; no increase of intraocular pressure has, as a rule, been observed in glaucomatous eyes.

The intraocular pressure of the glaucomatous eye either remains stable, or may even show a slight tendency to decrease (fig. 6).

A similar picture of different responses to the red and the green light may be seen also in Figures 7 and 8, representing individual curves bearing out the results of experiments carried out on definite days.

DISCUSSION

The reaction of intraocular pressure in response to red light, which is missing in glaucomatous patients, points to a definite disturbance between their color-perceiving apparatus and their autonomous nervous system. The green-perceiving apparatus of these patients may possibly be more active than in normal subjects.

It is of interest to recall the remark made by Khodin as early as 1897 (*Journal for War Medicine,* 1897, in Russian), namely, that the increase in intraocular pressure is accompanied with a definite shift of color perception toward the green.

Wessely (1927) has described the presence of scotoma for the red as a symptom of glaucoma.

Some changes in color sensitivity have also been described in glaucomatous patients by Colomba (1932), who is likewise inclined to regard the analysis of color per-

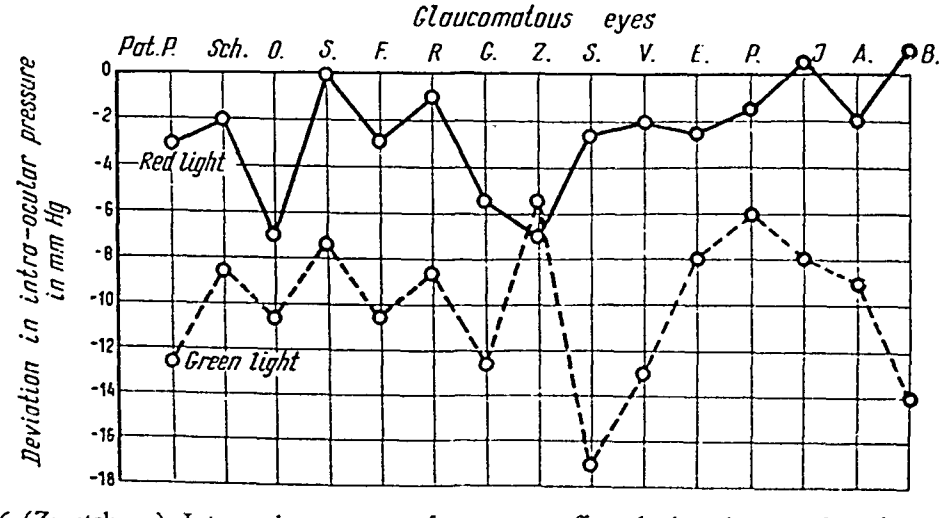


Fig. 6 (Zaretskaya). Intraocular pressure of one eye as effected when the second eye is exposed to colored light. (For chart details, please see legend of Figure 3.)

ception as one of the tests helpful in an early diagnosis of glaucoma.

Pointing out the importance of the investigation of color-vision disturbances for the diagnosis of glaucoma, Oloff (1932) remarks that they are of rather frequent occurrence in subjects affected by this disease.

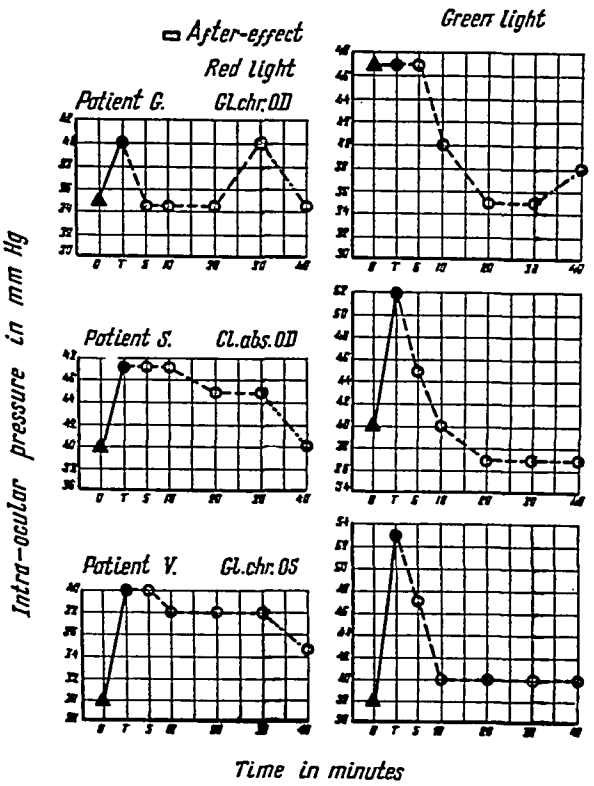


Fig. 7 (Zaretskaya). Change in intraocular pressure produced in one eye of glaucomatous patients by illuminating the other eye with red or green light. (For chart details, please see legend of Figure 4.)

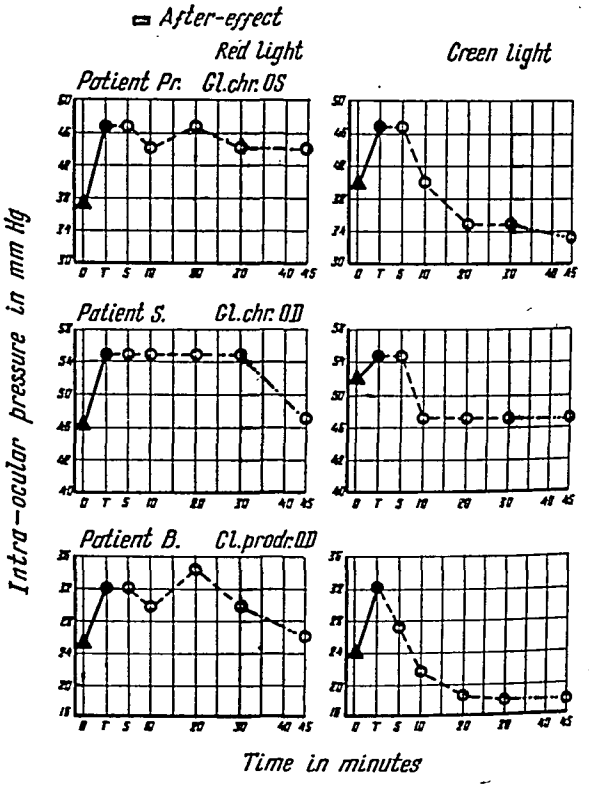


Fig. 8 (Zaretskaya). Change in intraocular pressure produced in one eye of glaucomatous patients by illuminating the other eye with red or green light. (For chart details, please see legend of Figure 4.)

Conclusions

Without claiming to have deciphered the mechanism of action of the accessory stimuli applied by us upon the intraocular pressure in a normal or a glaucomatous eye, the author, nevertheless, feels justified in advancing the following conclusions based upon her experiments.

1. The lowering intraocular pressure caused by vegetative reactions due to accessory stimuli is less in normal eyes and proceeds in a more uniform way, along a smoother curve, than in eyes of glaucomatous patients.

2. Fluctuations in intraocular pressure caused by darkness and light are likewise much more sharply expressed in glaucomatous eyes than in normal ones.

3. The pupillary reflex produced no appreciable effect upon the change in intraocular pressure when the second eye was exposed to the light stimulus.

4. The reduction in the intraocular pressure of the eye tested is dependent upon the brightness of the light stimulus applied to the second eye.

5. The opposite nature of the change in intraocular pressure, as brought about by the green or the red light stimuli, is evidence of the fact that the excitations of the green-perceiving apparatus of vision and of its red-perceiving apparatus produce two an-

tagonistic reactions of the autonomous nervous system.

6. The fact that, in contrast to unaffected subjects, glaucomatous patients do not show the usual increase in intraocular pressure in response to red stimuli of the eye, gives us ground to believe that the determination of the response of the intraocular pressure to the red light may become a supplementary method for diagnosing glaucoma.

7. In so far as stimulation with green light is followed by a particularly marked drop in intraocular pressure in glaucomatous patients, there seems to be some hope that green light may be applied to such patients for therapeutic purposes in the form of green spectacles used for reducing their intraocular pressure.

Sadovaya-Chernogryazskaya Street (14/19).

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NOTES, CASES, INSTRUMENTS

A SIMPLIFIED TANGENT-SCREEN TECHNIQUE USING A PANTOGRAPH ATTACHMENT

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The pantograph attachment shown in the accompanying figure was designed for the purpose of transferring the field from the tangent screen onto a chart. When employed in conjunction with the technique to be described, it offers several advantages over the methods in general use.

1. It reduces the time consumed in tangent-screen examinations and eliminates the necessity for freehand drawing by making the procedure of transferring the field quick and automatic.

2. It enhances the accuracy of the field chart and thus makes possible more careful comparative field studies, so essential in the evaluation of the course of a case of glaucoma.[1]

3. It permits the use of an unmarked screen, so that the examiner is not influenced by the outline of the normal blind spot or by the other markings.

4. It makes it possible to relegate to an untrained assistant the task of charting the field.

5. It enables the perimetrist to use the same screen at any desired distance by selecting the chart appropriate for that distance.

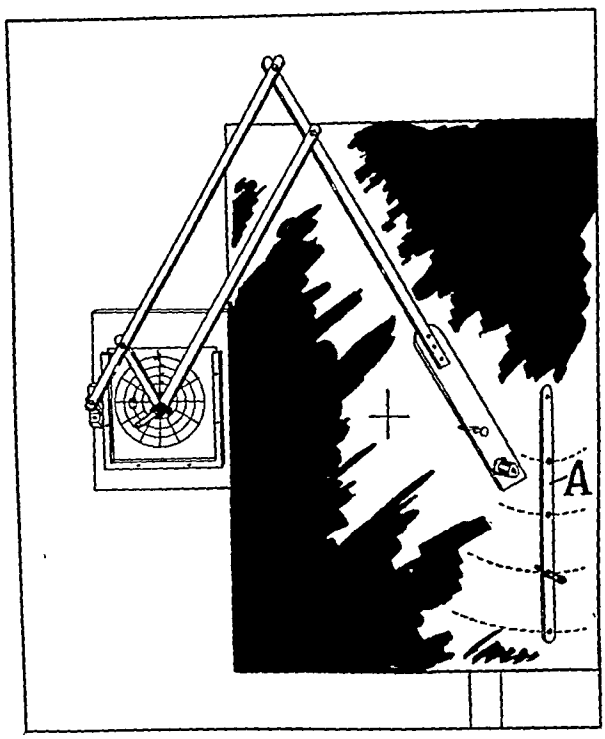


Fig. 1 (Posner). *Pantograph attachment for tangent screen.* This device is used for transferring the field automatically onto a chart. It has a reduction ratio of 1:8. The end segment is made of a transparent plastic. The tangent screen is left unmarked. A wooden rod (A) may be used for drawing temporary markings on the screen. Perforations placed at 5-degree intervals accommodate a wax crayon. The rod thus serves both as a ruler and compass.

The pantograph is a device widely used by artists and draftsmen for reducing and enlarging drawings accurately and automatically. Its use in connection with the tangent screen was suggested by Downey[2] and by Marks.[3] The devices described by them failed to gain popularity, probably because they were intended for automatic registration, rather than for copying the field, and thus could not help but be too cumbersome and obtrusive to be practical.

The pantograph attachment designed for use with the tangent screen reduces the field to one eighth its actual size. If a screen, one-meter square, is used, the corresponding field on the chart would be five-inches square. The writing arm is provided with a bushing which accommodates either a lead pencil or a colored crayon. The end section of the tracing arm is made of a transparent plastic, so that both the tracing style and the screen markings are under continuous observation. The frame which holds the chart is adjustable, so as to permit exact centering of the chart with reference to the screen. This adjustment also allows for a considerable range in screen sizes which

may be used with the same pantograph.

The technique of tangent screen perimetry, as herein briefly outlined, is well suited for use in conjunction with the pantograph attachment. The tangent screen is one-meter square and is made of black wool felt stretched over a wooden frame. A wooden disc, six inches in diameter, is attached to the frame behind the screen in such a way as to serve as a support for the central part of the screen. The screen does not carry any markings and is thus adaptable for use at other distances. The subject is seated so that his eyes are at one-meter distance from the center of the screen and on the same level. Uniform, shadowless illumination of about 5 to 7 foot-candles is provided by a Circline fluorescent tube mounted on a floor stand which carries an adjustable chin rest for head fixation. This accessory unit will be more fully described elsewhere.

The test objects which were found most useful are the white spherical ones devised by Evans. They range in size from 0.4 to 1.5 mm. The set* also contains larger disc-shaped test objects which may be used either as white or as colored stimuli by coating them with chalk of the desired color.

The field is plotted on the screen with colored chalk, using different colors to represent different sizes of stimuli and different eyes. A simple notation, made in the corner of the screen with each color used, serves as a key for the identification of the lines in the subsequent charting of the field. For example: "R-1" written in the blue chalk means that the blue line represents the field of the right eye as plotted with a 1-mm. white test-object. The colored chalks should be dry, nonwaxy, and of dark shades.† The chalk marks may be removed with a soft brush. Occasionally the screen should be cleaned with a vacuum cleaner. A felt screen is preferable to a woven one, since the chalk dust remains close to the surface.

The method of plotting the field is an adaptation of that employed by Evans for angioscotometry. For a detailed description the reader is referred to Evans' excellent monograph.[4] One fundamental principle might bear emphasizing here: *The stimulus should always be moved perpendicularly to the border of the scotoma.* This presupposes a knowledge of the shapes and locations of the typical scotomas for each condition, together with the most common variants.

Tangent-screen perimetry is an integral part of the ophthalmologic examination and, as such, should preferably be carried out by the ophthalmologist himself, if the findings are to have any clinical significance. Good perimetry requires special study and experience, which can be gained only by careful work and by correlating the field with the clinical picture. It is hoped that the pantograph attachment here described, by reducing the time consumed and by eliminating the need for free-hand drawing, will extend the use of the tangent screen in ophthalmologic practice.

667 Madison Avenue (21).

* Made by the National Electric Instrument Co., Long Island City, New York.

† Obtainable in most artists' supply stores.

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THE PREVENTION OF CYCLOPLEGIC GLAUCOMA

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"What precautions must be used in daily practice to assure adequate examinations of eyes at any age without danger of cycloplegic glaucoma?" was one of the questions asked in the American Academy's Home Study Course on Refraction. In spite of the obvious importance of the question, the answers given by the students were, almost without exception, very unsatisfactory. This communication has two aims, therefore: (1) to find out why the answers were so poor, and (2) to focus attention of all prospective students on a correct approach to the problem. It must be remembered that the home study course stresses the academic approach with particular emphasis on the basic sciences; and, as a consequence, the reading which is required of the students is the standard accepted textbooks on any given subject.

REVIEW OF REFERENCES

Review of these references for the subject of refraction showed that the standard textbooks left much to be desired in their discussion of the problem. Thorington,[1] Fuchs,[2] and Cowan[3] briefly mention in a scant sentence or two that cycloplegics should not be used in the presence of glaucoma. May[4] mentions the fact that the tension should be checked, but does not specify a tonometric tension. Duke-Elder[5] states that the presence of glaucoma should be excluded before using mydriatics, and that miotics should be instilled afterward. The *American Encyclopedia of Ophthalmology*[6] suggests taking the tension first, and also says it is "a good plan" to instill a miotic afterward. O'Rourke in Berens[7] says that caution is indicated, and that a cycloplegic should not be used until a fundus examination is made and the tension tested digitally, and, if there is any doubt, tonometrically. Gifford,[8] although brief, gave the most complete answer when he said that the intraocular pressure should be estimated in all people over 25 years of age, the fundus observed through undilated pupils to rule out the presence of a glaucomatous cupping, and a miotic instilled in all people over the age of 20 years, at the conclusion of the examination.

Discussions in these same textbooks under the heading of glaucoma were no more complete in so far as this particular question was concerned. Here the problems of diagnosis were discussed with regard to provocative tests, perimetry, and tension curves in early stages. Such procedures obviously are extremely important in confirming a suspected case, but they can hardly be carried out as routine on every case for cycloplegic refraction.

PRECAUTIONS TO OBSERVE

What then are the precautions to be observed? What steps must be taken to prevent a cycloplegic glaucoma? First, it is important when the history is being taken to ask specifically whether the patient has ever seen halos around lights, whether there is any history of glaucoma in the family, or whether the patient has ever had any episodes of ocular inflammation suggestive of attacks of acute glaucoma. It goes without saying that the visual acuity must be determined, and in those cases where it is possible a manifest refraction should be performed.

The next step is to make an external examination of the eyes, paying particular attention to the size of the cornea, the depth of the anterior chamber, the size of the pupils, and the pupillary reactions. Any deviation from the normal in the way of a small cornea, a shallow anterior chamber, or pupils which seem unduly large and do not react to light briskly should arouse suspicion and require that further study be made to rule out glaucoma. A careful ophthalmoscopic inspection of the optic discs

must be made in every case, and any case in which there is any suspicion of a cupping, must have a complete study.

Clinical routine

It is a good clinical habit to check the tactile tension in every case, but no clinician can appreciate a difference of 5 mm. Hg by this technique. Therefore, it is extremely important to check the intraocular pressure *tonometrically* on all patients over 25 years of age before a cycloplegic is instilled. This measurement should be rechecked tonometrically after the pupils are dilated. Any case in which there is an increase of intraocular pressure of 5 mm. Hg or more, following dilatation of the pupils, is suspect and requires an immediate careful workup and prolonged follow-up. Gradle[9] has shown that in 2.8 percent of 500 eyes, there was an increase of 5 mm. Hg or more in the intraocular pressure following the use of cycloplegic for refraction.

Following the use of a mydriatic it is important to instill a miotic to hasten recovery from the effects of a dilated pupil in all cases. In those cases in whom there is an abnormal increase in intraocular pressure under mydriatic, it is absolutely necessary to keep the patient in the office or clinic until both the tension and pupils have returned to normal with the use of the miotic. Subsequent treatment is then decided on after a careful glaucoma work-up.

The importance of these procedures cannot be over-emphasized. The practice of routinely dilating all pupils without adequate examination is not only poor ophthalmology, it is dangerous, and it is important that all those who are responsible for the teaching of our young men recognize and emphasize this point.

58 East Washington Street (2).

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QUININE AMAUROSIS*

B. L. Braveman, M.D., D. S. Koransky, M.D., and M. M. Kulvin, M.D.
Hines, Illinois

Quinine in many instances is the drug of choice for the prophylactic and active treatment of malaria. With the return of many servicemen who have suffered from malaria and the easy availability of quinine at present, toxic reactions to the drug will probably be seen more frequently.

The toxic action of quinine in the retina is reported as being (1) directly toxic to the ganglion cells and (2) acting upon the retinal arterial system to produce extreme vasoconstriction with resultant ischemia and damage. Patients in most of the reported

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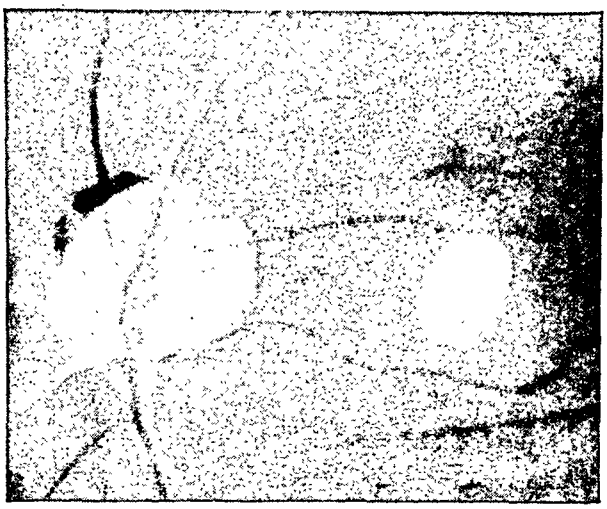


Fig. 1 (Braveman, Koransky, and Kulvin). Fundus picture in a case of quinine amaurosis four weeks after poisoning showing optic atrophy and silver-wire arteries.

cases recovered much of their central vision. However, varying amounts of peripheral constrictions remained. Duke-Elder states, "In all cases the tendency is for recovery: in the milder degrees of poisoning the vision may recover in a few hours but in more severe cases amaurosis may persist for several days or even weeks, and in this event some degree of atrophy of the nerve and some permanent loss of vision is inevitable. Permanent blindness, however, has not been recorded."

The following case is the report of an individual who ingested a large overdose of the drug and developed severe toxic cardiovascular and retinal damage.

Report of a case

A 42-year-old white man, a bartender, was admitted to the hospital on December 29, 1946, in a comatose condition. No history was obtainable.

On initial examination systolic blood pressure was 60, diastolic pressure could not be recorded. The pulse rate was not obtainable. An emergency electrocardiogram recorded a ventricular tachycardia. The patient was given immediate emergency management of oxygen, and so forth. The tachycardia and low blood pressure persisted for a period of eight hours. Gradually the blood pressure rose, the pulse rate fell, and the patient responded to treatment. Within 48 hours after admittance, the patient regained consciousness and at that time stated that the room was dark.

An ophthalmologic examination revealed light perception and projection to be absent in both eyes. The pupils were round, measured 4½ mm., and fixed to light and accommodation. Ocular movements, adnexa, and anterior segments were normal. Both fundi revealed well demarcated, flat discs. The retinas appeared markedly pale and somewhat edematous. The maculas were cherry red against the pale retinal background. The arterial tree was markedly attenuated, the arteriovenous ratio being approximately 1 to 4, and the arterial tree could only be followed out to the region of the equator.

Diagnosis. A provisional diagnosis of retinal ischemia was made and vasodilators were administered in large doses (intravenous sodium nitrite, papaverine, and niacin by mouth).

Course. Within 72 hours, the retinal edema receded and the fundi regained a normal color. However, the vascular tree remained constricted.

Seven days after the original eye examination, the arterial tree was completely sheathed and had the appearance of silver wire. The discs became progressively paler and were dead white in appearance by the second hospital week and have remained so.

Fifty days after admission faulty light perception and projection were obtained; shortly thereafter finger counting at 18 inches could be elicited. The pupils remained fixed to light and accommodation and field studies could not be obtained.

Five days after admission, a history of excessive doses of quinine was obtained from the patient and confirmed by his wife. He stated that it was his custom to take 45 grains of quinine daily when he felt an attack of malaria coming on. On December 28, 1946,

he took all of the quinine that he had available, which consisted of approximately 100 tablets varying in dose from 2 to 5 grains each. At that time the diagnosis of quinine intoxication was established. The patient did not complain of impaired hearing, but audiometric examinations revealed partial nerve deafness bilaterally.

Summary

This is a case of quinine poisoning with bilateral amaurosis persisting for a period of at least 50 days. The probable dose was at least 200 grains (Goodman and Gilman state that the fatal dose is 120 grains). The patient also suffered from a cardiovascular episode which consisted of a ventricular tachycardia which persisted for a period of eight hours and was associated with the marked fall in blood pressure. The outstanding findings in the fundi was the markedly persistent vasoconstriction that led to severe retinal damage.

Veterans Administration Hospital.

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Historical Miniature

Thomas Young, who first described astigmatism when he published measurements of his own eyes in 1801, was also the first to discover the very common occurrence of hypermetropia. The recognition of this fact, which Donders did not mention in his "Refraction and Accommodation," in 1866, is of far greater importance than the description of an isolated case of extreme hypermetropia which was published by Janin in 1772.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

May 5, 1947

DR. BENJAMIN FRIEDMAN, *president*

SURGICAL ANATOMY OF THE EYE

DR. RAYMOND E. MEEK discussed this subject during the instruction hour.

BIFOCAL SEGMENT SELECTOR FOR SPECTACLE FRAMES

DR. AARON ROTH demonstrated an attachment to spectacle frames. This can be incorporated in the frames, and allows the wearer to move his bifocal segment up so that he can use it directly in front of his eyes if necessary.

CENTRAL SEROUS RETINOPATHY

DR. EMANUEL ROSEN presented two cases of central serous retinopathy following vaccination. He demonstrated that the macula may be involved after vaccinia inoculation. Such an involvement usually occurs within an incubation period of 7 to 11 days. Histologically, it simulates the picture seen in the brain in cases of postvaccinial encephalitis. Dr. Rosen stated that we may assume this to be an allergic response with specific localization in the macula.

PERIPHERAL VISUAL ACUITY WITH SPECIAL REFERENCE TO SCOTOPIC ILLUMINATION

DR. JOSEPH MANDELBAUM'S paper (Louise L. Sloan collaborating) was published in the JOURNAL 30: 581 (May) 1947.

In his concluding remarks Dr. Mandelbaum said that:

1. Scotopic peripheral acuity does not parallel the rod population or the light sensitivity of the retina.

2. Maximum scotopic acuity can be achieved by 4- to 8-degrees' eccentric fixation.

3. Light intensity is not as critical a factor in peripheral acuity as it is in central acuity.

4. At the lowest scotopic levels, visual acuity is fairly constant from 4-degrees to 30-degrees' eccentric fixation.

5. A considerable overlap occurs between cone and rod function, the paracentral rods dominating discriminatory function at light intensities well above the cone light threshold.

6. For 25- and 30-degrees' eccentric fixation, the rod cells dominate form discrimination even at intensity levels as high as one millilambert.

USE OF PLACENTAL EXTRACT IN VIRUS DISEASES OF THE CORNEA

DR. BERNARD KRONENBERG described the preparation of aqueous placental extract, lipoid extract, immune gamma globulin from placental blood, and placental tissue coagulant. He gave a preliminary report on the use of aqueous placental extract in the treatment of herpetic keratitis and superficial punctate keratitis. In view of the favorable results obtained in these cases, Dr. Kronenberg stressed the need for further clinical investigation.

Dr. Kronenberg reported the use of immune gamma globulin in the treatment of uveitis. He said that the immunologic rationale and the favorable results obtained suggest the need for further investigation in this disease. The favorable results obtained in the treatment of retinitis pigmentosa with placental extract by Filatov was not corroborated by Dr. Kronenberg. Old corneal opacities, tuberculous episcleritis, diabetic retinopathy, and vascular changes

in the retina did not respond to treatment with placental extract.

Dr. Kronenberg also described the use of placental tissue coagulant, preoperatively, to lower the blood clotting time in diabetics.

Syndrome of glaucomato-cyclitic crises

Dr. Adolph Posner and Dr. Abraham Schlossman presented nine cases which form a homogenous group and exhibit signs of mild glaucoma, associated with cyclitis. The clinical features were as follows:

Unilateral attacks of ocular hypertension occur without congestion, pain, or marked impairment of vision. These attacks last from a few hours to two weeks. Cells in the aqueous and keratic precipitates appear either simultaneously with hypertension or within 24 hours after the onset of the hypertension. Posterior synechias are never observed. The precipitates are not numerous and disappear spontaneously within one month. Individual attacks may occur without precipitates. Heterochromia was present in one third of the cases and anisocoria in one third of the cases.

Gonioscopy showed the angle to be open in all four cases examined. In two of the cases it was wide, and moderately narrow in the other two cases. The attacks are self limited.

Pupillographic examinations gave normal curves in all six cases examined. In three cases the curve was of the type found in primary glaucoma, while the other three cases showed evidence of disturbances of the central sympathetic nervous system.

Dr. Posner said that treatment does not shorten the total duration of the attack. Pilocarpine (½ to 2 percent) usually lowers the tension. Homatropine is not dangerous and its action is not dependable. Surgery does not prevent recurrence of the attacks.

This syndrome of recurrent attacks of unilateral glaucoma with mild cyclitic signs forms a clinical entity intermediate between primary and secondary glaucoma, since it exhibits features of both types of the disease.

Discussion. Dr. Ludwig von Sallmann agreed with Dr. Posner and Dr. Schlossman that cases of patients with recurrent attacks of increased intraocular pressure as was described should be classified as a definite syndrome. He said that these cases can be distinguished from typical primary glaucoma with a few deposits on the cornea, from secondary glaucoma, and from the so-called sympathicus glaucoma with and without heterochromia.

In regard to the pupillographic examinations, Dr. von Sallmann raised the question as to whether, in view of the unilaterality of the lesion, a disorder in the subordinate ciliospinal center of Budge can be completely disregarded.

Dr. von Sallmann said that in addition to the hypothalamic disturbance, Dr. Posner assumes the coexistence of a peripherally operating mechanism as, for instance, a labile peripheral autonomic system; this factor must be present unilaterally. There seems to be a considerable range of doubt or alternate explanations. One could visualize that the functions of the terminal nerves or the capillariomotoric response of the other intraocular mechanisms of regulation are at fault in the one eye. In view of the presence of infective foci and strong allergic reactions of some of the patients, the question arises whether an antigen-antibody reaction or a toxic factor couldn't be responsible for the onset of the periodic attacks in a disposed eye. That is, the cells in the aqueous and the precipitates on the cornea could be the expression of a transient low-grade inflammation rather than of a primarily nervous disturbance.

What further studies may reveal on the interrelationship between disorders of sympathicus centers and between the centers and a peripheral mechanism remains to be seen. At the present time it is likely that a transient increase in the permeability of the

ciliary capillaries is the most important single peripheral factor, which has a bearing on the development of the recurrent attacks. In the last year, studies were conducted in the Knapp Laboratory on an experimental glaucoma induced by increased permeability of the ciliary capillaries. Various therapeutic approaches were studied on experimental animals. The effects of adrenergic drugs, of pituitrin, of substances acting on the intracellular cement, as Ca ions and adrenal cortical hormone, and of a series of histamine antagonists were tested, and promising results were obtained both in respect to the reduction of increased permeability of intraocular capillaries and the lowering of intraocular pressure. There is some hope that one or the other of these therapeutic measures will be of help in the glaucomato-cyclitic crises described by Dr. Posner and Dr. Schlossman.

Bernard Kronenberg,
Secretary.

SOCIEDAD OFTALMOLOGICA DE MADRID

May 16, 1947

Syndrome of Van der Hoove

Dr. Mier read a paper on Syndrome of Van der Hoove. The patient, 32 years of age and 1.38 meters tall, had suffered three fractures, which were corroborated by X-ray pictures. The X-ray films also showed considerable osseous rarefaction of the epiphyses of the long bones and a very small and dense sella turcica in the shape of a kettle and covered with a bony layer, in the interior of which was the strangulated hypophysis. The patient showed hypophyseal disturbances. Both the middle and internal ears showed otosclerosis.

Discussion. Dr. Marion Amat congratulated Dr. Mier on his brilliant dissertation and recalled the fact that he had published in the *Semana Medica Española* of December, 1940, an interesting clinical observation which presented the complete triad of the Syndrome of Van der Hoove; namely, blue sclerotic, multiple fractures and otosclerosis and, in addition, cranial asymmetry, alterations in the basal metabolism, and calcemia.

Visual disturbances as the first subjective manifestation of a tumor of the hypophysis

Dr. Marin Amat and Dr. Marin Enciso presented a paper on this subject.

Marfan's syndrome

Dr. Marin Enciso and Dr. Lopez Garcia presented a paper on "Marfan's Syndrome: Extraction of Subluxated Crystalline Lenses." They presented a girl who showed this syndrome with excessive length of the limbs, especially the hands, feet, and fingers, very large arms, congenital subluxation (ectopia) of both crystalline lenses complicated by ocular hypertension which necessitated an iridectomy in both eyes and later extraction of both subluxated, transparent crystalline lenses. The operations were accomplished without any loss of vitreous or any complication.

Discussion. Dr. Mario Esteban. Arachnodactylia is one of those dystrophies, the study of which is always interesting. The pathogenic interpretation of the condition lends itself to the formulation of hypotheses which leave behind them not one, but many questions.

Evidently there is an anomaly of development of germinal origin which affects the mesoderm. But what is the fundamental cause of the dystrophy? Why are there other malformations and ectopia of the crystalline lenses and such excessive length of the bones of the hands and feet that the flexor tendons become relatively short causing a permanent contraction of the finger joints?

One may suggest the theory that there is hypophyseal disfunction, and perhaps also

parathyroid disfunction, which start in fetal life.

Professor Carreras. Marfan's syndrome does not constitute an isolated symptomatic complex, but forms part of a much larger and more general syndrome for which Schmidt proposes the name of "Congenital Mesodermal Dysmorpho-dystrophy." Marfan's syndrome is one of its clinical types and another (at least until now) is the syndrome of Marchesani in which there is microphakia and spherophakia in addition to brachydactylia. There have been cases of brachydactylia with ectopia of the crystalline and of spherophakia with arachnodactylia, which proves there is some common basis for the aforementioned changes. At times there are frustrated and asymptomatic forms. In addition to luxation of the lens and spherophakia, which are the most characteristic features, there may exist other ocular anomalies (megalocornea, aniridia, coloboma, and so forth). Of the different theories proposed to explain this syndrome, the mesodermal theory of Weve seems best.

The disturbance which affects the development of the mesodermal structures could be explained by the action of some chemical or prehormonal substance, since in the embryonal period, when these events seem to begin, one cannot speak of actual hormones. Delayed involution or partial persistence of the tunica vasculosa lentis could originate these zonular deficiencies which would later cause the changes in the crystalline lens. Although the lesion attacks ectodermal organs and formations, such as the crystalline, the origin of the disturbance is rooted in the mesoderm. Heredity also plays a role. The typical cases of the disease, or even the incomplete and frustrated forms, are transmitted by heredity of the dominant type. The asymptomatic forms, on the other hand, are generally transmitted by the recessive type.

Dr. Marin Enciso (closing). In the first place I wish to thank Dr. Esteban and Professor Carreras for their remarks on the subject. With reference to Dr. Esteban's suggestion on the endocrine origin of the syndrome, this has been partly answered by Professor Carreras. The disturbance begins in embryonic life at a time when one could not very well speak of fetal endocrine influences. The morphologic peculiarities of the patients with Marfan's syndrome suggest, however, the influence of endocrine factors, especially of the hypophysis, but actually this idea can be only a suggestion, since it is not based on definite data.

With regard to the substance which is affected, it seems that in Marfan's syndrome the changes in the mesenchyme dominate to such an extent that some include it in the congenital mesenchymal dysplasia. However, it is not rare to observe cutaneous and neurologic changes which lead one to think of simultaneous changes in several blastodermal parts. The disturbance probably depends on a juncture of genetic factors combined in diverse ways in various cases.

Joseph I. Pascal,
Translator.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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TERRY-OWENS DISEASE

Since retrolental fibroplasia was described by Terry in 1942, our knowledge of this disease of premature infants has been fragmentary, and conflicting hypotheses have been advanced in an attempt to explain it. These hypotheses, have been based upon (a) clinical observations of patients seen in advanced stages of the disease, and (b) upon histologic examinations of eyes removed when the lesions were far advanced. It is natural, therefore, that these examinations made during the late stages of the disease have led to inadequate and conflicting premises as to its nature.

To understand retrolental fibroplasia, it is necessary to follow the clinical course of the disease from its onset to the development of the final characteristic picture. Dr. William C. Owens and Dr. Ella U. Owens have investigated the problem of retrolental fibroplasia from this standpoint. Their findings will be reported in an article entitled, "Retrolental Fibroplasia in Premature Infants," which will appear in a subsequent issue of the JOURNAL. As part of their study

on retrolental fibroplasia, they routinely examined all the premature infants weighing 2,000 grams or less born in The Johns Hopkins Hospital or admitted to the Premature Nursery of The Johns Hopkins Hospital for a period of two years.

In their report they describe the clinical course of retrolental fibroplasia as it occurred in 10 premature infants in whom they observed the lesion develop. In every case observed, the lesion had its onset after birth. The lesion did not result from an overgrowth or persistence of any structure characteristic of an embryonic or fetal stage of development such as the tunica vasculosa lentis or the primary vitreous, as had formerly been supposed. They found that the earliest changes occurred in the retina and the retinal vessels. The retinal vessels became enlarged and tortuous; the retina became gray, swollen, and elevated; and the vitreous became hazy. As the disease progressed, large masses of elevated retina fused and gradually covered the retrolental space, producing the picture that has been described as typical of retrolental fibroplasia, which in reality is the end stage of the lesion. In the cases described, the lesion began to develop about two months after birth. It gradually increased in activity and intensity until about the fifth month after birth, when it began to subside, the later changes being due to contracture of the retrolental tissue.

The article of Dr. William C. Owens and Dr. Ella U. Owens is particularly interesting for their observations throw an entirely new light on the nature of retrolental fibroplasia. The disease has a definite onset in postnatal life. It occurs primarily in the retina and retinal vessels; it is not related to an abnormal persistence or hyperplasia of the tunica vasculosa lentis or of the primary vitreous. The fact that the lesions in some of the cases subside spontaneously suggests the possibility that, if the cause of the disease can be found, the institution of proper therapy may result in a regression of the lesions, leaving eyes with almost no remaining abnormality.

The disease that Terry described and upon which Owens has elaborated so convincingly is, therefore, surely an entirely separate entity from that of the overgrowth or persistence of fetal developmental tissue within the eye. In discussing the paper by Owens at the recent meeting of the Wilmer Residents Association, Verhoeff pointed out that the term "retrolental fibroplasia" is not truly significant of either of these two conditions, and thus its employment adds to the confusion. Although eponyms are unscientific, the use of the term "Terry-Owens Disease" can be practiced in this event until a more suitable, or at least scientific, name is evolved.

Much pride is taken in proposing that the name "Terry-Owens Disease" be made an integral part of our medical and ophthalmic nomenclature. Tularemia conjunctivitis was the first ophthalmic disease discovered by ophthalmologists in the United States and "Terry-Owens" disease is the second. We are growing up.

Derrick Vail.

COLOR BLINDNESS; NO CURE

During the examinations in the enlistment and drafting of men and women for admission to the armed forces—Army, Air, and especially the Navy—many of them were astonished, not to say shocked, when informed that they were "color blind." Because they had never experienced difficulty in their lives, and, doubting the recruiting examiner's judgment, they sought examination elsewhere. When convinced that they had shown uncertainties in their estimates of the colors shown them, they were inclined to believe they were ignorant of colors, or that they had some temporary and unsuspected diminution of their sight in general. They sought means for educating themselves in the appreciation of colors, adopt-

ing exercises by which they might so correct their defects as to be able to pass the prescribed tests.

The term "color blindness" is a rather cruel designation of the state of the sight which prevents an individual from easily recognizing colors and makes him hesitate to declare the name of a color and to display an ability to match it and blend it with other colors.

The appreciation of *color* is a physical property of the sight—occasioned by the breaking up of light when broken into rays of differing quantities. This action is shown when one holds a prism of glass before the light as it comes from the sun and observes the reflection thrown into various colors, like those of the rainbow after a storm, exhibiting the red at one end and violet at the other. Now, there are some persons who cannot see red, or green, or violet; these are the true actual so-called color blind. And there are others who have difficulties in appreciating some colors when they are shown under varying conditions of light, or in matching or blending a given color with another. Few, very few, persons are absolutely blind to all the colors.

Scientists have given another name to color blindness—it is spoken of as "achromatopsia," and those who, while recognizing all the colors as such, have difficulty in manipulating any or all of the rainbow colors are the "anomalous." These anomalous persons have been divided into classes depending upon the number of the colors with which they have difficulty, or the replies which they make in the testing—thus "deuteranopes" and so on in each degree, the main color is given a Greek numeral to indicate the result. There is no blindness in the ordinary sense.

In practice and experience in railway, naval, and other forces, red and green have been the colors employed as signals of safety or danger. So, in general, because of the employment of those two colors, such achromatics have been spoken of as the "red-green blind." This defect has long been recognized and largely has had a place made for it, since the subjects, as a rule, exhibit the defect in all their avocations. Those who, in bright light make out to the satisfaction of all, are prone to go astray when in reduced light, or in cloudy weather, or at sundown and daybreak. This class is more dangerous in action than the known red-green individuals as they cannot instantly distinguish the colors set.

The cause of color blindness is not known; many theories are held, and it is amusing to stand on the sidelines and watch the fierceness of the fights which go on between the advocates of one adopted theory who struggle to have opponents accept their pet ideas. As a working hypothesis, most ophthalmologists are willing to accept the Young-Helmholtz theory that each color has its own nerve, the rays carried over it to be appreciated by the brain.

At present, ordinary cases of color blindness present no visibly known cause for their trouble. Their eyes are healthy and show no departure in structure from what is obtainable in the examination of the perfectly normal cases. But, color deficiencies are complained of by those who have had distinct disease of their eyes, or of the nervous system, as in optic atrophy and in some cases of cataract.

The appreciation of color was recognized in the earliest known records of humanity. The recognition of the "Arch in the Heavens" was an index of man's ability to distinguish the different bands in the rainbow. At the time of the Flood, doubtless, not all the colors as known to man today were recognized by primitive man. Even nowadays savage peoples in the remote lands do not employ all the civilized colors. We may conclude that *color* has been a developed sense. May we hope that, in the future, the civilization of the, until recently, savage inhabitants of the Oceanic Islands can be observed by

scientific inquirers so that many new facts concerning the color vision of such backward peoples can be made known to us?

It was a common expression of those who had been rejected by the Armed Services, that they were "color-ignorant." It is true that some persons do not know what names to give to modern tints and shades of common colors, they cannot say what is "cerise" or what "mauve"; yet, these same individuals, when shown the red, green, blue, yellow, and white lanterns in the railways and street crossings, accurately and promptly called the names of the colors.

Now, because of having been rejected, many, eager for enlistment or employment, have sought means to educate themselves or so to develop their senses that they can pass the same tests which they failed to pass a short while before.

Color blindness has been closely observed since about the end of the 18th century. Many are the ludicrous stories told of well-known persons' mistakes, such as a staid Quaker appearing at First Day's breakfast in a flaming red coat of his own selection, having indignantly objected to the practice of his wife's insistence on choosing the cloth for his clothing. Or, the more serious story of a trusted railway engineer, who for 40-odd years had guided his train to a distant city without a broken record. He declared that he "knew every tie from the one point to the other with his eyes shut," but when examined after a short illness, was found to be deficient "with his eyes open."

Color blindness is found in males, rarely in females, but a woman of a color-blind family may be a "carrier" and transmit the affection to her male descendants, the females of the family serving as carriers to their male children.

At the beginning of the scientific study of color vision, common colored articles were employed. Since these did not have fixed qualities, efforts were made to standardize the coloring of objects employed and to have the standards accepted by all interested nations as the international standard.

Lamp lights were devised and wool skeins dyed to a fixed degree. Later cards were printed. All these were first standardized and then modifications of them were adopted, and "mistaken colors" arranged so as to enable the examiner to have an idea of what the defective one might offer as his conception of the true colors. The cards, or plates, have various figures formed of the test-color, surrounded by similar color formations but of the "confusion color." This makes the set figure indefinite and has the property of confusing the examinee, thus demonstrating to the examiner the true state of his vision.

To repeat, it has been the endeavor of the true scientist to seek means at least to increase a deficient's powers, but without success. It is to be recorded, alas, that designing persons, or perhaps misguided enthusiasts, have prepared schemes arranged with standard and obscuring colors, with which they have held out to would-be "clients" assured prospects that by daily practice with these devices, they can "cure" this color blindness and safely pass all the color tests prescribed by the Government.

I have been concerned all my medical life with practical observation of known and suspected color deficiencies—my professional observation confirming facts I had become aware of in my early days and in school and college life. In deep sympathy for those found to be so defective that they have been forced to leave their chosen, and otherwise efficient, employment because of their "color blindness," I have pursued every available means to be practiced for such studies. My experience has been in practical-every-day environment, not in complex laboratory surroundings. In no case have I been rewarded by results so perfect or of such cheering success that a color-blind man or a woman, under all sorts of conditions devised, has been

able to pass the tests conducted by another disinterested observer. In the cases of excessive use of tobacco, especially of an alcoholic, there have been recorded recoveries from that kind of toxic amblyopia after a season of abstention from "nicotine and its tincture."

In May, 1947, there was published in the *Archives of Ophthalmology* an extensive report by Roswell Gallagher and his colleagues of their analyses of the "Efforts of Training Methods on Color Vision" observed in the case of 40-odd individuals in which they state:

"Training which enables a person (previously classified as a deficient in color vision) to achieve a test rating comparable to that of persons who have normal color vision apparently does not result in the development of the ability to differentiate colors in all situations and under all conditions with the accuracy and speed possessed by those who have normal color vision." When testing objects, not hitherto employed, were exhibited, the subject failed to recognize them correctly.

And, at the meeting of the American Ophthalmological Society held in June, 1947, at Hot Springs, Virginia, it was unanimously ruled that—"The conclusion reached after consultation with various groups interested in the subject of defective color sense was 'to the effect that color deficiency cannot be remedied by diet, training, or any other treatment now known to Science.'" This judgment was confirmed by the American Medical Association, and was repeated at the meeting of the association at Atlantic City in June, 1947.

It is by reason of these pronouncements that this paper has been offered for the benefit of those who might have been induced to enter into schemes devised to improve their color defects.

Burton Chance.

OBITUARIES

ERNEST F. KRUG
(1877-1948)

Dr. Ernest Frederick Krug died on February 28, 1948, after a long illness. He was born in Cleveland, Ohio, a son of Prof. Joseph Krug, supervisor of instruction in the German language in the Cleveland public schools, and of Magdalena Weinhardt Krug.

After completing his education in Cleveland, Dr. Krug came to New York to study medicine and was graduated from the College of Physicians and Surgeons of Columbia University in 1900. He then interned at the Lennox Hill Hospital in New York and from that time on was always associated with that institution.

He became an assistant to Dr. Emil Gruening and later to Dr. Wilbur Marple. He also took postgraduate work abroad, studying for some time under the eminent ophthalmologist Prof. Dr. Ernst Fuchs. He successfully practiced ophthalmology and otolaryngology for many years, but from 1922 on he limited his practice to diseases of the eye. During World War I, Dr. Krug served in the medical corps. He held the rank of major.

After fulfilling various appointments at the Lennox Hill Hospital, Dr. Krug became attending ophthalmologist in 1920, from which position he was retired, in 1942, to become a consultant in his department. Through his untiring efforts, a modern and well-equipped eye department was established and he devoted a great deal of his time to teaching and training the younger ophthalmologists. He was always interested in the younger men and was happy to pass on to them the knowledge which he had gained from his long years of experience. He was always willing to offer them guidance and encouragement. Many of these doctors continued throughout his lifetime to seek his advice and often called him in consultation.

Dr. Krug held the appointment of associate professor of ophthalmology at the Post Graduate Medical School for many years and, until 1946, he was associate attending ophthalmologist at the Post Graduate Hospital and Dispensary. He also served for some time as attending ophthalmologist at the Central Neurological Hospital at Welfare Island.

He was a Fellow of the New York Academy of Medicine, a member of the American Ophthalmological Society, the American Academy of Ophthalmology and Otolaryngology, and the New York Ophthalmological Society.

Dr. Krug was a thorough ophthalmologist in every field, a keen observer, an accurate diagnostician, and a very skillful surgeon. His methods were simple and direct. He loved his chosen work deeply and he gave unstintingly throughout his long career of himself and of his knowledge to those who were afflicted. He will be remembered by all who knew him for his genial good nature, ready wit, and quick repartee.

His contributions to ophthalmic literature were few, but they were important. They were as follows: "An investigation of the ferment activity of the rabbit's vitreous" (1931); "Foreign substances injected into the vitreous of the rabbit," Ernest F. Krug, M.D., and George L. Rohdenburg, M.D. (1932); "Venous angioma of the retina, optic nerve, chiasm and brain," Ernest F. Krug, M.D., and Bernard Samuels, M.D. (1932); "A cyst of the posterior chamber with a microscopic study of the eye" (1937); "A case of tuberous sclerosis," Ernest F. Krug, M.D., and Francis A. Echlin, M.D. (1943).

In 1911 Dr. Krug was married to Miss Louise P. Hoffmann, who survives him. He also leaves two sons and three grandchildren.

Joseph H. Krug.

WILLIAM TARUN
(1870-1948)

Dr. William Tarun was graduated from the University of Maryland Medical College in the class of 1900. He began his special training at the Presbyterian Eye, Ear, and Throat Hospital almost at once under Dr. J. Frank Crouch in otology and later under Dr. Hiram Woods in ophthalmology. Dr. Woods shortly appointed Dr. Tarun chief of the Eye Clinic at the University Hospital and associate professor of ophthalmology and otology which position he held until Dr. Woods retired from the university.

In his earlier years of practice, Dr. Tarun had a large following in both otology and ophthalmology but later limited his practice to ophthalmology. With his keen mind and excellent training he soon became one of the leading ophthalmologists of Baltimore.

He was a member of the American Medical Association, the American College of Surgeons, the Medical and Chirurgical Faculty of the State of Maryland, and the American Ophthalmological Society to which he was elected in 1917 and whose meetings he always attended.

His original contributions were not numerous but he was active in the discussion of the papers presented. His hobbies were golf and gardening in both of which he excelled.

Dr. Tarun was an able physician, a good citizen, a Christian gentleman, and a most genial companion. His relationships to his colleagues were always characterized by the highest ethical standards. His passing followed a distinguished career of work well done, and his memory will long live in the hearts of his many friends and patients.

Clyde A. Clapp.

ERVIN TÖRÖK
(1877-1947)

By the death of Ervin Török, ophthalmology has lost an accomplished surgeon

and a man of attractive personality. Dr. Török was a native of Hungary, where he was graduated from the University of Budapest and received his doctor's degree in 1899. He obtained his preliminary education in ophthalmology at the University Clinic of Schulek in Budapest. After several years of postgraduate training with Grosz and Blaskovics in Budapest and with Hirschberg in Berlin, he arrived in the United States, in 1905, with a letter of introduction to Dr. Herman Knapp. He then became resident and a member of the staff at the New York Ophthalmic and Aural Institute where he inaugurated a tuberculin clinic and was one of the first to use this method of treatment in this country. He was a successful teacher in the postgraduate course of instruction which was then being given at that institution. He became full surgeon in 1913, when the hospital moved to 57th Street and its name was changed to the Herman Knapp Memorial Eye Hospital. He resigned as surgeon, in 1927, to become professor of ophthalmology at the New York Polyclinic Hospital.

In 1912, Dr. Török was appointed ophthalmologist at the Beth Israel Hospital in New York City; he organized the department of ophthalmology at this rapidly growing hospital and remained its chief for 25 years, until his resignation in 1938. It was here that he showed his ability as an organizer and capable administrator.

His other hospital affiliations included the Beekman Street Hospital and several institutions in Westchester County. His excellent clinical knowledge associated with an unusually clear and logical approach to ophthalmic problems won for him a very active field as a consultant for several of the larger accident insurance companies and as expert witness in medico-legal claims.

He became a member of the American Ophthalmological Society in 1912.

Dr. Török published some excellent papers, mostly on surgical subjects, and he was the author, together with Dr. Gerald H. Grout, of "Surgery of the Eye: A Handbook for Students and Practitioners," which was published in English in 1913; a second edition appeared in 1925, and was translated into Spanish. The book describes the surgical technique of the Blaskovics clinic.

A sound and resourceful surgeon, his skill in operating was striking. He was one of the first in this country to perform the scleral resection (Müller's operation) for retinal detachment in high myopia. He also modified the method of forceps intracapsular extraction by grasping the anterior capsule of the lens with a blunt forceps and then extracting the lens by traction and by exerting pressure according to the usual von Graefe procedure.

He was a man of attractive presence and of an exceptionally charming personality. Always courteous, never ruffled or impatient, his tender sympathy endeared him to his patients by whom, and by his many colleagues, his passing will be greatly deplored. He is survived by his wife, who was Louise B. Felter.

Arnold Knapp.

CORRESPONDENCE

Dr. van Heuven replies

Editor,
American Journal of Ophthalmology:

In reply to the correspondence on page 484 of volume 31, April, 1948, American Journal of Ophthalmology, I want to state that I take no responsibility for the report of my lecture on "Retinal Detachment," held at Cleveland's Ophthalmological Club in January, 1947. Further:

That I was dismissed from lecturing at the Utrecht University by the Germans on Monday, April 12, 1943, and, after the liberation of Holland, was restored, in 1945, by Royal Appointment;

That I never secretly subscribed to the Nazi organization of physicians;

That indeed two scientific papers from my hand appeared in German scientific journals; the copy of these, however, had left my house before the outbreak of the war;

That together with all patriotic colleagues I resigned my membership of the Dutch Medical Association during the war, and that after the liberation I have never applied for membership again on account of disagreement with their leaders (I shared this view with several distinguished colleagues);

That I still am a member of various scientific Dutch societies. I enclose translation of a statement of the secretary of the Dutch Ophthalmological Society that my resignation of membership had nothing to do with politics or political dispositions.

During the war I was a regular member of the Dutch Medical Underground sharing all their activities and being penalized for it by the Germans. Besides I played an active roll in the Fighting Underground. I enclose a statement from my direct superior as to these, my activities.

I regret that a young oculist, whom I only met once or twice and who has no personal knowledge of my affairs, has badly confused gossip and gospel and made himself the speaking trumpet of others.

(Signed) J. Alexander van Heuven,
New Haven, Connecticut.

STATEMENT FROM DR. ROELOFS

I, the undersigned, Dr. C. Otto Roelofs, secretary of the Dutch Ophthalmological Society, declare herewith that the reason why Dr. J. A. van Heuven, ophthalmologist at Utrecht, decided to resign his membership of this Society in October, 1945, had *nothing* to do with politics or political dispositions.

(Signed) C. Otto Roelofs,
Amsterdam, Holland.

STATEMENT FROM UNDERGROUND SUPERIOR

During the occupation there was in my house a center for the food supply and armament of the underground forces. For many years I knew Dr. van Heuven as a patient and when I approached him with the question whether he would dare to do something on behalf of the underground work he did not hesitate for a moment and at once consented.

We all trusted him fully; right from the beginning he was in perfect knowledge of everything which happened at my house. He took an active part in the food supply of the underground movement and had to do many jobs which were most unfamiliar to him, paid our secret caterers, and was present at our daily conferences.

When the commander of the first Division, Leo Berk, was shot and we were unable to find him, Dr. van Heuven searched all the hospitals as a doctor to find Berk and did not even hesitate to penetrate for that purpose into the St. Anthony Hospital which was entirely occupied by the Germans. In identifying men who were murdered by the Huns he has rendered great services to us.

We were very painfully struck by the fact that, after the liberation, various gossip was told about Dr. van Heuven, while we knew for certain that this man was politically perfectly trustworthy.

I am always willing to provide any further explanation wanted.

(Signed) W. J. M. Bordewijk,
Utrecht, Holland.

PREDILECTION OF LEFT EYES FOR GLAUCOMA

Editor,
American Journal of Ophthalmology:

In the October, 1947, number of the JOURNAL, Holst published a statistical study of glaucoma in which he shows the incidence of glaucoma to be higher in the left eye. Ascher, one of the leading experts of

ocular hemodynamics, explains for this fact in the Correspondence column of the February, 1948, issue of the JOURNAL.

I think that it is only possible to decide a question of such importance on the basis of a large number of cases. In 1935 I published in *Klinische Monatsblätter für Augenheilkunde* the most extensive statistics of glaucoma based on 3,214 cases of the Budapest University Ophthalmic Clinic. In these statistics the incidence of occurrence in the right or in the left eye was not taken into account. Holst's publication inspired my revision of the 1935 publication completing it with the material from the Eye Department of the Jewish Community Hospital in Budapest.

I have found monocular glaucoma in 669 cases. Bilateral glaucoma in which that of one eye was absolute occurred in 761 cases. Of the monocular cases, 359 occurred in the right eye and 310 in the left. Of the bilateral cases in which absolute glaucoma was present in one eye, 363 occurred in the right eye and 398 in the left.

Consequently it cannot be stated that, as regarding glaucoma, the left eye would be in a less advantageous position.

(Signed) P. Weinstein,
Budapest, Hungary.

BOOK REVIEWS

NEUROLOGY OF THE OCULAR MUSCLES. By David G. Cogan, M.D. Springfield, Illinois, Charles C Thomas, 1948. Clothbound, 229 pages, 121 illustrations. Price, $6.00.

In his preface, Dr. Cogan finds himself ". . . in the ambiguous position of simplifying in the interest of lucidity and yet being critical of simplification in such a complex field as the ocular motor system." He has succeeded extremely well in attaining his goal and has done it in such a pleasing style that one fails to hear the wheels turn.

The chief disappointment, if there be one, is in the brevity of the book. Upon finishing it, the reader is left with the definite impression that Dr. Cogan had much more to say, but hesitated to do so for fear of making statements which might later prove to be erroneous. The desire of the student is always for a pedagogic presentation and there is comparatively little pedagogy in the book.

The practicing ophthalmologist will find much of interest and the neurologist even more. The first section of the book is concerned with the anatomy and physiology of the ocular muscles. The next section is on the anatomy of the cranial nerve supply. A third section is devoted to supranuclear connections of the ocular motor system. The last two sections deal with the pupil and nystagmus respectively.

Two points make the book extremely worthwhile to all who are even remotely interested in the neurology of the ocular muscles. These are: first, the superb illustrations and, second, the very comprehensive bibliography containing 825 references in many languages. The only fault, in the mind of the reviewer, is a very small one. It is in the use of the term "ductions" rather than the more preferred one of "vergences" —at least if one follows the ideal of Lancaster.

Every ophthalmologist is sure to find the book a valuable addition to his library and one which will doubtless whet his appetite for more knowledge along the same lines. We can only hope that the second edition will be twice as thick as the first.

Richard G. Scobee.

TRANSACTIONS OF THE SOCIÉTÉ BELGE D'OPHTHALMOLOGIE. Meeting of December 1, 1946, pp. 1-174.

This volume of the Transactions of the Société Belge d'Ophthalmologie brings the membership lists of the society, the minutes of the business meeting, the reports of the scientific session, and the obituaries of Dr.

H. Coppez, Dr. L. Leplat, and Dr. J. Moorkens. At the scientific meeting 20 papers and case histories were presented.

L. Weekers and R. Weekers discussed nonperforating cyclodiathermy. M. and J. Wibo combined iridectomy with a preceding coagulating cyclodiathermy, using the pyrometric electrode. They reported on 10 patients in whom the operation was a success.

P. Huwart reported his striking success with sulfosine (sulfur in oil) in otherwise refractory cases of ocular syphilis. F. Roussel presented his studies on the intraocular application of penicillin in discussing his animal experiments and three clinical cases. He recommends the injection of penicillin into the anterior chamber in severe intraocular infection. Injections into the vitreous are extremely dangerous and should be used only as a last resource in cases of endophthalmitis.

R. Rubrecht's surgical treatment of active corneal lesions by partial excision of the diseased corneal tissue and superficial conjunctival flaps met with some opposition as in previous publications.

Among rare case histories was one by Elise Soil who removed a door handle from the bottom of an orbit without injury to the eyeball. De Walsche presented a case of an extremely large corneal papilloepithelioma. F. Bonhomme described the present technique in the fitting of contact lenses and indications for prescribing them. L. Alearts found syphilitic reagins in the anterior chamber and outlined their diagnostic possibilities in this preliminary report. He also presented a patient with larvae on Descemet's membrane.

Other presentations were made by M. Appelmans and N. Lanoy on superficial punctate keratitis in onchocerciasis and by Jean Coppez on nummular keratitis.

Alice R. Deutsch.

TRANSACTIONS OF THE OPHTHALMOLOGICAL SOCIETY AT PARIS AND OF THE OPHTHALMOLOGICAL SOCIETIES OF THE EAST, OF LYON, AND OF THE WEST. Meetings of March-April, 1947. No. 2, pp. 120-294.

This issue brings a résumé of the meetings of the Ophthalmological Society at Paris on March 15, 1947, and April 19, 1947, and of the Ophthalmological Society of the East on March 16, 1947. It is divided into three parts. Each part gives a report of the scientific sessions of one day.

The first part contains 10 papers about various topics. Three papers deal with the experiences with penicillin. Dubois-Poulsen and Vouters describe its effect in metastatic uveitis; Guilloumot and J. P. Baillart have used this drug in orbital osteoperiostitis; Carlet-Soulages summarizes his experiences with penicillin on gonococcus conjunctivitis when he was stationed in the Far East with the French expeditionary forces.

A. Dubois-Poulsen's and A. Rozan's graphic study with Howe's ergograph on the ciliary muscle and the relationship of the objective signs of fatigue of this muscle to asthenopic complaints are very interesting. So are M. R. Onfray's presentation of Dvorine's color plates and Peron's and Desvigne's case report of a periarteritis nodosa, localized on the arteries of the conjunctiva.

The second part contains the minutes of the business meeting and 10 papers of varying importance. P. Halbron, F. Lepage, Leconte, and H. Mowas report on the substitution of penicillin for silver nitrate in the prophylactic treatment of the newborn, an especially interesting topic because of similar research work in this country. E. Haas discusses the characteristics of gonococcic iridocyclitis, its specific reactions and treatment. P. Michaud emphasizes the importance of mountain air and rest in ocular tuberculosis. There were also case reports on

chorioretinitis and periphlebitis in hereditary syphilis; of uveitis in leptospirosis; and of a choroidal angioma complicated by intractable glaucoma which followed an injection of tetanus antitoxin.

A symposium on the essential shrinkage of the conjunctiva was the highlight of the session on March 16, 1947. Beauvieux delivered the lecture which dealt with the clinical description, pathology, etiology, differential diagnosis, and treatment of this comparatively rare disease.

The topics of the following 17 papers were many and their presentation and subjects of varying interest. A. Bronner and P. Pouliquen gave another lecture on penicillin therapy with especial emphasis on the technique of subconjunctival, anterior chamber, and vitreous injections in otherwise hopeless external eye infections.

Mathieu describes an original modification of intracapsular cataract extraction of an intumescent lens wherein a micropuncture to decrease the tautness of the capsule precedes the extraction. R. Bruckner combines a case report on toxoplasmosis with a detailed study of this disease. The origin and the manifestation of uveal carcinoma were discussed by J. Nordmann and G. Hoerner, and sarcoma of the choroid by J. C. Poirot.

A detailed case report of a nevocarcinoma of the lacrimal sac was given by Gallois and Michel-Gallois. Two cases of perforating scleromalacia were described by C. Henry and B. Algan. Beau, Thomas, and Bénichaux report a case of bilateral pulsating exophthalmus and explain the pathology and the treatment, which consisted in the ligature of the right common carotid. The pathogenesis of the ocular structures in methyl-alcohol intoxication was the topic of Rohr's paper.

The closing paper was read by Christian Henry. He reported on his research concerning the diastolic hypotension of the central retinal artery in fatal coma. He stresses the importance of the diastolic retinal pressure on the outcome of every kind of coma. A comparatively high diastolic pressure is of favorable prognosis as it is the sign of a cellular edema which is reversible. A decreasing diastolic pressure indicates cerebral degeneration which continues unrelentingly toward death. Even so the toxic cause should be removed. Alice R. Deutsch.

LA PROPHYLAXIE DE LA CÉCITÉ EN ROUMANIE (1940-1947). By Dr. Nicolas Blatt. București, Imprimeria Națională, 1947.

In this 68-page monograph, Blatt discusses the problem of blindness in Roumania. He briefly displays statistics, considers the causes of blindness, and gives a critical review of such social measures as the laws that apply to vaccination against smallpox, the application of the Credé procedure, and industrial accidents, schools for amblyopes, pensions for the blind, eugenics, and social insurance.

F. H. Haessler.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Crosby, E. C., and Henderson, J. W. **The mammalian mid-brain and isthmus regions. Part II. Fiber connections of the superior colliculus. B. pathways concerned in automatic eye movements.** J. Comp. Neurol. 88:53-92, Feb., 1948.

The paper deals primarily with the pathways underlying certain automatic eye movements. The studies were made on the midbrain of the monkey. The authors stimulated selected areas of the exposed brain by a minimal faradic current and noted the eye movements produced.

Francis M. Crage.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Ajo, Aarni. **On the refractive index of the retina.** Acta Physiol. Scandinav. 13: 130-149, 1947.

The author's measurements were made on the retinas of cows, newly born calves, pigs, and horses. The refractive indices for these animals are reported. The values were higher in the light adapted retinas since the visual purple exudes water when bleached.

Francis M. Crage.

Barany, E. H. **The action of atropine, homatropine, eserine, and prostigmine on the osmotic pressure of the aqueous humour.** Acta Physiol. Scandinav. 13:95-102, 1947.

Aqueous solutions of these drugs were instilled into the conjunctival sacs of male albino rabbits. Atropine and homatropine showed a tendency to lower the osmotic pressure of the aqueous. Eserine and prostigmine caused a reduction in the osmotic pressure in previously untreated eyes. An initial phase of rise in intraocular pressure and intense iris hyperemia was followed by a hypotonic phase in which the tension was lowered and there was increased protein content and visible flare in the aqueous. The protein increase and flare were attributed to the increase of capillary permeability. In the previously treated eyes these miotic drugs produced none of these changes except a moderate reduction in the intraocular pressure. In these eyes, habituated to eserine and prostigmine, the osmotic pressure remained practically unchanged. Increased capillary permeability

was considered as the probable cause for the decrease in the osmotic pressure.

Francis M. Crage.

Babudieri, B., and Grignolo, A. **Three new methods of micro-dosage of penicillin.** Reports of the Superior Institute of Health. V. 10, 1947.

The authors describe three new and simple methods for the biological micro-dosage of penicillin. These methods make it possible to assay the penicillin contained in a volume of 0.05 to 0.002 $cm.^3$ and are so sensitive as to detect as low an amount as 0.000004 O.U. of the antibiotic, equal to only 2×10^{-12} gr. of pure sodium salt of penicillin.

Eugene M. Blake.

Bachi, S. and Borsello, G. **The effect of olfactory stimulation upon retinal arterial pressure.** Rassegna ital. d'ottal. 16:418-432, Nov.-Dec., 1947.

The author studied the retinal arterial pressure following the use of various types of odorous stimulants and found that purely olfactory stimulants do not affect the pressure at all, while those substances which act upon the trigeminal nerve elevated the retinal pressure in a high percentage of cases. No effect was observed in anosmic individuals. This would indicate that there is no synergistic action between the olfactory and the trigeminal nerves as a result of olfactory stimulation by odors. Eugene M. Blake.

Friedenwald, J. S., and Woods, A. C. **Introduction and outline to the studies on the physiology, biochemistry, and cytopathology of the cornea in relation to injury by mustard gas and allied toxic agents.** By members of the staff of the Wilmer Institute. Bull. Johns Hopkins Hosp. 82:81-101, Feb., 1948.

The preliminary studies showed that intracorneal injection caused more severe damage than did dropping the toxins on the cornea. Some products cause damage only when used in massive concentrations and others will cause damage in small doses. The recognizable clinical and histologic changes which follow chemical damage of the tissue are only remotely and indirectly connected with the initial chemical injury. Among many facts discovered; the excellent tolerance of the ocular tissues for di-isopropyl-fluorophosphate is worthy of special note. In mustard injury to the cornea it was felt that antibacterial agents could be given without danger of increasing the injury and would protect the eye from secondary infections. An effective ointment base in which BAL could be incorporated was found. Mustard was found to penetrate the cornea more rapidly than it did the skin. All compounds which were found most effective as antidotes to mustard contain sulfhydryl groups whose acid dissociation is below pH 7. Threshold doses of mustard cause transitory inhibition of mitotic activity in corneal epithelium. Glutathione in the intact cell is relatively inaccessible to mustard. The inhibition of mitosis is the most sensitive index of mustard injury. Studies on cohesion of epithelium with the stroma were undertaken because a loosening of the corneal epithelium is one of the earliest pathologic findings. Studies on corneal metabolism show that mustard causes a diminished oxygen consumption. There is a close metabolic interaction between the epithelium and stroma especially in the utilization of glucose and lactate. (1 table.)

H. C. Weinberg.

Friedenwald, J. S. **Summary and some possible interpretations.** Bull. Johns Hopkins Hosp. 82:326-337, Feb., 1948.

In this paper the effects of mustard on corneal metabolism and the possible rela-

tion of these effects to the loosening of the corneal epithelium are discussed.

The metabolic interaction of corneal epithelium and stroma is reviewed, and it is emphasized that the epithelium normally assists the stroma in maintaining a supply of carriers for energy-rich phosphate transfers. There appears to be a special hydrogen transport system for the utilization of the stroma lactate independent of that concerned with the utilization of endogenous lactate in the epithelium. Pyruvate transfer and utilization remains unaffected after mustard injury to the cornea. Lactate and serine transfer and utilization is disturbed after mustard injury. The metabolic factors involved in lactate utilization are discussed.

The cohesive system is highly complex and there is a correlation between the loosening of the epithelium after mustard injury and the utilization of lactate from the stroma. Mustard causes loosening of the tissue under aerobic conditions but not under anaerobic. The boundary of epithelium and stroma may contain components of the hydrogen transport system for the utilization of stroma lactate. The oxidation of some of these components destroys some of the cohesive forces. Mustard injury appears to affect the nuclear boundary early.

H. C. Weinberg.

Friedenwald, J. S. **Note on karyolysis of the corneal stroma cells.** Bull. Johns Hopkins Hosp. 82:178-181, Feb., 1948.

A method is described for preparing the cornea for the study of its stroma.

Extra fluid must enter the stroma to enable the nuclei to swell. This is obtained when the epithelial and endothelial barriers are injured. After exposure to mustard and other injurious agents the nuclear boundary becomes more fragile. The nuclei burst after exposure if incubated ten hours at 37 degrees C. Large doses of mustard or nitrogen mustard cause pycnosis of all types of corneal cells. (4 figures.) H. C. Weinberg.

Friedenwald, J. S., and Buschke, W. **Nuclear fragmentation produced by mustard and nitrogen mustards in the corneal epithelium.** Bull. Johns Hopkins Hosp. 82:161-177, Feb., 1948.

Mustards and nitrogen mustards applied to the cornea cause a small percentage of cells in the basal layer to die by nuclear fragmentation. Pathologic mitosis occurs which is similar to the prophase and metaphase of normal mitosis. Lowered temperatures and anoxia cause inhibition of normal mitosis and inhibition of nuclear fragmentation of corneal epithelium exposed to mustard. Immersion of the tissue in Ringer's solution suppresses nuclear fragmentation and mitosis. Cells injured by mustard in the premitosis stage go on to nuclear fragmentation which is a pathologic mitosis. Because of injury the cells can not go back to the resting state. Exposure to hypotonic solution, solutions of low pH, and to nitrogen mustard dissolved in hypotonic solutions of low pH, causes an increase in the number of cells susceptible to this injury of nuclear fragmentation. (2 figures.) H. C. Weinberg

Friedenwald, J. S., Buschke, W., Scholz, R. O., Snell, A., and Moses, S. G. **Primary reaction of mustard with the corneal epithelium.** Bull. Johns Hopkins Hosp. 82: 102-120, Feb., 1948.

The method used for exposing beef eyes to mustard vapor is described. There is an uptake of 3.3 micrograms of mustard per square cm. per minute and 8 percent of the mustard absorbed disappears per minute. The effective dose that produces minimal mitotic inhibition of rat cornea epithelium is 2.5×10^{-10} micrograms per cell. In the intact cell, glutathione is rel-

atively inaccessible to reaction with mustard.

A method is described to determine the electrical resistance of the cornea which is used as an index to the integrity of the cell membrane. Exposure to mustard does not result in any primary injury to the corneal epithelial cell membrane that is detectable by this method. Histologic studies show that tissue contaminated with mustard vapor has an increase in acidophilia, and that the region of the nuclear membrane and the basement membrane may be among the sites of primary mustard reaction. (8 figures, 5 tables.) H. C. Weinberg.

Friedenwald, J. S., Buschke, W., and Scholz, R. O. **Effects of mustard and nitrogen mustard on mitotic and wound healing activities of the corneal epithelium.** Bull. Johns Hopkins Hosp., 82:148-160, Feb., 1948.

Slow inhibition of mitosis in the corneal epithelium of the rat exposed to mustard and nitrogen mustards is produced by doses too small to cause recognizable signs and symptoms of damage. Recovery from this inhibition occurs spontaneously but the inhibition can be made to last for several weeks by repeated instillations of the poison. During prolonged inhibition of mitosis the basal cells of the corneal epithelium increase in size.

Wounds of the corneal epithelium heal at a normal rate even in the absence of mitotic activity. Large doses of the toxic agent may slow down the whole mitotic cycle. Cells that are in mitosis at the time of exposure to the toxin in moderate doses will complete their division normally. Systemic administration of the poisons in MLD 50 dosage causes an inhibition of mitosis in corneal epithelium, bone marrow, and in intestinal mucosa. Inhibition of mitosis represents the lowest threshold effect so far recognized in the reaction of tissues to these poisons. (4 figures, 3 tables.)

H. C. Weinberg.

Friedenwald, J. S., Buschke, W., and Moses, S. G. **Comparison of the effects of mustard, ultraviolet and X-radiation, and colchicine on the cornea.** Bull. Johns Hopkins Hosp. 82:312-325, Feb., 1948.

A comparison of the effect on the cornea of mustard, ultraviolet and X-radiation and colchicine is given because of the similar effects of these substances in causing erythema, vesiculation, and ulceration of the skin. The administration of mustard causes the same effect on the viscera as that produced by exposure to any of the penetrating radiations. The inhibition of mitosis by ultraviolet and mustard show similar properties with those factors which cause nuclear fragmentation. In cells in which mitosis has been markedly inhibited by X-rays there was no nuclear fragmentation.

Loosening of corneal epithelium and the increased NPN content of the cornea after exposure to ultraviolet and mustard show no correlation with nuclear fragmentation or inhibition of a mitosis. The mechanism of loosening of the epithelium produced by colchicine may be different from that induced by mustard because of the production of increased NPN in the latter. (2 figures, 5 tables.)

H. C. Weinberg.

Friedenwald, J. S., and Moses, S. G. **A mechanical device for the extraction of soluble compounds from the cornea and other tough tissues.** Bull. Johns Hopkins Hosp. 82:350-352, Feb., 1948.

By simply squeezing a tissue that is placed in a vessel the extraction of soluble compounds is obtained as well as by the squeezing and shearing manipulation used in the grinding of the tissue in a mortar. A specially fitted plunger is at-

tached to a lever which reduces the amount of energy needed for this process. The device can be attached to a motor and six samples can be extracted simultaneously. (2 figures.) H. C. Weinberg.

Herrmann, Heinz. **The effect of histamine and related substances on the cohesion of the corneal epithelium.** Bull. Johns Hopkins Hosp. 82:208-212, Feb., 1948.

Histamine in concentrations of 5 to 10×10^{-6} M. causes a loosening of the corneal epithelium. Chemically related natural bases such as histidine and tyramine have no such effect in concentrations up to 1×10^{-2} M. Adrenalin, ephedrine, and physostigmine cause a loosening of the corneal epithelium in concentrations of the order of 10^{-3} M.

This histamine effect develops slowly after some hours of incubation. The loosening produced by histamine occurs at the boundary between the basal epithelial cell layer and the overlying epithelium, not between the basal cells and the underlying stroma as is the case with other agents which were studied. (3 tables.) H. C. Weinberg.

Herrmann, H., and Hickman, F. H. **Loosening of the corneal epithelium after exposure to mustard.** Bull. Johns Hopkins Hosp. 82:213-224, Feb., 1948.

In beef eyes a loss of cohesion between the corneal epithelium and the stroma is a prominent feature of mustard injury. This is not due to an inflammatory reaction nor is it a manifestation of death of the epithelial cells. This occurs before nuclear fragmentation. Anoxia and lowered temperatures aid tissues to recover to some degree from mustard injury. Exposure to adequate dosage of mustard causes corneal epithelium to slough with edema of the corneal stroma. The capillary endothelium of the conjunctiva likewise is affected. Petechial hemorrhages with packing of the red cells that cause obstruction to the circulation with a loss of plasma into the tissue are further manifestations of tissue damage.

Three phases of mustard injury are, the primary chemical reaction of mustard and tissue components which takes a few minutes, a second symptom-free period during which neither physiologic nor histopathologic changes are recognized and which may last up to twelve hours and the stage of recognizable symptoms of damage to the tissue. The pathologic mechanism of mustard injury suggests abnormal utilization of oxidative energy or the inhibition of some normally balancing reductive process. (8 tables.)
H. C. Weinberg.

Herrmann, H., and Hickman, F. H. **The adhesion of epithelium to stroma in the cornea.** Bull. Johns Hopkins Hosp. 82:182-207, Feb., 1948.

A simple mechanical device is described for the quantitative estimation of the adhesion of the epithelium to the corneal stroma. Loosening of the corneal epithelium occurs after exposure to temperatures over 45 degrees C. or to freezing with subsequent incubation. Exposure to proteolytic enzymes also causes a loosening of the epithelium. The cohesion of the tissue is diminished on exposure to high concentrations of calcium chloride and sodium thiocyanate. No loosening of the epithelium was observed on altering the pH from 3 to 9.

No evidence was found to demonstrate the presence of an intercellular cement in the cornea. The adhesive forces may originate in the attraction of non-polar hydrocarbon residues in the boundary surface. The coherence surface may be a protein lipoid multilayer. The phenomenon of epithelial loosening in the cornea

is somewhat analogous to vesication in the skin. (10 tables, 6 figures.)

H. C. Weinberg.

Herrmann, H., and Hickman, F. H. **Exploratory studies on corneal metabolism.** Bull. Johns Hopkins Hosp. 82:225-250, Feb., 1948.

The glycogen content of the epithelium of the beef cornea is like that of muscle, 1 percent. The phosphate fraction is the same as in the intestinal mucosa. The adenosine phosphate content is the same as in muscle also. The lactic acid content of epithelium is seven times as high as that of the blood. The glycogen content of the epithelium decreases 25 micrograms per hour by phosphorolysis and is not inhibited by iodoacetate. In the supravital cornea 1000 micrograms of glucose is metabolized in twelve hours but the process is completely inhibited by the addition of iodoacetate and is partially inhibited by fluoride. As long as glucose is supplied to the cornea the carbohydrate breakdown suffices for the maintenance of oxidations. In the excised cornea glycogen and lactate together do not provide sufficient substrate for the saturation of the oxidative mechanism. Lactate production from carbohydrate precursors takes place at a comparable rate in both the epithelium and in the stroma. Enzymatic oxidation is restricted to the epithelium, whereas the metabolism of the separated stroma is essentially anaerobic. (14 tables.)

H. C. Weinberg.

Herrmann, H., and Hickman, F. H. **The effect of mustard on some metabolic processes in the cornea.** Bull. Johns Hopkins Hosp. 82:251-259, Feb., 1948.

Mustard injury to beef cornea inhibits utilization of lactate and causes a decrease in the oxygen uptake which is equivalent to that required for the complete combustion of the utilized lactate. The decline in oxygen uptake lags behind the decline in lactate consumption by one or more hours. The metabolic change preceeds the loosening of the corneal epithelium and is caused by the same dosage of mustard. Under anaerobiosis the loosening of corneal epithelium does not occur. After incubation of 15 hours the normal corneal lactate reservoir is depleted but the oxygen uptake rises instead of declining as it does after the utilization of lactate is inhibited by the mustard. Glucose and glycogen are utilized at a normal rate in mustard-treated corneas and their utilization is not associated with an extra accumulation of lactate except under anaerobiosis. In the cornea there is a special hydrogen transport system for a major part of the lactate oxidation which is damaged by mustard. A component of the system becomes oxidized and causes a loosening of the epithelium. (6 tables.)

H. C. Weinberg.

Herrmann, H., and Hickman, F. H. **Further experiments on corneal metabolism in respect to glucose and lactic acid.** Bull. Johns Hopkins Hosp. 82:260-272, Feb., 1948.

Beef corneal epithelium consumes the lactate produced by the stroma and the rate of glucolysis in the stroma is influenced by the epithelium. The corneal epithelium exhibits a typical Pasteur effect in that glycogen is consumed more rapidly under anaerobic than under aerobic conditions. One quarter of the carbohydrate requirement of the epithelium is furnished in the form of lactate by the stroma.

Mustard injury causes a loss of cohesion between stroma and epithelium. The metabolic interaction between stroma and epithelium is connected with the mechanism for maintenance of tissue cohesion. Injury to this mechanism results in the loss of cohesion and in the loss of meta-

bolic interactions. The mechanism by which the epithelium consumes its endogenous stores of lactate is less susceptible to mustard injury than is the mechanism by which it acquires and consumes the lactate from the stroma. (10 tables.)

H. C. Weinberg.

Herrmann, H., and Hickman, F. H. **The consumption of pyruvate, acetoin, acetate, and butyrate by the cornea.** Bull. Johns Hopkins Hosp. 82:273-286, Feb., 1948.

Pyruvate is consumed very rapidly by normal corneal tissue but very slowly by denuded corneal stroma. Anaerobiosis, or exposure to mustard, iodoacetate, fluoride or arsenite do not influence the consumption of pyruvate by the whole cornea. Half of the pyruvate can be recovered as lactate. One mole of carbon dioxide can be recovered for each four moles of pyruvate lost. Acetoin is consumed by the cornea during pyruvate consumption and is not inhibited by mustard. The very slow consumption of butyrate by the cornea is inhibited by exposure to mustard. (9 tables.)

H. C. Weinberg.

Herman, H., and Hickman, F. H. **The utilization of ribose and other pentoses by the cornea.** Bull. Johns Hopkins Hosp. 82:287-294, Feb., 1948.

Beef cornea utilizes d-ribose and d-xylose one-tenth as fast as it utilizes glucose and one-half as fast as it utilizes lactate and glycogen. D-lyxose is used one-half times as fast as is d-ribose. There is no utilization of d-arabinose. An unknown intermediary compound is formed in the utilization of ribose. The breakdown of ribose in the cornea may involve phosphorylation.

Utilization of ribose is markedly inhibited by iodoacetate and fluoride, but is only slightly inhibited by mustard. In the presence of ribose the utilization of glycogen and of the lactate depot in the cornea is suppressed. (7 tables.)

H. C. Weinberg.

Herrmann, H., and Moses, S. G. **Studies on non-protein nitrogen in the cornea.** Bull. Johns Hopkins Hosp. 82: 295-311, Feb., 1948.

The nonprotein nitrogen content of the beef cornea on prolonged incubation is quite constant. Exposure of a cornea to mustard causes a rise in extractable NPN from its protein. Six micrograms of mustard are taken up after ten minutes exposure by each square cm. of cornea. This is approximately 70 moles of nitrogen for each mole of mustard bound and approximately equal to the available SH groups to nitrogen in some proteins.

The oxidation of some proteins that react with mustard may increase their susceptibility to hydrolysis and may account for loosening of corneal epithelium after exposure to mustard. The NPN is increased before the loosening of epithelium appears. Anaerobic incubation of corneas exposed to mustard protects them against loss of cohesion.

Serine and lactate are normally consumed by the intact cornea but not by the denuded stroma. After exposure to mustard the concentration of serine rises in the stroma and falls in the epithelium. After injection of serine into the stroma and subsequent incubation the concentration in the epithelium was found to rise rapidly and to reach a level far higher than in the stroma. (11 tables.)

H. C. Weinberg.

Hughes, W. F., Jr. **The tolerance of rabbit cornea for various chemical substances.** Bull. Johns Hopkins Hosp. 82: 338-349, Feb., 1948.

This paper consists of one large table in which data are compiled on the reac-

tions in 304 rabbit eyes when various chemicals are injected in varied concentrations. The chemicals include solvents, protein precipitating agents, mucoid dissolving agents, metals, arsenicals, oxidizing agents, quinones and hydroquinones, reducing agents, sulfhydril binding agents and dyes. (1 table.)

H. C. Weinberg.

Maumenee, A. E., and Scholz, R. O. **The histopathology of the ocular lesions produced by the sulfur and nitrogen mustards.** Bull. Johns Hopkins Hosp. 82:121-147, Feb., 1948.

The conjunctiva of rabbits' eyes, when injured by mustard, shows edema of the stroma with a necrosis of the epithelium. In the capillaries there is a loss of endothelium, packing of the red cells and occlusion of the lumen. The corneal epithelium shows fragmentation of nuclei of the basal layer of cells which later become detached from the stroma, show pycnosis of the nuclei and slough.

Injury to the stroma is manifested early by edema of the posterior portion. The nuclei become pycnotic and may burst eight hours after injury. The polymorphonuclear leucocytes appear within twenty-four hours. The first evidence of damage to the corneal endothelium is a sloughing of the cells. Iris damage occurs especially after exposure to HN_2 and is first evidenced by a loss of the capillary endothelium with a packing of red cells and occlusion of the lumen. Repair of the conjunctival epithelium is accomplished by migration of cells from uninjured adjacent epithelium. Macrophages remove the debris. Occasionally "pearly white" avascular areas are observed as well as areas with new capillaries. The corneal epithelium is repaired by a sliding of adjacent uninjured corneal epithelial cells. In the corneal stroma polymorphonuclear leucocytes remove the debris and large macrophages are transformed into keratoblasts. Scarring with blood vessels appears if the injury is severe. The repair of the endothelium begins ten days after injury by a migration of uninjured cells. Repair of the iris is essentially the same as that of conjunctiva. (26 figures, 1 graph.) H. C. Weinberg.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Angius, Tullio. **Research concerning accommodation.** Rassegna ital. d'ottal. 16:460-466, Nov.-Dec., 1947.

Angius shows that the accommodative power varies with somatic conditions and with age. As much as three diopters difference may be found in normal individuals. His studies of the 19 to 26-year age group show the same curve as that of Duane. A plea is made for more exact study of the accommodation and for more precise instruments of investigation.

Eugene M. Blake.

Belmonte Gonzales, N. **Observations on corneal astigmatism.** Arch. Soc. oftal. hispano-am. 7:1169-1172, Dec., 1947.

In fitting contact lenses Belmonte was impressed with the fact that they usually correct the total astigmatism of the eye. This raises a question as to the existence of a lenticular astigmatism, to which the discrepancy between ophthalmometric data and the total astigmatism of the eye is usually attributed. The sources of error in ophthalmometric measurements are discussed, and it is suggested that an ophthalmometer without these defects could be constructed. In the meantime the author finds the bicylindric method of Marquez the most accurate means for determining the ocular astigmatism.

Ray K. Daily.

Blanchi, G. **A new explanation for the variation in refraction in diabetics.**

Rassegna ital. d'ottal. 16:433-440, Nov.-Dec., 1947.

The various theories to explain the sudden changes in refraction in patients with diabetes are reviewed. The author suggests a new explanation, namely an axial displacement of the lens, and shows by some rather complex formulas how it is possible for this to occur. Two cases of rapidly developing hypermetropia are reported. Eugene M. Blake.

Dascalopoulos, N. **Acquired inversed astigmatism.** Ann. d'ocul., 180:688-695, Nov., 1947.

Operations which alter the corneal curvature all produce an inverse corneal deformity. This occurs at the point of least thickness and in the direction of least resistance. Inverse astigmatism also occurs in myopia, glaucoma and hyperthyroidism and with chalazion and scleral keratitis. The corneal curvature basically depends upon the ocular tension, the pull of the extraocular muscles and the supporting structures, namely the orbit behind, and the lids anteriorly. Any condition which disturbs the equilibrium of these forces vertically or horizontally may produce inverse astigmatism. Chas. A. Bahn.

Hardy, L. H., Rand, G., and Rittler, M. C. **A screening test for defective red-green vision.** Arch. Ophth. 38:442-449, Oct., 1947.

The authors have selected 18 plates from the Pseudo-Isochromatic Plates for Testing Color Perception, compiled in 1940 by the American Optical Company. When these 18 plates are used under standard conditions of illumination, they serve as a satisfactory screening test for red-green defects. It is neither qualitative nor quantitative; that is, it does not classify the type of deficiency in red-green vision, or the degree of deficiency. No provision is made for detection of the rare forms of defective blue-yellow vision. Using these plates, an incorrect response to five or more plates indicates defective red-green vision.

John C. Long.

Latorre, S. **High transitory corneal astigmatism in a case of sphenoidal ethmoiditis.** Arch. Soc. oftal. hispano-am. 7:1009-1012, Oct., 1947.

In the course of an orbital cellulitis, an extension of an ethmoidal sinusitis, a nine-year-old child developed an astigmatism of 3.50 diopters. The astigmatism disappeared after recovery, indicating that it was caused by compression of the eyeball. Another patient could temporarily abolish a corneal astigmatism of four diopters by pressure of the upper lid against the cornea. Ray K. Daily.

Littwin, Charles. **Use of one contact lens in correction of high unilateral myopia.** Arch. Ophth. 38:259-260, Aug., 1947.

In a patient with 13 diopters of myopia in one eye and only one quarter diopter of myoptic astigmatism in the other fusion and comfort could be obtained by the use of iseikonic lenses only with the eyes in the primary position. When a contact lens was prescribed for the myopic eye, comfortable binocular vision could be obtained in all directions of gaze.

John C. Long.

Mathewson, W. R. **Rapid retinoscopy.** Med. Press 219:101-102, Feb. 4, 1948.

The author describes a rapid method of performing retinoscopy. It is a modification of a procedure described by Harrison Butler and the principal instruments are a Purvis Streak retinoscope and a Hamblin retinoscopy lens rack. The

work is done at a distance that is at slightly greater than one-half meter.

Francis M. Crage.

Matteucci, P., and Toselli, C. **The accommodation time in paralysis of the cervical sympathetic and in accommodative spasm.** Rassegna ital. d'ottal. 16:407-417, Nov.-Dec., 1947.

In the patients affected by Horner's syndrome the paralysis of the sympathetic did not modify the speed of accommodation nor the amplitude. Spasm of accommodation provoked a prolongation of this act, for distance or for near, or for both. Astigmatic and hyperopic eyes always showed an increased power of accommodation. Low grade myopes and emmetropes showed little variation in the accommodative time for near.

Eugene M. Blake.

Pacalin, G. **The diploscope in the prescription of glasses.** Ann. d'ocul. 180:696-701, Nov., 1947.

The diploscope of Remy has been much more widely adopted in France than elsewhere. It is based on the principle that a person looking through two apertures which correspond with the binocular line of fixation will see three horizontal letters if properly distanced and sized. They will be in their regular order and correctly placed if binocular vision is normal; but, if abnormal, the letters will either be doubled, omitted or improperly arranged. The diploscope is therefore used as a simulation test to educate binocular vision, verify the respective sizes of the retinal images in each eye, verify the accuracy of refractive corrections especially in anisometropia, to detect ocular motor and convergence disequilibrium and abnormal levelling of the two eyes. If convergence is insufficient or relative exophoria exists, crossed diplopia will result. With convergence excess or relative esophoria there is homonymous diplopia.

Chas. A. Bahn.

Radnót, Magda. **Data on the occurrence of calcification in the eye tissues.** Brit. J. Ophth. 32:47-54, Jan., 1948.

The zonular opacity seen in the region of the palpebral aperture as an opaque band is a calcified degeneration of the layers under the epithelium. It occurs as an occupational disease in hat makers and is caused by the deposition of rabbit hairs on the cornea. A second type is primary in otherwise healthy eyes and a third is secondary to ocular damage; the latter usually follows severe uveitis. In this report, 12 such cases of corneal calcification are presented in each of which there was also lime in other tissues of the eye. These deposits occurred in the lens, choroid, detached retina, optic nerve and in old chorioretinal scars. In some of them actual formation of bone was found. (14 figures.)

Morris Kaplan.

Ronchi, V. **Recent developments in the theory of form and color vision.** Arch. Soc. oftal. hispano-am. 7:959-1000, Oct., 1947.

This is a general review of physiologic optics, from the time of Rayleigh's investigations. The author's work on the resolution of visual images is based on the data obtained from the study of the resolution of photographic emulsions. He applies Hecht's photochemical theory to color vision as well as to form vision, by assuming that the impulses of form and color vision differ in frequency. He demonstrates the similarity between retinal physiology and the phenomena of photographic emulsions, points out the possibility of transformation of visual radiations into acoustic stimuli, and advances a unitarian theory of the mechanism of sensory functions.

Ray K. Daily.

Vila-Coro, A. **Fukala's method of treatment of high myopia.** Arch. Soc. oftal. hispano-am. 7:1013-1026, Oct., 1947.

Vila-Coro is an enthusiastic advocate of lens extraction for the arrest of progressive myopia. Discission in patients under 15 years of age, discission followed by a linear extraction in adults with transparent lenses, and intracapsular suction extraction in adults with opacities in the lens are the procedures advocated. The indications for the operation are progressive myopia of not less than ten diopters, and myopia in patients over 40 years of age who have incipient lenticular opacities. Vitreous, choroidal, or retinal hemorrhages are regarded as contraindications to surgery. Degenerative lesions which do not involve the macula do not contraindicate the operation. To arrest the progress of myopia, and to improve ocular nutrition, both eyes should be operated, with an interval of six to eight months between the operations.

Ray K. Daily.

5

DIAGNOSIS AND THERAPY

Azzolini, U., and Pascucci, F. **Streptomycin therapy in Reiter's infections.** Giorn. ital. di oftal. 1:14-22, Jan.-Feb., 1948.

Streptomycin was used in the treatment of three men afflicted with Reiter's disease of long duration. There was marked improvement in the urethral and conjunctival condition, but none in that of the joints. Francis P. Guida.

Dollfus, M. A., Barrois, P., and de Grénédan du Plessis. **Tissue therapy of Filatov.** Ann. d'ocul. 180:681-687, Nov., 1947.

The details of the Filatov treatment have been so repeatedly recently abstracted or described in this journal that the preparations of the placenta and its extracts, dead skin, cod liver oil, and details are here omitted. The author restates the conclusions of the article by Filatov and Verbitskaia in which the progress is measured in such small units as to be understood only by God, and from which one draws the conclusions that figures don't lie, but—. The authors report on two cases of retinal pigmentary degeneration treated by the Filatov method, one of which was possibly functionally improved. Six cases of high myopia were also treated without any appreciable improvement functionally or structurally. Chas. A. Bahn.

Dubois-Poulsen, A. **A new instrument in surgery of the face: the dermatome.** Ann. d'ocul. 180:664-671, Nov., 1947.

The dermatome of Padgett which was observed in action by the author during the recent war has been modified by him, making it smaller. This instrument consists essentially of a rectangular, metal frame with a hand grip on one end. Attached to the base is a razor-like blade with a micrometer adjustment. This adjustment is regulated by a swinging arm. Thus the section of the skin is accurately regulated, and the swinging arm propels the excised skin forward to facilitate its preservation. This instrument is considered of signal service especially in entropion, and also in orbitoplasties. In the latter the skin is accurately fixed to the free lid border and the graft is held in place by an acryllic mould.

Chas. A. Bahn.

Greeves, R. A. **Technical ophthalmological details.** Tr. Ophth. Soc. U. Kingdom 65:341-346, 1945.

The paralysis of the orbicularis muscle is obtained by blocking the facial nerve in the cheek. Peripheral iridectomy has been discarded for the complete one. The

trephine should be applied slightly obliquely and the lateral hinge finally separated with scissors to prevent its loss into the anterior chamber. Greeves advises against the use of a miotic immediately following a trephine operation as a quiet chronic iritis may follow and the pupil become firmly adherent posteriorly. Beulah Cushman.

Grignolo, Antonio. **Clinical and experimental use of streptomycin in ocular tuberculosis.** Minerva med. 39:16-20, Jan., 1948.

Grignolo inoculated the anterior chamber of the eyes of 33 guinea pigs with a virulent strain of human tubercle bacilli. One group was used as a control and one received full doses of streptomycin six days after the inoculation. Another group was treated with streptomycin 15 days after inoculation, and the fourth with streptomycin and sulfone. The group treated early showed marked inhibition of the tuberculous process. Those whose treatment was commenced on the fifteenth day were no better than the control group, thus demonstrating the advantage of early treatment, at least in the experimental animal.

Seven patients with ocular tuberculosis were treated with streptomycin. In two with choroiditis there was a favorable response and in two with anterior uveitis no improvement. One patient with miliary pulmonary disease and choroidal foci was greatly benefited, whereas two with phlyctenular keratitis were not improved.

Eugene M. Blake.

Grignolo, Antonio. **Clinical research on the employment of streptomycin in non-tuberculous ocular lesions.** Minerva med. 1:271-275, March 17, 1948.

In 72 patients streptomycin was administered by instillation, unguent, ocular baths, subconjunctival injection and injection into the anterior chamber. The dosage was that of tolerance, avoiding the state of streptomycin resistance. Good results were obtained in blepharitis ulcerosa, acute staphlyococcus and Koch-Weeks conjunctivitis, but no better than with penicillin. Gonococcic infections improved under treatment with streptomycin but were not cured. In one case of inclusion conjunctivitis, the inclusion bodies disappeared rapidly. In 12 cases of florid trachoma the conjunctival sac was rapidly sterilized, but the nodules were unaffected. No improvement was noted in the treatment of corneal ulcerations due to pneumococcus, staphylococcus or streptococcus, nor in herpes, epidemic keratoconjunctivitis or dacryocystitis. Streptomycin appeared to be effective against b. coli, b. Friedländer, b. proteus and a few other organisms.

Eugene M. Blake.

Iliff, C. E. **Beta irradiation in ophthalmology.** Arch. Ophth. 38:415-441, Oct., 1947.

The majority of reports on radiation therapy of the eyes are concerned with gamma rays. Beta rays possess the same qualities as other rays in the power of selective tissue destruction, but in contrast to gamma rays, they penetrate about 3 mm. of tissue only. In no case in which beta ray therapy has been used has damage to the lens been observed. Treatment is carried out with a special radon applicator. Excellent results are reported from the use of beta irradiations in vernal conjunctivitis, tuberculosis of the anterior ocular segment and in small benign tumors of the anterior segment. The agent is ideal for preventing superficial vascularization after keratectomy and keratoplasty. Granulation tissue, conjunctival flaps and pterygiums can be made avascular with contact therapy. Encouraging results are obtained in acne rosacea

keratitis. Corneal dystrophies, sarcoid, lupus erythematosus, pemphigus, punctate keratitis and corneal ulcers due to pyogenic infections are not benefited by beta rays, and may be made worse by their use. John C. Long.

López Enríquez, M. **Retinography with a short focus camera.** Arch. Soc. oftal. hispano-am. 7:1038-1041, Oct., 1947.

To convert the large Gullstrand ophthalmoscope into a fundus camera, Enríquez increased the illumination, by using a stronger nitra lamp, and attached a Leica camera to the ocular by means of a collar. (2 illustrations, 4 fundus photographs.) Ray K. Daily.

Morón-Salas, José. **For corneal examination.** Arch. Soc. oftal. hispano-am. 8:90-92, Jan., 1948.

Morón-Salas devised a mounting to hold a twenty-diopter lens and a piece of blue glass. This device serves as a substitute for an ultraviolet light, to intensify fluorescin stained corneal defects, to demonstrate corneal lesions such as keratitis filamentosa, and to check on the fit of contact lenses. It does not bring out the fluorescence of the lenticular cortex. (3 illustrations.) Ray K. Daily.

Traquair, H. M. **Pre-operative and post-operative treatment in eye operations.** Tr. Ophth. Soc. U. Kingdom 65: 356-365, 1945.

This paper deals with the various circumstances and factors with which the surgeon is concerned other than the operation itself. Psychological disturbance is much more common than physical disease, therefore, pre-operative treatment is largely psychological. The patient should be encouraged to take the operation in his stride. Local preparatory measures should be reduced to a minimum. After operation the patient may walk back to bed or be taken on a cart if the operating theatre is some distance away. The patient should be comfortable in bed after operation especially after cataract operations. Hemorrhage into the anterior chamber is frequently due to disturbed sleep. The patient's personal habit of taking cathartics should not be changed because of the operation. Post-operative embolism may be reduced by having the patients move the legs freely several times a day for about five minutes. Dark glasses are recommended and the patients are warned not to rub the face with a towel for six weeks, until the wound is well healed.

Beulah Cushman.

6

OCULAR MOTILITY

Adler, F. H. **Some confusing factors in the diagnosis of paralysis of the vertically acting muscles.** Am. J. Ophth. 31: 387-397, April, 1948. (17 figures.)

Aguilar y Menoz, José. **Diagnosis and treatment of heterophoria with the heteroscope.** Arch. Soc. oftal. hispano-am. 7: 1027-1037, Oct., 1947.

Aguilar's heteroscope is devised on the principle of Remy's diploscope and is used in a similar manner. The instructions for its use are given in detail. It is urged that orthoptic training should be continued to the point of simultaneous perception before surgery is done for strabismus, and to the point of binocular vision after it, in order to avoid a recurrence. (16 illustrations.)

Ray K. Daily.

Arriago Cantullera, José. **Postanesthetic ocular paralysis.** Arch. Soc. oftal. hispano-am. 7:1199-1208, Dec., 1947.

The literature is reviewed, and three cases of ocular paralysis are reported,

which followed the injection of 6 cgr. of estovain between the first and second lumbar vertebrae. In the first patient paralysis came on in both eyes one week after the operation. The patient made a complete recovery under intensive therapy with vitamin B. Two others are still under treatment. The various theories on the pathogenesis of this accident are discussed and no new viewpoints are presented. Ray K. Daily.

Hudelo, A. **Syndrome of Hertwig Magendie.** Ann. d'ocul. 180:702-705, Nov., 1947.

In a nine-year-old boy, disassociation of gaze and voluntary ocular movements was observed. He had defective dental articulation. Vision in the right eye was 0.9 and in the left, 0.6, and there was slight strabismus. In this syndrome vertical disassociation of the visual axes is present with proprioceptive inadequacy. Chas. A. Bahn.

Latorre, S. **Sensomotor orbital postoperative ophthalmoplegia.** Arch. Soc. oftal. hispano-am. 7:1173-1175, Dec., 1947.

Latorre reports a very unusual occurrence after a retrobular injection of 4-percent novocain solution used in the course of removal of a traumatic cataract. At the end of the operation the levator of the upper lid was paralyzed. At the end of 48 hours when the bandage was removed, the patient presented a picture of complete ptosis, paresis of the inferior and internal recti, and anesthesia of the skin innervated by the frontal and external nasal nerves. There was slight anesthesia of the upper half of the cornea. There was no hematoma in the orbit. Intensive vitamin B therapy brought about an improvement in two weeks, and a complete cure in two months. Ray K. Daily.

Lisman, J. V. **A triple-armed suture for resections.** Am. J. Ophth. 31:466, April, 1948. (2 figures.)

Orzalesi, F. **Heredofamilial degeneration of the cornea: histological report.** Rassegna ital. d'ottal. 16:393-406, Nov.-Dec., 1947.

An instance of corneal degeneration in an 8-year-old girl is carefully described by the author. Although the lesion probably belongs in the heredofamilial group, there were atypical features. The principal alterations were situated exclusively in the anterior layers of the parenchyma and consisted of small foci of destruction of the corneal lamellae and spaces, either empty or filled with corneal detritus. The basal layer of epithelium showed vascularization, especially over the stromal foci. Bowman's membrane presented defects in some places.

The author suggests that to the three types of corneal degeneration described (Groenow's nodular, Dimmer's reticular and Feher's granular) there be added a fourth type. More intensive study of the fatty elements could perhaps clarify the picture. (5 figures.) Eugene M. Blake.

Scobee, R. G., and Green, E. L. **Relationships between lateral heterophoria, prism vergence, and the near point of convergence.** Am. J. Ophth. 31:427-441, April, 1948. (8 figures, 7 references.)

7

CONJUNCTIVA, CORNEA, SCLERA

Allenic. **An interesting case of conjunctivitis sicca.** Ann. d'ocul. 180:706-707, Nov., 1947.

A woman, aged 62 years, after a short attack of unexplained fever developed a diminution of tears and salivary secretion with parotid inflammation. After approximately a week, all the symptoms subsided. The author associates these symp-

toms with the syndrome of Sjögren which may be due to parasympathetic hypofunction involving the vagus nerve.

Chas. A. Bahn.

Azzolini, U. **A report of mycosis of the conjunctivia in self-pitying individual.** Riv. di oftal. 2:112-118, March-April, 1947.

In a young self-pitying woman afflicted for eight years with a unilateral chronic conjunctivitis of the lower fornix, myces of the Macrosporium were found in the secretions. The canaliculus was not involved. It was decided that the lesion was due to a self-induced injury secondarily infected by the fungus.

Francis P. Guida.

Bodian, Martin. **Trachoma.** Arch. Ophth. 38:450-460, Oct., 1947.

Of 100 natives working at an American Army base in Fiji 22 percent had clinical evidence of active trachoma and 42 percent harbored Prowazek-Halberstädter inclusions in the conjunctival epithelium. Of the natives with clinical trachoma, 68 percent showed typical conjunctival inclusions. Inclusion bodies morphologically indistinguishable from those observed in frankly trachomatous patients were found in 34.6 percent of the natives with no clinical evidence of the disease. This observation suggests the existence of a carrier state in trachoma. Transmissibility and pathogenicity of the virus of trachoma from these patients still await demonstration. Fifty American soldiers based in Fiji for from one to three years failed to show clinical trachoma or inclusion bodies.

John C. Long.

Casari, G. F. **Histological study of the conjunctival nodules in erythema nodosa.** Rassegna ital. d'ottal. 16:467-472, Nov.-Dec., 1947.

Erythema nodosa developed in a 14-year-old girl whose general health was excellent, but who had previously had a dry pleurisy. An eruption appeared at the inner and outer angles of the bulbar conjunctiva of each eye. Microscopic examination showed no changes in the pavement epithelium, below which was fibrous and hyaline tissue, with edema and necrosis. There were scattered areas of perivascular lymphocytic infiltration. There were some epithelioid elements with fragmentation of the nuclei. The ocular condition was believed to be a para-allergic manifestation of tuberculosis.

Eugene M. Blake.

Castroviejo, R. **Keratoplasty and keratectomy—indications and contraindications.** Ann. d'ocul. 180:577-586, Oct., 1947.

Generally speaking, keratoplasty is preferable to keratectomy because of better visual results. Active inflammation and glaucoma are contraindications to either operation. Eyes should be free from inflammation for at least six months, and hypertension should be adequately controlled before any surgical treatment can be considered.

Three groups of patients are analyzed. 1. In the most favorable group are those with slight corneal opacities, especially those due to keratoconus and interstitial keratitis. 2. In the less favorable group are most cases of corneal dystrophy without vascularization but with normal stroma and endothelium. Included are the types of Fleisher, Haab-Dimmer, Groenow, and Salzman. 3. In the least favorable group the patients have more extensive cicatrization especially with vascularization, extensive pupillary zone involvements, adherent leucomas, less favorable dystrophies, severe thermal and chemical burns, corneal opacities in aphakic and amblyopic eyes, calcareous deposits and other degenerative diseases such as pemphigus. Preliminary radium

therapy to reduce vascularization, partial or complete keratectomy, iridectomy and other measures may be advisable adjuncts. The surgical risks involved must be justified. Chas. A. Bahn.

De Laet, H. **The profile of circular corneal grafts.** Ann. d'ocul. 180:629-638, Oct., 1947.

Is especially the marginal profile of corneal trephined grafts modified by differences of curvature, pressure and tension? Experiments on pigs' eyes, human eyes, and on rubber tubes made to simulate the human cornea, were carried on to elucidate the physical laws involved as well as their practical applications in both the donor and enucleated corneas. Theoretically some deformity does exist, but practically the construction of the human cornea overcomes this tendency. The lamellar structure of the stroma with its elastic fibers sandwiched between two non-elastic membranes, those of Bowman and Descemet, prevents distortion of the disc. The author, however, favors the removal of the disc from the donor cornea by a stamping rather than a sawing motion of the trephine. For this purpose the donor cornea is placed on a corresponding plastic disc. Chas. A. Bahn.

Dor, Louis. **Chronic conjunctivitis in cholesterolemia.** Ann. d'ocul. 180:708-709, Nov., 1947.

The association of some chronic conjunctivitides and palpebral eczemas with quantitative and qualitative lipid abnormalities is briefly discussed. The administration of a drug, chophytol, which apparently is a choline preparation, was in some patients followed by more rapid improvement than otherwise might have been expected. Chas. A. Bahn.

Heyrowsky, K. **A case of vicarious bleeding into the conjunctiva and bloody tears.** Wien. klin. Wchnschr. 59:702-704, Oct. 24, 1947.

A 26 year old woman, the fourth one presenting the same symptoms, had a polyglandular disturbance, genital hypoplasia and recurrent vicarious bleeding into the eye. Her female ancestral tree is presented and other members of her family were found to have the same vicarious bleeding. The patient was given various hormonal extracts, her medical condition was improved by general regime and after 1½ years of treatment the patient had no recurrences.

Theodore M. Shapira.

Hughes, E. L. **Local sulphonamide therapy of dendritic ulcer.** Brit. J. Ophth. 32:43-46, Jan., 1948.

Local sulphonamide therapy in the form of albucid ointment was used in 16 consecutive cases of dendritic ulcer. Thrice daily 6-percent ointment was instilled and the entire corneal surface was painted daily with 30-percent solution. Of the 16 eyes, 12 responded well. Improvement seemed to be directly proportional to corneal sensitivity; the greater the loss of sensitivity, the less favorable was the result. Those that did respond well were clinically cured within eight days.

Morris Kaplan.

Kettesy, A. **On results obtained by total conjunctival hooding of the cornea for serpiginous ulcer.** Brit. J. Ophth. 32: 36-43, Jan., 1948.

Total hooding of the cornea by a conjunctival flap was first introduced for the treatment of Mooren's ulcer and in the author's hands was so very satisfactory that in his clinic it has become routine treatment for serpiginous ulcer as well. In this report 56 consecutive cases of serpiginous ulcer so treated are described and are compared to twice as many treated in the ordinary, routine

way which did not include the use of penicillin. The results were uniformly satisfactory. The conjunctiva is undermined above, is brought down and is sutured to the normally attached conjunctiva below the cornea. The procedure failed only when the sutures were placed across the cornea. The hood was left in place for six months and then removed with scissors. In all cases pain ceased immediately. Visual improvement was well over twice that obtained by other measures and the hospital stay was reduced from 14 days to six.

Morris Kaplan.

Larsson, S. **Treatment of perforated corneal ulcer by autoplastic scleral transplantation.** Brit. J. Ophth. 32:54-57, Jan., 1948.

Soon after successful removal of a retrobular hemangioma in a seven-year-old child a severe corneal ulcer developed because of lagophthalmos. Despite all routine treatment, and four attempts to cover it with a conjunctival flap, the ulcer persisted, became larger and developed a large descemetocele. A scleral button was removed by means of an ordinary punch, the ulcer edges were excised, the button placed in the opening and a conjunctival flap covered over it. The result was very satisfactory; the button remained in place, the ulcer remained closed, the flap persisted and the vision improved from 0.2 to 0.5.

Morris Kaplan.

Magitot, A. **The transparency of corneal grafts.** Ann. d'ocul. 180:619-628, Oct., 1947.

Corneal transplantation is not new; in animals, 125 years old; in humans, only 65 years. The results of 100 transplants were reported by Elschnig in 1925, and but few basic improvements have been made since. American exuberance and over-dramatization of keratoplasty, especially in the popular press, was editorially commented upon recently in this journal. Corneal healing and transparency is largely dependent upon the normalcy of the epithelium and the endothelium. Rapid epithelial reproduction is apparently due to an extension of conjunctival proliferation. But little is known concerning the nutrition and replacement of the stromal cells. Although the cornea and sclera are similar anatomically, one is transparent but the other is opaque. This transparency is largely due to a hydrophile gel which exists both in colloid and crystalline form. The refractive index is of less importance in corneal transparency than the hydrophile gel. Under normal conditions oxygen passes through the cornea into the anterior chamber and carbon dioxide passes in the reverse direction. In the presence of toxic agents, cations are retained in the cornea by both systems, affecting both corneal permeability and transparency. Anaesthetic corneas are predisposed to opaque grafts, which means that nervous regulation is involved. Each epithelial cell is attached to a nerve filament. It has long been known that partial keratectomies with a healthy bed frequently retain their transparency. In pemphigus, however, the stroma remains clear but the epithelium soon becomes opaque. The corneal metabolic rate is high; many wearers of contact glasses observe Fick's phenomenon. Autoplastic grafts are more frequently successful than homoplastic. Of the latter, approximately 20 percent are incompatible with the cornea of the host and therefore doomed. Heteroplastic grafts are almost uniformly unsuccessful in man. Corneas for grafts are best preserved at 4 to 7 degrees C. They may remain vital for fifteen years at this temperature. The best preservative media are hemolized serum and cerebrospinal

fluid. The performance of keratoplasty is not more difficult than cataract extraction, and it must be undertaken with the same sense of its moral and medical responsibility. Chas. A. Bahn.

Michtner, H. **Lesions in corneal epithelium caused by spraying of lacquer.** Proc. Ophth. Soc. Vienna p. 36, Jan. 18, 1943.

Some months after having started working as a lacquer sprayer a man developed pain in both eyes and headache. Slitlamp examination revealed minute whitish opacities in the corneal epithelium which did not impair the vision. After a change of occupation the corneal lesions disappeared completely.

F. Nelson.

Neame, Humphrey. **A rare case of bilateral macular keratitis with cyclitis, affecting all layers of the cornea. Comparisons with corneal lesions present in some virus infections.** Tr. Ophth. Soc. U. Kingdom 65:328-340, 1945.

The eyes of a patient with bilateral macular keratitis, two with nummular keratitis and two with disciform keratitis are described. The opacities were numerous but countable and the depth variable. The size of the spots varied from 0.5 to 1 mm. The disappearance of the spots was complete except in the severe cases of disciform and zoster keratitis.

The author concludes that nummular keratitis lies morphologically between superficial punctate keratitis and disciform keratitis and that the one case he presented forms a link between superficial punctate keratitis and nummular keratitis. (5 figures.)

Beulah Cushman.

Nizetic, Z. **Visual results after corneal grafts.** Ann. d'ocul. 180:596-603, Oct., 1947.

After a brief review of the subject one sees this statement: good vision in one eye usually means that keratoplasty is superfluous on the other. Twelve personal cases of operation performed during a period of fifteen years are reported with observation from six months to eleven years afterward. The keratoplasties were necessitated by trachoma, serpentic ulcer and parenchymatous keratitis. Vision ranged from 0.1 to 1. Chas. A. Bahn.

Offret, G. **The biologic problems of keratoplasty.** Ann. d'ocul. 180:613-618, Oct., 1947.

The successes reported in homografts range from 40 to 85 percent. Preservation of the cornea at 4°C. preserves sufficient vitality for replacement surgery. Corneal transplantation somewhat resembles tendon transplantation. Both are essentially mesodermal and their basic structures are not replaced after transplantation. The epithelium and endothelium are of vital importance in maintaining transparency in keratoplastic grafts. Allergy and immunity play a more important part in success than has been realized. Allergic toxic reactions of the donor implant to bacterial and other toxins of the host are relatively frequent. Keratoblasts in the donor cornea succumb within three days and are replaced by those of the recipient cornea, which possibly arise from epithelial cells. Cicatricial tissue and new blood vessels interfere most with the vitality of the graft. In some types of hereditary dystrophies the donor graft is not poisoned by the cornea of the host. The early life of the graft depends largely upon the diastatic activity of the stromal cells. Keratoplasty has been used therapeutically in some acute corneal diseases.

Chas. A. Bahn.

Paufique, L. **Defense of non-perforating corneal grafts.** Ann. d'ocul. 180:587-595, Oct., 1947.

This type of operation is advisable largely in corneal opacities, especially bilateral, which cause practical blindness. These include: 1. inflammatory diseases such as tuberculosis, syphilis, rosacea, trachoma, severe thermal and chemical burns; 2. degenerative diseases, especially severe keratoconus, recurrent progressive pterygium, and severe dystrophies. Optical iridectomy may be a preliminary or subsequent adjunct. The underlying opaque corneal tissue forms a protective wall for the intraocular contents and does not reduce vision as much as is generally supposed. Obviously the results are not brilliant. The 60 cases reported were unfavorable surgical risks. Patients must be carefully selected for this type of surgery which must be expertly performed. Chas. A. Bahn.

Somerset, E. J. and Sen, K. **Intra-ocular foreign bodies. An account of military cases from the Burma-Assam front.** Brit. J. Ophth. 32:13-23, Jan., 1948.

Techniques and results of care in 29 selected cases of intraocular foreign body are presented. (These cases were evacuated by air personally by the abstractor from the Burma front into India). Each patient selected had a retained foreign body within the eyeball and each retained fair light perception. Most patients were seen several weks after the injury and most had received routine administration of sulpha drugs by mouth when first injured. Fifteen were British and 14 were Indian and the latter tended to react much less to surgery or injury than the former. There were no cases of serious infection and no cases of sympathetic ophthalmia. Morris Kaplan.

Sourdille, G. P. **Perforating partial grafts of the cornea: their technique and results.** Ann. d'ocul. 180:604-612, Oct., 1947.

The donor eye after enucleation is placed in paraffin oil, kept at a temperature of 4°C. and finally washed with serum. Two sized trephines are used: in the donor eye, 5.1 mm.; in the recipient eye, 5 mm. Descemet's membrane should not be traumatized. A lid suture is used, the eye is bandaged 17 days, and examined after five days.

The success of the transplant depends partly on the normality of the donor cornea and especially the uveal tract. Centrally located opacities with sharply limited margins in the recipient eye are a good omen. Increased intraocular tension following the operation as well as vascularization are bad omens, as are also slight vitreous loss, mobility of the graft adhesions between cornea and iris, and lowered vitality of the surrounding cornea, as in severe alkaline burns. In one case sympathetic ophthalmia was observed. Chas. A. Bahn.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Barany, E. H. **The mode of entrance of sodium into the aqueous humour.** Acta Physiol. Scandinav. 13:55-61, 1947.

Radio-active sodium chloride in solution was injected intraperitoneally into anesthetized rabbits. Studies of aspirated aqueous were made on animals whose bloodpressure in the ophthalmic and retinal artery was lowered by carotid clamping and on control animals whose arteries were not clamped.,

Those with obstructed carotids should have shown a lowering of the accumulation of sodium in the chamber if ultrafiltration affected the dynamics of passage of the sodium. Since the rate accumulation of sodium was not greatly affected by the clamping and the subsequent lowering of arterial pressure, the author believes that the process involved

in the passage of the sodium was not one of filtration but of secretion.

Francis M. Crage.

Barany, E. H. **The relative importance of ultrafiltration and secretion in the formation of aqueous humour as revealed by the influence of arterial blood pressure on the osmotic pressure of the aqueous.** Acta Physiol. Scandinav. 13:81-86, 1947.

It has been shown that clamping the carotid artery reduces the rate of ultrafiltration by reducing the filtering pressure in an eye. If untrafiltration played an important role in the formation of the aqueous humour then one should expect that clamping a carotid would influence the osmotic pressure of the aqueous.

Osmotic pressure studies were made on aqueous aspirated from each of the two eyes of rabbits in which one carotid was clamped off. After the blood pressure of the eye on the clamped side had been kept at 30 mm. Hg below normal for one and one-half to two hours no significant difference in osmotic pressure of the aqueous was detected between the two eyes. The amount of filtered aqueous therefore could not be considerable. This favors the theory of secretory production of the aqueous humor.

Francis M. Crage.

Laval, Joseph. **Hyaline membrane of the iris. Report of two cases.** Am. J. Ophth. 31:461-463, April, 1948. (5 figures.)

Lowenstein, Arnold. **The sympathizing eye.** Tr. Ophth. Soc. U. Kingdom 65:219-231, 1945.

The author presents the findings in the exciting and sympathizing eyes in two cases. He stressed the findings of corneal epithelial edema, the digestive power of granulomatous tissue towards the glass membranes, the existence of huge macrophages filled with lens matter in the anterior chamber and the great mass of eosinophiles, the granulomatous tissue in the vitreous with epithelioid and giant cells especially in the pre-retinal region. The huge perivascular retinal infiltrates contained many plasma cells and plasma cell rows lined the internal limiting membrane. The histologic findings refute the allergic theory of sympathetic ophthalmia. The provoked allergic uveitis resembled endopthalmitis and not sympathetic ophthalmia.

The saprophytic virus of the conjunctiva may be transferred by a perforating wound into the contents of the globe. If the strain is neurotropic the alleged virus creeps along the ciliary or optic nerve to the brain. In cases of sympathetic ophthalmia it migrates along the nerves to the other eye. The infection of the other eye is patch-like. The repeated reabsorption of the virus creates allergy with release of an H-substance where the nerve endings enter the tissue of the second eye.

This assumption would explain: 1. the multiplicity of independent foci of inflammation, 2. the predominant impairment of the outer layers of the eye and relatively inconsiderable retinal disease, 3. the histamine-like reaction in the epithelium of the conjunctiva and cornea, 4. the tuberculous structure, typical of allergic tissue reaction, 5. the presence of eosinophile cells found frequently in allergic tissue, 6. the negative bacteriological findings, 7. that the disease of the second eye is prevented when the whole source of infection is removed in time, and that excision of the exciting eye is ineffective when the second eye is diseased, 8. sympathetic ophthalmia in cases of evisceration of the exciting eye, 9. meningeal involvement, deafness and bleaching of eyelashes by migration of the virus into other nerve trunks at the base of the brain. Beulah Cushman.

Samuels, Bernard. **The problem of sympathetic Ophthalmia.** Am. J. Ophth. 31: 397-410, April, 1948. (10 figures.)

Whittington, T. H. **Leucosarcoma of iris.** Pro. Roy. Soc. Med. 65:65-66, Jan., 1948.

A hemorrhagic yellowish lobed nodule was found protruding from the anterior surface of the iris in a 64-year-old woman. It was not cystic and not transluminable. The tumor was removed by iridectomy and found to be malignant melanoma.

Irwin E. Gaynon.

9

GLAUCOMA AND OCULAR TENSION

Barkan, O. **The technique of goniotomy for congenital glaucoma.** Tr. Am. Acad. Ophth. pp. 210-223, Jan.-Feb., 1948.

The author's streamlining of the older de Vincentii's operation has found its most successful use in some types of congenital glaucoma. Of 76 such operations performed, 66 are reported as having tension normalized, and 10 unsuccessful. The effectiveness of the stripping of the iris from the cornea where it is adherent because of persistent embryonic tissues, depends on several factors. Schlemm's canal must be patent; the cornea must not be so degenerated structurally or functionally that a return to normal is prevented, and the uveal and retinal tissue must not be too badly degenerated to prevent a reasonable return of vision. If the cornea is sufficiently transparent, goniotomy is performed by direct vision under a prismatic contact glass. If not, the operation is performed without a contact glass but with preliminary canthotomy. One-fourth or more of the adherent iris is stripped at one operation which may be repeated, usually without increasing risks. Air or physiological salt solution may be used to further deepen the anterior chamber. This operation, if indicated, should be performed before degenerative changes in the eye doom it to partial or complete failure. Meticulous attention to the numerous details that make goniotomy successful in infantile glaucoma is imperative. Any attempt to abstract these details would be unfair to the author and to the patients. These should be read in the original article by those who are sufficiently deft and understanding to successfully perform this operation.

Chas. A. Bahn.

Cristini, Giuseppe. **Operative results, mechanism of action, and indications for cyclodiathermy in glaucoma.** Giorn. ital. di oftal. 1:1-13, Jan.-Feb., 1948.

The records of thirty-seven patients operated on by the method of Weekers are reviewed with reference to vision, ocular tension and visual fields (primary glaucoma 18, aphakic glaucoma 3, secondary glaucoma 10, hydrophthalmos 6). In five cases, histopathologic examinations were made of the globes enucleated at varying intervals following the cyclodiathermy.

The change in pressure is attributed by the author to changes in the vascular hydrostatic pressure and of the osmotic pressure and not to variations in the balance between absorption and secretion of the aqueous. The author feels that the Weekers method should not be used in eyes which can be treated by the classic decompression procedures.

Francis P. Guida.

Friede, R. **Treatment of chronic hypotonia bulbi. Wien. klin. Wchnschr. 59:752-754, Nov. 14, 1947.**

The author is interested in attempting to raise the intraocular pressure temporarily (days or weeks) in cases of hypotonia bulbi so that what little vision remains may be preserved and possibly increased and feels that he has succeeded.

He suggests two ways of increasing the intravitreal tension. First, he has the patient drink two or three liters of water for days; and second, he tenotomizes the four recti muscles because he believes the tension at their insertion over the ciliary body tends to decrease the secretion of intraocular fluids by the ciliary body. When the bulb has more tonus he reattaches the muscles. He believes that in early cases of uveitis with hyptotony, the latter may be arrested by his treatment.

Theodore M. Shapira.

Heinz, K. **Retinal detachment following a Lindner bulbus fistula and Elliot trephining.** Proc. Soc. Vienna p. 41, Feb. 22, 1943.

In a man whose left eye had been blind from glaucoma for a long time instillation of homatropine solution into his apparently normal right eye was followed by a severe attack of glaucoma. A Lindner fistula was made and the large quantities of vitreous that appeared were cut off. After 10 days the eye tension was again normal and an Elliot trephining was performed. Four days later the lower half of the retina was found detached but the eye recovered completely after it had been operated upon for this condition.

F. Nelson.

Longhena, Luisa. **Considerations of glaucoma secondary to cataract surgery.** Riv. di oftal. 2:125-144, March-April, 1947. 1947.

After reviewing the literature the author reports 12 cases of glaucoma following cataract operation. She feels that the glaucoma which follows cataract extraction is not a secondary glaucoma but a primary type, since sooner or later glaucoma appears in the unoperated eye. Repeated tonometric measurements preceding surgery can bring to light this latent glaucoma and help to avoid acute attacks by proper treatment during surgery and post-operatively. Once manifest, glaucoma following cataract surgery must be treated as in a non-aphakic eye. However, the prognosis is poor and frequently in spite of surgical and medical treatment, there is total loss of vision and finally of the eye.

Francis P. Guida.

Matteucci, P. **The transmission of humoral nervous impulses in primary chronic glaucoma.** Ann. d'ocul. 180:671-680, Nov., 1947.

Quantitatively and qualitatively the aqueous comes from the blood, which in the glaucomatous differs chemically from that of normal eyes. The existence of a central vasomotor disequilibruim in the glaucomatous has been experimentally proven and is becoming more widely accepted. Involved in this disequilibrium is the sympathetic-parasympathetic mechanism. This affects capillary permeability (vasomotor phenomena), also photomotor reactions, and in the glaucomatous may cause a descending optic atrophy. The author's experiments in determining the cholinase and the amino-oxidase in the aqueous and in the blood of normal and glaucomatous patients support the concept that a deficient parasympathetic and/or over-active sympathetic mechanism and reaction exist in the uveal tract of the glaucomatous. For a statistical study of 12 glaucomatous patients and 5 non-glaucomatous patients, the aqueous was obtained at the time of operation for glaucoma or cataract extraction. The data show that the amino-oxidase of normal compared with glaucomatous eyes is higher in the glaucomatous than in the normal eye and also that the cholesterinase in both the serum and aqueous humor is definitely higher in the glaucomatous. Biologic investigators of glaucoma should read this article in the original.

Chas. A. Bahn.

PAN-AMERICAN NOTES

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Communications should reach the editor by the 12th of the month

PAN-AMERICAN OFFICERS

At the III Pan-American Congress of Ophthalmology, the following officers were elected to serve from 1948 to 1952: President, Dr. Conrad Berens; vice-presidents: Argentina, Dr. Esteban Adrogué; Bolivia, Dr. Aniceto Solares; Brazil, Prof. Ivo Correa Meyer; Canada, Dr. John MacMillan; Chile, Dr. Santiago Barrenechea; Colombia, Dr. Francisco Vernaza; Costa Rica, Dr. Alexis Aguero; Cuba, Dr. Miguel Branly; Ecuador, Dr. Varas Samaniego; Guatemala, Dr. Miguel Medrano; United States, Dr. Frederick C. Cordes and Dr. William L. Benedict. Secretary for north of Panama, Dr. Thomas D. Allen; secretary for south of Panama, Dr. Moacyr E. Alvaro; assistant secretaries for Latin America, Dr. Jorge Balza and Dr. Manoel Silva; assistant secretary for the United States, Dr. Brittain F. Payne; assistant secretary for Central America, Dr. Palomino Dena.

COMMITTEES APPOINTED

It was decided at the council meeting and ratified by the general assembly that the following permanent committees should be appointed:

Interamerican Federation of Ophthalmologic Societies. President, Dr. William Benedict (United States); Members: Dr. Jorge Malbran (Argentina), Dr. Aniceto Solares (Bolivia), Dr. Sylvio Abreu Fialho (Brazil), Dr. Italo Martini (Chile), Dr. Carlos Mena (Costa Rica), and Dr. Jorge Suarez Hoyos (Colombia).

Committee on Lighting and Optics. President, Dr. Magin Diez (Argentina); Members: Dr. J. Pascal (United States), Dr. Roque Bellido Tagle (Perú), Dr. J. M. Penichet (Cuba), Dr. Rivas Cherif (Mexico), Dr. A. Cowan (United States), Dr. Caretti (Argentina), and Mr. Tolman (New York).

Committee on Glaucoma. President, Dr. Antonio Torres Estrada (Mexico); Members: Dr. Peter Kronfeld (United States), Dr. Julio Raffo (Perú), Dr. Hilton Rocha (Brazil), Dr. Baudilio Courtis (Argentina), Dr. Esteban Adrogué (Argentina).

Committee for the Encouragement of Research in Ophthalmology. President, Dr. Edwin Dunphy (United States); Members: Dr. Phillips Thygeson (United States), Dr. Esteban Adrogué (Argentina), Dr. Paulo Filho (Brazil), Dr. Lech Junior (Brazil).

Committee on Pharmaceutics. President, Dr. Parker Heath (United States); Members: Dr. Roberto Pereira (Argentina), Dr. K. Swan (United States), Dr. W. Hughes (United States).

Society of "Amigos." Honorary President, Dr. Francisco Belgeri (Argentina). President, Dr. Paulo Cesar Pimentel (Brazil); Members: Dr. William Crisp (United States), Dr. Shaler Richardson (United States), Dr. Magin Diez (Argentina), Dr. Santiago Barrenechea (Chile), Dr. Abelardo Zertuche (Mexico).

Committee on Establishment and Guidance of Ophthalmologic Societies. President: Dr. Jesus Rhode (Venezuela); Members: Dr. Frederick Cordes (United States), Dr. Durval Prado (Brazil), Dr. Roberto Pereira (Argentina), Dr. Oscar Horstmann (Cuba).

Committee on Legal and Industrial Ophthalmology. President, Dr. Jorge Diaz Guerrero (Colombia); Members: Dr. Ralph Lloyd (United States), Dr. Alberto Urrets Zavalia (Argentina), Dr. Santiago Barrenechea (Chile), Dr. J. M. Espino (Venezuela), Dr. Morris Davidson (United States), Dr. José A. Senà (Argentina), Dr. Thomas R. Yanes (Cuba), Dr. Eduardo Arce (Bolivia), Dr. Colombo Spinola (Brazil).

Committee on Standardization of Ophthalmic Hospitals and Clinics. President, Dr. J. H. Dunnington (United States); Members: Dr. Magin Diez (Argentina), Dr. Ivo Correa Meyer (Brazil), Dr. J. M. Penichet (Cuba).

Committee on Interamerican Medical Relationships. President, Dr. R. Pacheco Luna (Guatemala); Members: Dr. Daniel Kirby (United States), Dr. Derrick Vail (United States), Dr. Palomino Dena (Mexico), Dr. Sylvio Abreu Fialho (Brazil), Dr. Georgiana Theobald (United States), Dr. Olga Ferrer (Cuba).

Committee of Purchasing Section. President, Dr. Rene Contardo (Chile); Members: Dr. Paiva Gonçalves (Brazil), Dr. Luis E. de Mora (Perú), Dr. Jorge Malbran (Argentina), Dr. Roberto Vazquez Barriere (Uruguay).

Contact Lens Center Committee. President, Dr. Baudilio Courtis (Argentina); Members: Dr. Arno Town (United States), Dr. Enrique Bertotto (Argentina), Dr. Daniel Silva (Mexico), Dr. J. Pascal (United States).

Committee on Orthoptics. President, Dr. Avery Prangen (United States); Members: Dr. Jorge Malbran (Argentina), Dr. Cesar Rodriguez (Perú), Dr. Raimundo Tartari (Argentina), Dr. J. Mendonça de Barros (Brazil).

Committee on Scientific Cinematography. President, Dr. Hilton Rocha (Brazil); Members: Dr. Gilberto Cepero (Cuba), Dr. A. Bedell (United States), Dr. Magin Puig Solanes (Mexico), Dr. Caretti (Argentina).

Committee on Trachoma. President, Prof. Cesario de Andrade (Brazil); Members: Dr. José R. Toja (Argentina), Dr. Roque Bellido Tagle (Perú), Dr. Paula Santos (Brazil), Dr. Phillips Thygeson (United States).

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NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. Archibald Alexander MacLachlan, Pittsburgh, Pennsylvania, died December 2, 1947, aged 73 years.

Dr. Hamilton Stillson, Seattle, Washington, died January 11, 1948, aged 90 years.

Dr. George A. Morley, Crookston, Minnesota, died recently, aged 79 years.

MISCELLANEOUS

REPORT OF EYE-BANK

The Stanford Eye Bank has reported that it provided 33 corneas for eye-graft operations during its first year of operation. All qualified eye surgeons on the Pacific coast are invited to make use of the facilities of the bank. Corneas collected and preserved by the Eye-Bank are distributed without cost to either patient or surgeon, except for a small service fee. Information on the correct procedure for registration of donors can be obtained by writing to the Stanford Eye Bank, 2398 Sacramento Street, San Francisco.

RECOGNITION DINNER HELD

On April 22, 1948, a recognition dinner was held at Talladega, Alabama, following the inauguration earlier this year of the assumption by the Department of Ophthalmology, Medical College of Alabama, of the full ophthalmic responsibility for the Alabama Institute for the Deaf and Blind. Representative officials of the state and of the university were present. There are 209 blind or partially blind children at the institute and much investigation and therapeusis are planned, particularly with reference to those children with progressive ocular disease. A resident in ophthalmology spends two days each week at the institute (50 miles from Birmingham) and the rest of his time at the Medical College and the Thigpen-Cater Eye Hospital. Dr. Arthur Steinmetz, Hayward, California, is the present resident.

SOCIETIES

The Milwaukee Oto-Ophthalmic Society held its regular meeting on April 27th at the Milwaukee Children's Hospital. The scientific program included: "Surgery of strabismus with special reference to the oblique muscles," Dr. Beulah Cushman, Northwestern University, Chicago; and "Treatment of acute laryngo-tracheo-bronchitis," Dr. Howard High, Milwaukee.

PENNSYLVANIA ACADEMY MEETS

The Pennsylvania Academy of Ophthalmology and Otolaryngology met on April 23rd, 24th, and 25th at the Penn-Harris Hotel, Harrisburg. Dr. Gabriel Tucker was the guest of honor.

Of particular interest to eye physicians were the following papers: "The surgery of the extraocular muscles," Dr. Glen Gregory Gibson, Philadelphia; "Retinal detachment," Dr. John H. Dunnington, New York; "Surgery of the lids and conjunctiva," and " External ocular diseases and their treatment," Dr. Raymond Emory Meek, New York; "Integrated implants and the presentation of a new type universal implant," Dr. Norman L. Cutler, Wilmington, Delaware; "General anesthesia for operations on the eye, ear, nose, and throat," Dr. Philip D. Woodbridge, Reading, Pennsylvania; and "Pitfalls in cataract surgery," Dr. Carroll R. Mullen, Philadelphia.

Two splendid motion pictures of ophthalmic interest were shown. They were "Keratoplasty," and "Cataract extraction—Extracapsular, intracapsular with forceps, intracapsular by suction." Both were made by Dr. Ramon Castroviejo, New York.

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 31 JULY, 1948 NUMBER 7

DACRYOCYSTITIS OF INFANCY*

J. V. CASSADY, M.D.
South Bend, Indiana

The treatment of dacryocystitis of infancy is still a controversial subject. The majority of the literature on this subject advocates conservative treatment and is opposed to early probing of the nasolacrimal duct. The tear-sac infection in infants is due to an imperforate lumen of the lacrimal duct with a retention of infected tears in the sac. Many ophthalmologists believe that a long period of irrigation with massage of the sac should be employed because of some bad effects that might ensue from early probing of the duct. One hundred cases that I treated by early probing of the duct cleared up promptly without incident or bad effects from such management.

REVIEW OF THE LITERATURE

In a recent review of the literature I found 15 papers recommending early probing of the duct to clear up the dacryocystitis of infancy and 18 that decried manipulation of the duct, the latter favoring conservative management with local antiseptics and sac massage for a period varying from 2 to 24 months. Among those favoring early probing were Weeks, Zentmayer, Ollendorf, Green, Nagel, Meller, Ferrer, Pesne, Berens, Sanford Gifford, Becker, Wiener and Alvis, Walker, and Judge. Those opposed to probing and advocating a prolonged period of conservative treatment were Posey, Klinedinst, Edward Jackson, Roy, Curdy, McMurray, Crigler, Rollet, Campbell, Botteri, Busacca, Meek, Hardesty, Moret, Arruga, Harold Gifford, and Guerry.

Several members of the Chicago Ophthalmological Society have contributed to the literature on this subject. The two papers that I wish to review are those of H. W. Woodruff and of Roy Riser. Dr. Woodruff, in 1931, pointed out that the majority of these infants come to the ophthalmologists at about six months of age. Some only require sac irrigation, while others need to have their nasolacrimal ducts probed. In some instances, he found it necessary to pass a second probe into the nose rubbing the two instruments together to break through the mucosa and establish a lumen from the duct into the nose.

Riser, in 1935, reported 44 instances of dacryocystitis of infancy, most of which were seen at about six months of age. Conservative treatment for 2½ months resulted in subsidence of the symptoms in 21 cases. Only 50 percent, however, were relieved by conservative treatment. Nine cases were probed and their symptoms subsided promptly.

EMBRYOLOGY AND DEVELOPMENTAL ANATOMY

To understand the pathogenesis of dacryocystitis of infancy better, the works of J. Parsons Schaeffer and of M. Schwartz of Tubingen should be considered. These two authors have made such valuable contributions to the embryology and developmental

* Read before the Chicago Ophthalmological Society, October 6, 1947. The author gratefully acknowledges the assistance given by the staff of the South Bend Medical Foundation, Inc., in the preparation of the embryology and the illustrations.

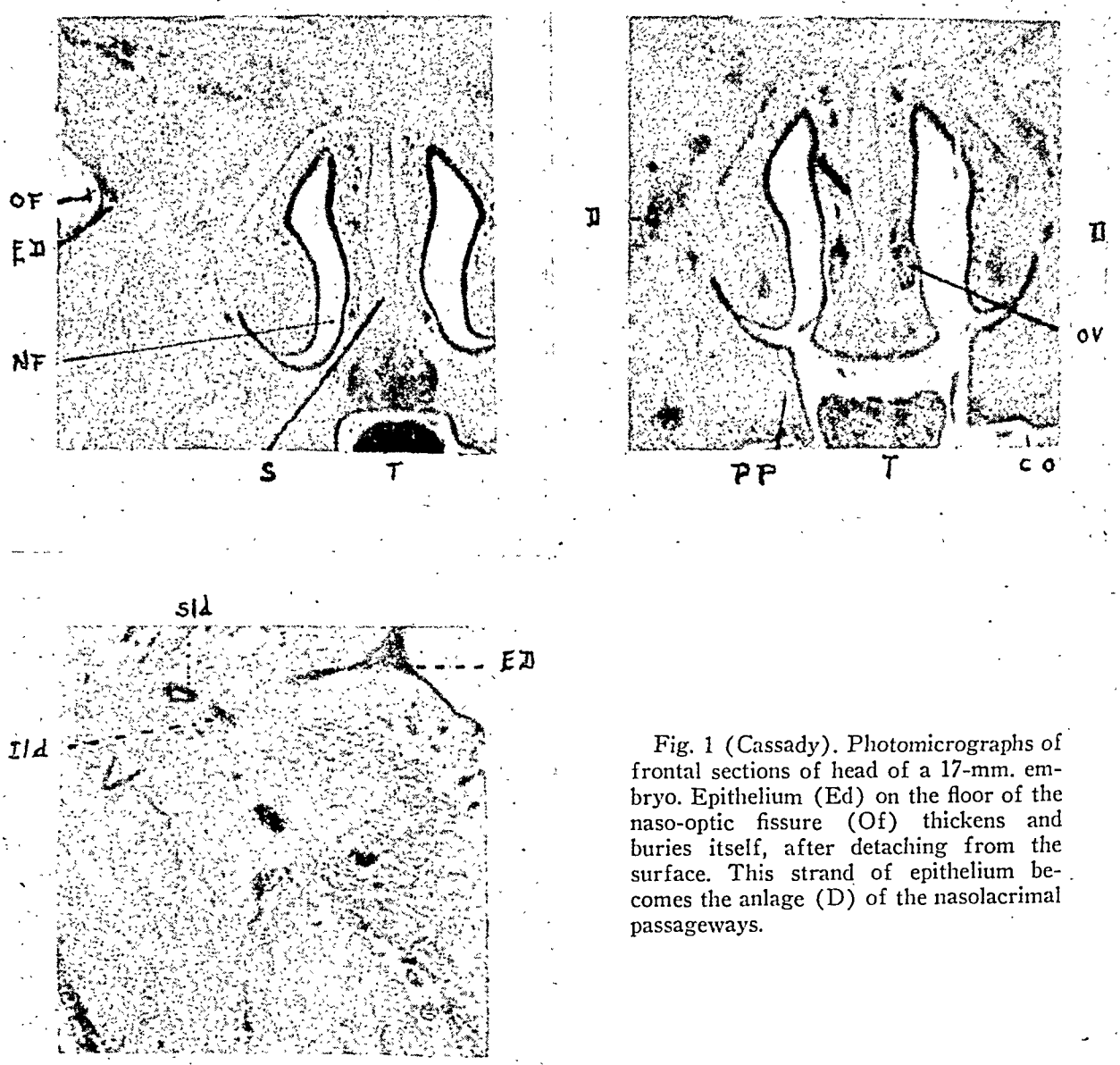


Fig. 1 (Cassady). Photomicrographs of frontal sections of head of a 17-mm. embryo. Epithelium (Ed) on the floor of the naso-optic fissure (Of) thickens and buries itself, after detaching from the surface. This strand of epithelium becomes the anlage (D) of the nasolacrimal passageways.

KEY TO ABBREVIATIONS IN FIGURES

Co—Cavum oris
D—Anlage of nasolacrimal passageways
Ed—Thickened surface ectoderm
If—Inferior turbinate
Ild—Inferior canaliculus anlage
Inm—Inferior meatus
Lm—Nasolacrimal membrane
Mm—Middle meatus
Nf—Nasal fossae
Nld—Nasolacrimal duct
Of—Naso-optic fissure
Ov—Organon vomeronasale
Pp—Processus Palatinus
S—Septum nasi
Sld—Superior canaliculus anlage
T—Tongue
Y—Detritus in lumen of unruptured duct

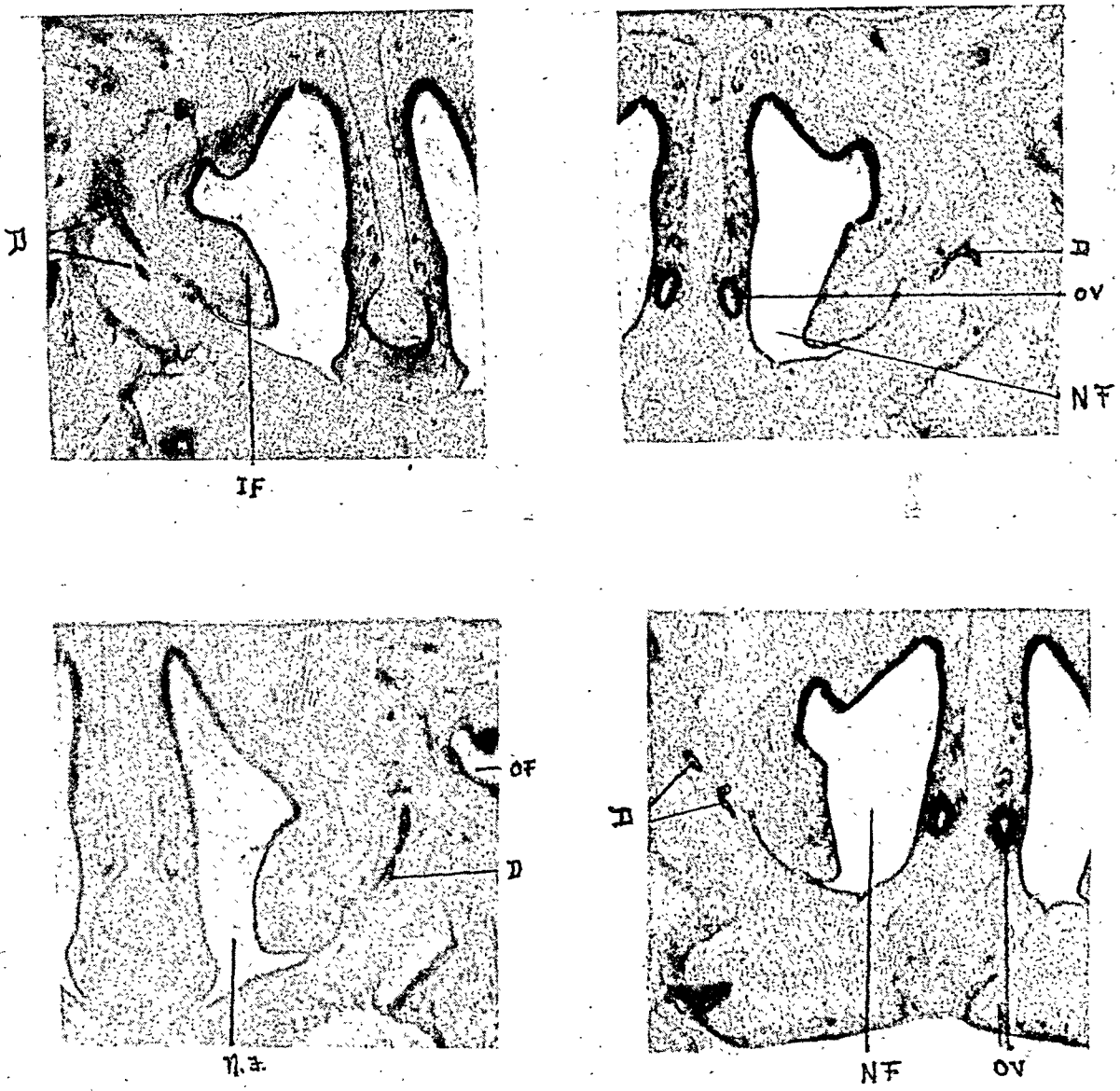


Fig. 2 (Cassady). Photomicrographs of frontal sections of 25-mm. human embryo. Solid epithelial rests (D) buried in the mesenchyme are formed between the nasal fossae (Nf) and the naso-optic fissure (Of).

anatomy of the nasolacrimal duct that, in spite of your familiarity with their work, I would like to review it.

"The nasolacrimal duct starts in the 12-mm. embryo from a thickening of epidermal cells which grows down into the mesenchymal tissue and detaches itself from the surface ectoderm. This epithelial cord begins to develop a lumen by the third month: sections through 100-day embryos show that the superior and inferior canalicular cords have extended to the free margin of the eyelids and that the nasal end of the mother cord of cells has reached the nasal mucous membrane. The ocular end establishes a lumen long before the nasal end and the latter is delayed approximately until birth or a little later. The last portion to become patent is the site of coalescence between the nasal sprout of the mother cord and the nasal mucous membrane. The position of the ostium, whether

at the highest point of the inferior meatus or at some lower site on the lateral nasal wall, and the shape of the ostium, whether large, wide open, or more or less guarded by folds of mucosa, depend upon the point

tact, (2) be of microscopic size and inadequate for normal function, (3) be buried in mucosa of the lateral wall of the inferior meatus and guarded by a valvelike fold of mucous membrane, (4) be wide open and

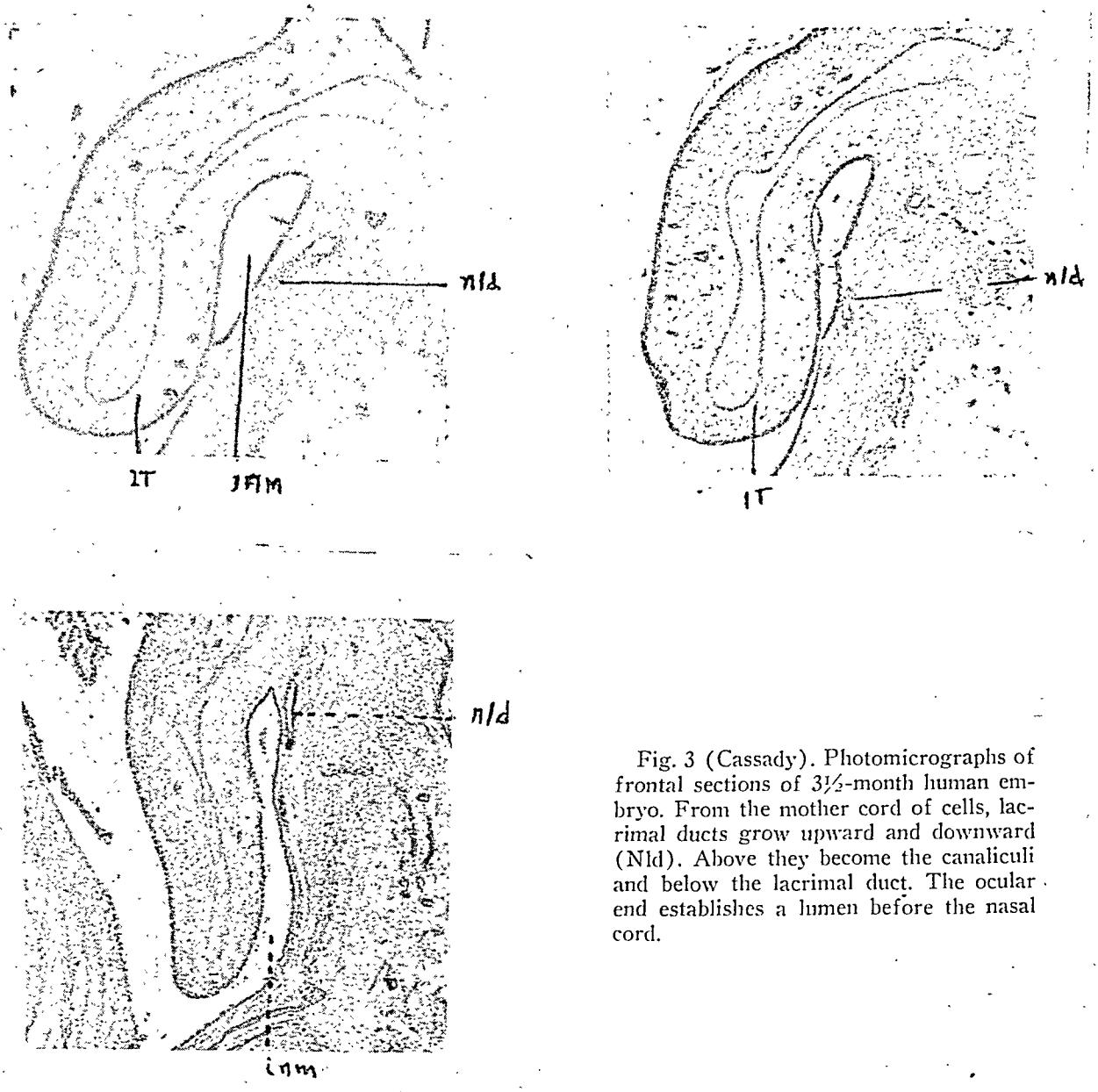


Fig. 3 (Cassady). Photomicrographs of frontal sections of 3½-month human embryo. From the mother cord of cells, lacrimal ducts grow upward and downward (Nld). Above they become the canaliculi and below the lacrimal duct. The ocular end establishes a lumen before the nasal cord.

and extent of coalescence between the nasal end of the mother cord and the nasal mucosa." This description is that of J. Parsons Schaeffer. He further goes on to say, "The nasal ostium of the duct may (1) fail of canalization, and its membrane remain in-

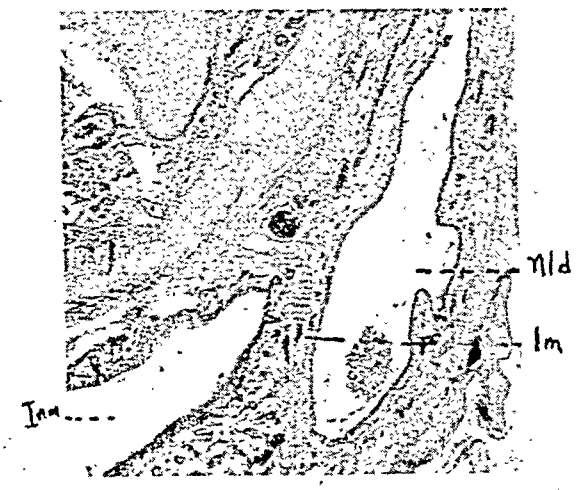
adequate." (See Figures 1, 2, 3, 4, 5, 6, and 7.)

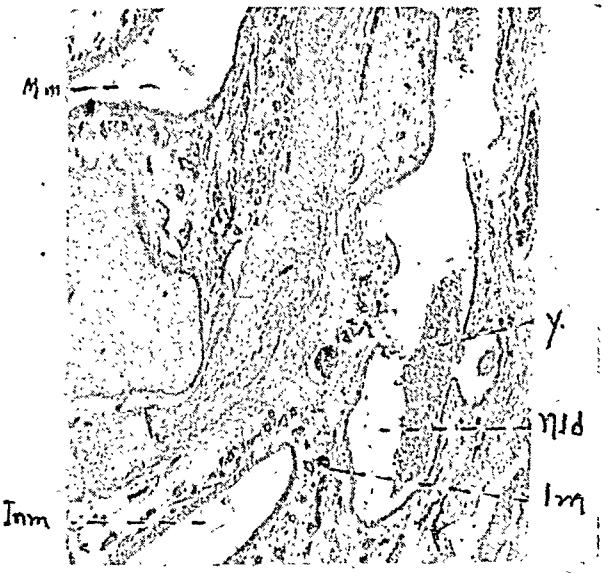
Schwartz, in 1935, after examining 207 nasolacrimal ducts in fetuses in the 8th, 9th, and 10th fetal months, found 35 percent had atresia or an imperforate lumen of the nasal

ostium. Some of these were associated with a terminal cyst or bulla and were ruptured by the trauma incident to delivery. The closed lumen was present in the stillborn in about the same proportion as in the older fetuses.

brane separating its lumen from the nasal cavity, indicate that passing a probe through into the nose should be the preferred method of treatment.

Prolonged conservative treatment, with





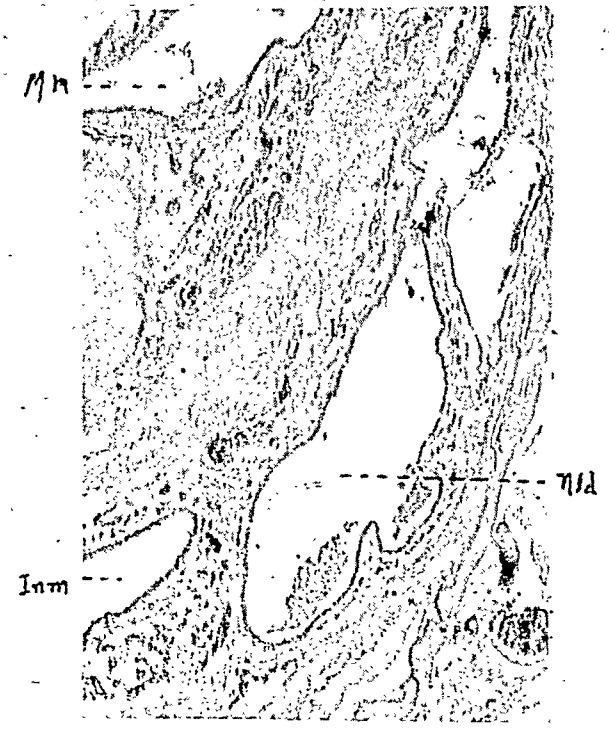


Fig. 4 (Cassady). Photomicrographs of section of the nasal end of the lacrimal passages in a full term, stillborn infant. A septum (Lm) separates the unruptured duct and the inferior meatus. The entire thickness of the nasal mucosa and that of the lacrimonasal duct abut against one another to occlude the lumen of the duct. Detritus (Y) is seen within the lumen of the duct.

The delayed development of the nasal ostium of the nasolacrimal duct, its failure to open at or near birth, the high incident of atresia of the duct, yet its practically complete lumen except for the imperforate mem-

its resultant sac distention, trauma, and infection of the passage, is likely to result in permanent distention and loss of elasticity, as well as endangering the eye from a purulent dacryocystitis. Several instances of loss

of an eye from dacryocystitis in infancy are reported in the literature (Granstrom, 1938).

"Atresia in the newborn is due to an unruptured lacrimal nasal membrane and in these surgical intervention may be necessary (Schaeffer)." Schaeffer, in a personal communication, is of the opinion that Schwartz's figure of 35 percent imperforate nasolacrimal ducts at birth is a conservative one.

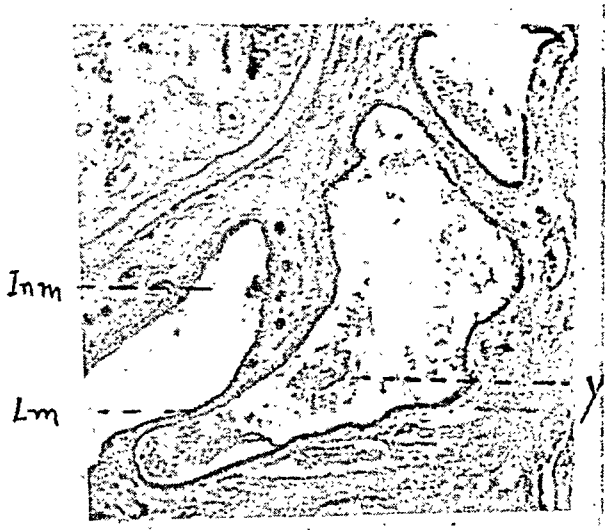


Fig. 5 (Cassady). Photomicrographs of section of the lower end of the nasolacrimal duct of a stillborn infant. The nasolacrimal membrane (Lm) separating the lower end of the duct from the inferior meatus (Inm) is very thin, but unruptured. Detritus (Y) is in the dilated lumen of the duct.

Incidence of dacryocystitis

A large percentage of nasolacrimal membranes are not ruptured at birth. The incidence of dacryocystitis of infancy has been reported as 1.75 percent in some 1,500 infants. In a local series of 279 infants, dacryocystitis occurred in 14 instances or 5 percent. This latter figure probably is higher than usual because special inquiry was made by pediatricians and careful examination for dacryocystitis was done in each of the 279 infants.

The reason why infection of the nasolacrimal sac is not seen more often is probably due to the fact that, although a patent lumen may not exist at birth, tears do not form at once and the need for patency of the duct does not occur until later. There are no definite figures in the literature as to just how early tears occur in infants. In an investigation of this subject in newborns and infants by our local pediatricians, the same 279 infants were investigated by asking their parents to note when they first cried tears. The time at which tears appeared varied from 1 to 12 weeks. The average time at which tears first appeared was at 3⅓ weeks.

Although the lacrimal passages may not be patent at or near birth, it is probable that they become patent within the first week or two after birth, before tears start. If dacryocystitis develops, it may resolve spontaneously as soon as the patency of the duct is established. This may occur without probing the duct if prolonged conservative treatment and watchful waiting are employed. If, however, the duct is not patent by 2 or 2½ months, or when these patients appear in the ophthalmologist's office for advice, it is unlikely that the membrane will rupture spontaneously.

Method of treatment

In 100 cases of dacryocystitis in infancy that I have seen and treated, so-called radical treatment was used; the duct was probed open at once without a trial period of conservative treatment. In almost all of these cases, an attempt to wash the sac with a lacrimal syringe showed the duct impatent and the solution would not go through into the nose. Only after the nasal duct was probed and its patency established would the solution go through. In other words, there is a membrane separating the nasal from the lacrimal duct mucosa. This obstructs the lower end of the nasolacrimal duct and its rupture is essential to establish free passage through the duct. As long as obstruction or an imperforate lumen exists into the nose, dacryocystitis persists. Local treat-

ment of the dacryocystitis with antiseptics or antibiotics may clear up the infection in the sac, but the sac will not remain clear and function properly until the lumen is open into the nose. Treatment which does not establish a lumen is too conservative and results in prolonged sac distention with more trouble than from radical treatment.

In my cases, the dacryocystitis subsided promptly with 1 or 2 treatments and in three fourths of the instances subsided within a few days to a week after probing. In other words, although there was a dacryocystitis of 2½ to 3 months' duration before probing was done, one office treatment was all that was necessary to cure the disease.

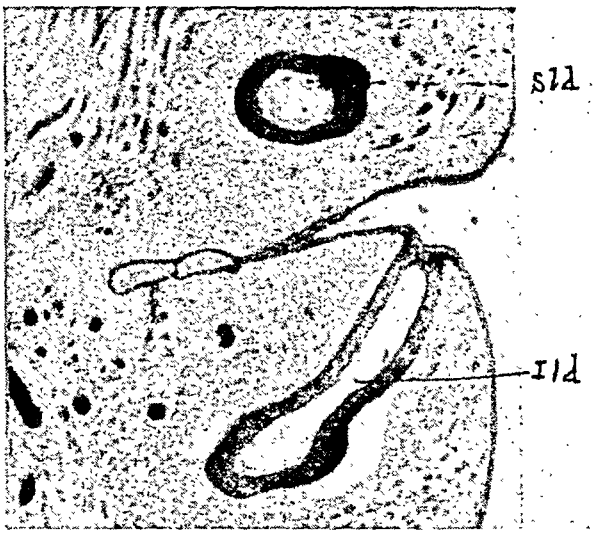


Fig. 7 (Cassady). Photomicrograph of section showing the upper and lower canaliculi, the lower at its vertical portion, the upper at its horizontal portion with patent lumen.

Technique of probing

Topical local anesthesia was used along with restraint of the child. The child was tightly swathed with the arms extended at the sides. The shoulders and head were held by the nurse. Pontocaine or butyn conjunctival instillations were used, and the duct was probed. The operator sat at the head of the table looking down toward the lower canaliculus, the illumination behind him directed at the punctum.

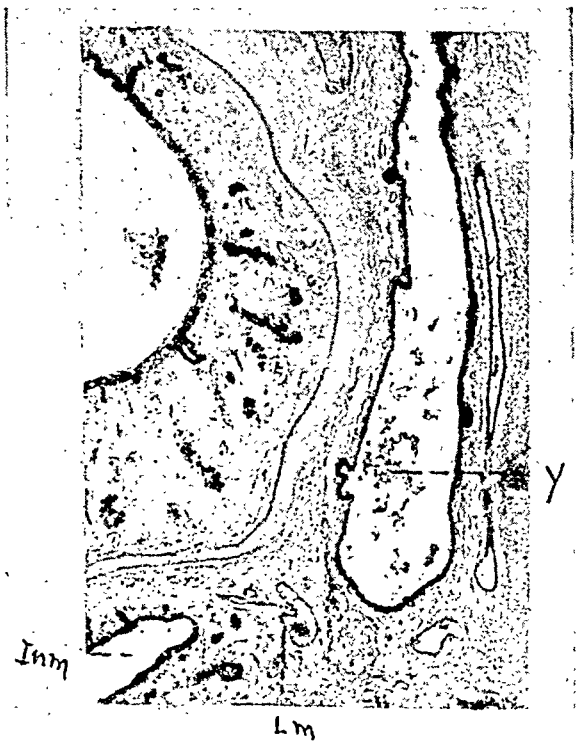


Fig. 6 (Cassady). Photomicrograph of section of the nasal end of a nasolacrimal duct in a stillborn full term infant. Although serial sections were used to find a thin lacrimal nasal membrane (Lm), no thinner could be found.

A conical punctum dilator was used to allow the introduction of a 23-gauge, 1-inch lacrimal cannula attached to a 2-cc. syringe containing normal saline. As soon as the cannula entered it, the sac was irrigated. As the cannula struck the osseous wall, it was turned from the horizontal to the vertical position where it passed easily down through the duct. Resistance of the membrane at its lower end is felt just before the cannula enters the nasal cavity. Perforation of this membrane is assured when the saline solution is injected and the infant swallows solution as it runs back into its throat.

The cannula attached to the syringe is used instead of a Bowman probe to simplify the procedure so that the irrigation and the probing can be accomplished with one probing of the duct.

A solution of penicillin, 2,500 units per cc., is prescribed as instillation drops for use at home for a few days after the office

treatment. If pus is still present in the sac at the next visit, the probing and irrigation are repeated. It is then possible to determine with the cannula whether or not the duct is patent. If it is plugged, the solution cannot be irrigated through into the nose until the canal is again probed.

Results

If carefully done, there is no danger from this type of treatment. In 100 cases, only one instance of a false passage occurred. This ballooned the tissue outside the lumen of the duct with saline. In this instance, the probe was withdrawn, reintroduced into the upper puctum and canaliculus, and the patency of the duct was established without untoward effect. The subcutaneous edema promptly disappeared, and the dacryocystitis had entirely cleared up within a week. The best security against creating a false passage is adequate immobilization of the child and careful, gentle handling of the cannula.

The average length of treatment using this method was between 10 days and 2 weeks. Some sac infections which had persisted for several months did not clear up with a single probing. The sac was distended and stretched with an infected mucosa for such a period of time that it had lost its elasticity and recuperative ability. When probing is delayed until the infant is six months of age, the ducts may not, in fact very often do not, clear up with one probing. If the duct is probed at the first visit to the eye physician, usually by 2 or 3 months of age, the infection clears up quite promptly and there are no untoward persisting symptoms.

Conclusions

A review of the developmental anatomy of the nasolacrimal duct shows that frequently the lumen of the duct is not patent at birth. About one third of newborn infants have a membrane over the lower end of the duct separating it from the nasal cavity. This is a common developmental defect which may or may not rupture before the passages are needed for tears. Tears first appear on an average at about 3½ weeks of age. The lumen is usually established by rupture of this membrane before tears start but if it is not, the sac distends, becomes infected, and dacryocystitis of infancy occurs. The incidence of this disease varies from 1.75 to 5 percent. Sometimes it will resolve spontaneously if the membrane ruptures but, in most instances, probing the duct is necessary to rupture the membrane mechanically.

The majority of articles in both the ophthalmic and pediatric literature advocate a long period of conservative treatment of dacryocystitis of infancy. The writers warn against early probing of the duct as being dangerous and radical and an unjustified method of treatment. In my own series of cases and also in those cases, reported in the literature, which did not respond to prolonged conservative management, the dacryocystitis subsided as soon as the duct was opened. (See Figures 4, 5, and 6.)

Summary

1. Tears start to form and appear at about 3½ weeks of age.

2. The incidence of dacryocystitis in infancy is somewhere between 1.75 and 5 percent.

3. Prompt subsidence of dacryocystitis can be obtained as soon as the lumen of the duct is adequately patent.

4. Early probing of the duct produces no untoward injury providing it is carefully and gently done.

5. Early probing of the nasolacrimal duct in infants is the method of choice for prompt subsidence of symptoms.

527 Sherland Building (9).

ANATOMIC FACTORS IN THE ETIOLOGY OF HETEROTROPIA*

RICHARD G. SCOBEE, M.D.
St. Louis, Missouri

The present status of our knowledge of the etiology of heterotropia leaves much to be desired. There are almost as many classifications of heterotropia as there are ophthalmologists to enumerate them. One finds much overlapping in the various existing classifications and often there is frank disagreement. It has been said that when there are many treatments for any disease, their very multiplicity is excellent evidence that no single treatment is satisfactory; just so the many existing classifications of heterotropia make them all suspect to a certain degree. It is the purpose of this paper to present a rearrangement of the usual classification of the types of heterotropia based upon factual evidence and to suggest an outline of treatment based upon this classification.

CLASSIFICATION OF TYPES OF HETEROTROPIA

Most classifications have at least three main categories: (1) anatomic, (2) innervational, and (3) paretic. Under *anatomic,* there are listed such things as "muscles too large or too small," "unusual attachments of muscles," and, rarely, "complete absence of a muscle."

In the *innervational* group are lumped all heterotropias which seem to be on a basis of refractive error, all of those with an anomaly of either convergence or divergence, those with "a weak fusion faculty," those without obvious cause, and all cases wherein fusion is impossible by virtue of some organic obstacle such as cataract, retinal detachment, hole in the macula, unilateral optic atrophy, congenital amblyopia, and so forth.

The *paretic* group contains those patients with heterotropia due either to trauma or noxae or those with congenital paresis.

The conscientious ophthalmologist must sooner or later become dissatisfied with such a classification because he will encounter some cases that are "neither fish nor fowl." A closer study of these particular cases makes one suspect that many of them may be partly innervational, partly paretic, and partly something else. While all writers faithfully include the *anatomic* category, few cases are ever actually reported as belonging to this group and the average clinician seldom even considers it in making a diagnosis. The few cases which have appeared in the literature as belonging in this group were rarely if ever diagnosed before the patient was on the operating table and the diagnosis was often a subject of some consternation to the surgeon.

Chavasse[1] made an admirable attempt to explain the heterotropia associated with accommodative effort or the lack of it, yet one often sees patients that will not fit into his classification. Chavasse was, of course, fully aware of these misfits and said of them that they were patients in whom ". . . there is a lag in the development of the reflex which settles the rival claims of accommodation and convergence." What he neglected to say was that the foregoing comment might be made about almost any patient with heterotropia and can neither be proved nor disproved.

Having made these prefatory remarks, a statement can be made that will undoubtedly be considered rash. *Ninety percent of all cases of heterotropia appearing in the first six years of life have some underlying ana-*

* From the Department of Ophthalmology, Washington University School of Medicine, and the Oscar Johnson Institute. This study was done under a contract with the Office of Naval Research as Project N6onr-202, Task Order I. Read before the American College of Surgeons, Section on Ophthalmology, September 9, 1947, New York, New York.

tomic cause for the deviation. Is this heresy? It will seem so to many. A consideration of the evidence is in order.

Anatomic factors

The anatomic factors playing an important role in the etiology of heterotropia are three in number: (1) Abnormal check ligaments, (2) abnormal muscle slips, and (3) abnormal insertions. They will be considered in that order.

The check ligaments

The check ligaments of the oculorotary muscles are familiar, at least by name, to every student of ophthalmology. They are one of the subdivisions of the fascia of Tenon and arise from the sheath of each of the oculorotary muscles. They are faithfully mentioned in all texts on anatomy and carefully depicted, with those of the medial and lateral rectus usually being chosen for the illustration. The picture—always diagrammatic—suggests that each oculorotary muscle has a check ligament and this ligament is shown arising perpendicular to the muscle from its sheath and running a course parallel to the line of pull of the muscle. The check ligaments, however, are not as simple as the usual description implies, nor may they be dismissed with no more than a mere mention if one is truly interested in the etiology of heterotropia and of heterophoria.

These ligaments arise from the muscle sheaths and are inserted, for the most part, into the orbital wall—really into the periorbita. Parts of the check ligaments on the medical and lateral rectus are inserted into the medial and lateral palpebral ligaments and into the medial and lateral conjunctival fornices respectively. The ligament of the medial rectus is also inserted into the lacrimal caruncle. Whitnall[2] wrote that ". . . these expansions of the sheaths draw the fornices of the conjunctiva backwards, exactly as muscle fibers adjacent to joint capsules draw the slack of synovial membranes out of the way in extension, but a more important function is that by their fixation to the orbital walls they anchor the whole fascial apparatus of the globe in position."

Appropriately named *check* ligaments, their primary function is quite obviously one of preventing or checking excessive excursions of the globe which would be produced by the oculorotary muscle from whose sheath the ligaments in question arose. For example, the check ligaments of the medial rectus prevent excessive adduction of the globe, while those of the lateral rectus prevent excessive abduction. This fact is as obvious as it is well known.

What is not so well known is the fact that the check ligaments may serve to check movement *in two directions.* Not only may they serve to prevent any excessive rotation which might be produced by the muscle from whose sheath they arise, but they may also prevent effective relaxation of that same muscle when its antagonist is contracting if they are abnormally developed. A muscle that is constantly prevented from attaining full relaxation when its antagonist contracts becomes at first a tonically contracted muscle and later a moderately fibrotic one with a consequent loss in elasticity—a tremendously important fact in patients with heterotropia.

One need not necessarily go to the dissecting room to study the check ligaments. The ophthalmic surgeon in the course of an operation for heterotropia is presented with an unexcelled opportunity to study these ligaments if he cares to do so. And he has the advantage over the cadaver anatomist in that he is working with fresh, living, normally colored tissues.

The medial rectus is probably attacked by the surgeon more frequently than any of the other oculorotary muscles and its check ligaments offer more variation than those of any other muscle. They cannot be adequately and properly inspected and studied until the insertion of the medial rectus has been severed from the globe.

The medial rectus always has one check ligament running in the horizontal plane of the globe and this is the one so carefully depicted in all textbooks. It arises from the sheath just as does the dorsal fin of a fish at a point between 6 and 8 mm. posterior to the insertion of the muscle itself into the sclera. Even in the nonheterotropic patient

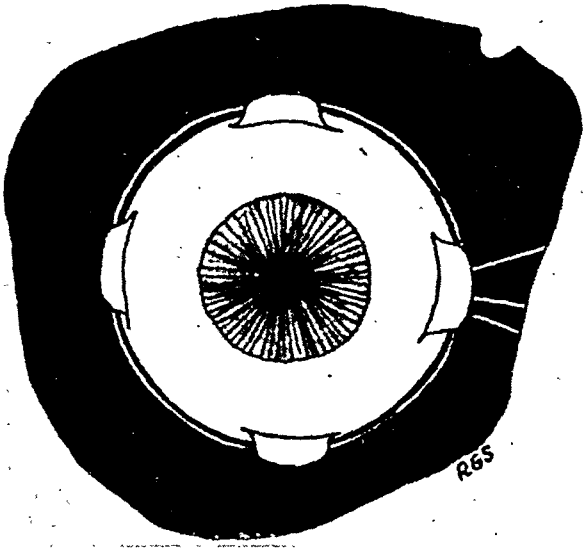


Fig. 1 (Scobee). Schematic diagram of the right eye viewed from the front showing the normal check ligaments on the medial rectus muscle. The intermuscular membrane is also shown as a thin white line running between all of the rectus muscles.

it is moderately thick and can be nicely visualized when put on a stretch by pulling the severed end of the medial rectus forward and toward the center of the cornea. Occasionally two very thin additional check ligaments are found in the normal person, one above and one below the main horizontal one. All three ligaments are shown in Figure 1.

In the patient with esotropia, several variations from the normal may be found, either separately or in combination. There may be any or all of the following: (1) Extra and thickened check ligaments, (2) fused check ligaments, and (3) posterior check ligaments.

(1) *Extra and thickened check ligaments.* A frequent finding is that of additional,

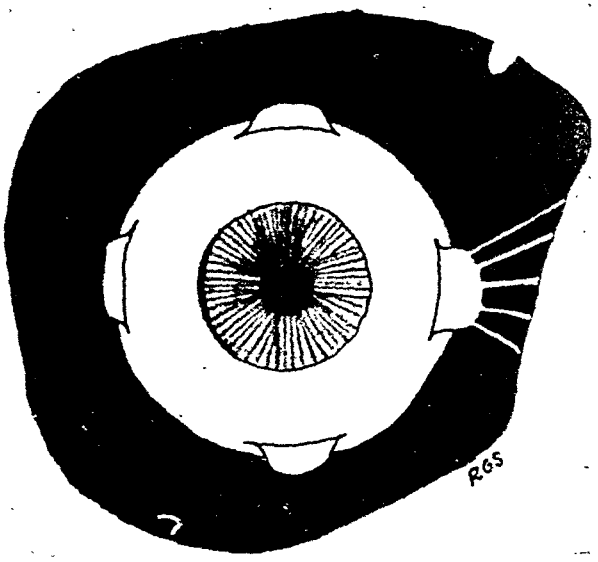


Fig. 2 (Scobee). Schematic diagram of the right eye showing extra and thickened check ligaments which are abnormal. The intermuscular membrane is not shown.

thickened check ligaments. The normal main horizontal ligament is present and quite obviously thickened and somewhat contracted. Extra check ligaments arise from a line paralleling the origin of the main ligament and either just above or just below it, as shown in Figure 2. They lie in planes which are oblique to the horizontal, in such a way that when put on a stretch they seem to fan out like the pages of a book from its binding when the covers of the book are purposely held wide open.

(2) *Fused check ligaments.* If the esotropia has been present from birth, it is not at all unusual to find that the 3 or 5 ligaments shown in Figure 2 are apparently fused together into a thick solid mass running from the muscle sheath to the orbital wall as in Figure 3. Such a mass is a dense ligamentous anchor which not only prevents excessive adduction by the medial rectus but it also prevents a normal excursion of the globe in abduction as well. Patients with esotropia and the fused type of check ligaments on the medial rectus will show:

(a) Definite although perhaps slight limitation of abduction of that eye in preoperative examinations.

(b) An absence of divergence of the

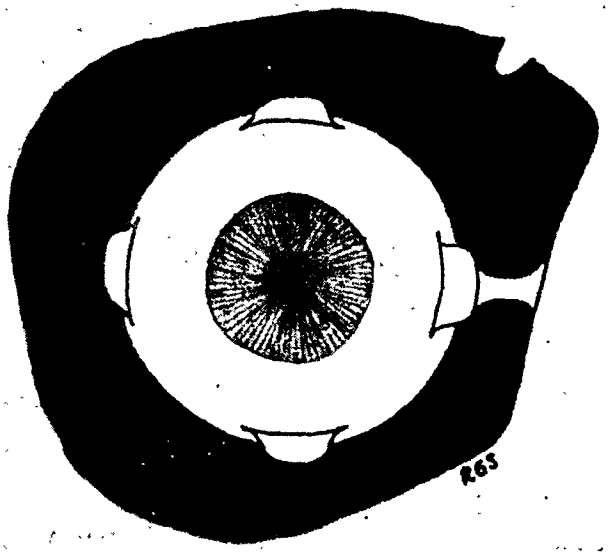


Fig. 3 (Scobee). Schematic diagram of the right eye showing a fused type of check ligament. It is quite thick and seems to be the product of fusion of several smaller ligaments. The intermuscular membrane is not shown.

eyes under general anesthesia, the esotropia either remaining constant in degree or decreasing only slightly.

(c) If, under general anesthesia, a muscle hook is placed in the lateral conjunctival fornix and depressed, this attempt to abduct the eye forcibly will result in a definite feeling of resistance to the abduction, and if abduction is forced by this method, the globe can easily be seen to retract.

(3) *Posterior check ligaments.* A final variation from the normal in the check ligaments of the medial rectus muscle in the esotropic patient is what could probably best be called a posterior check ligament. The normal check ligament arises from the muscle sheath just posterior to the level of the equator of the globe and when the ligaments are divided this far back, the external surface of the medial rectus is normally freed. A posterior check ligament, however, arises from the muscle sheath far back in the orbit and runs just as far anteriorly, inserting into the medial orbital wall along its entire course as shown in Figure 4. In order to section such a posterior ligament, one must often invade the orbit for a distance of perhaps 5 mm. past the level of the posterior pole of the eyeball. Until such posterior check ligaments are cut, the medial rectus will not stretch freely nor retract properly and the globe will not abduct as freely as it normally should.

Three variations from the normal check ligaments on the medial rectus muscle in patients with esotropia have been described:

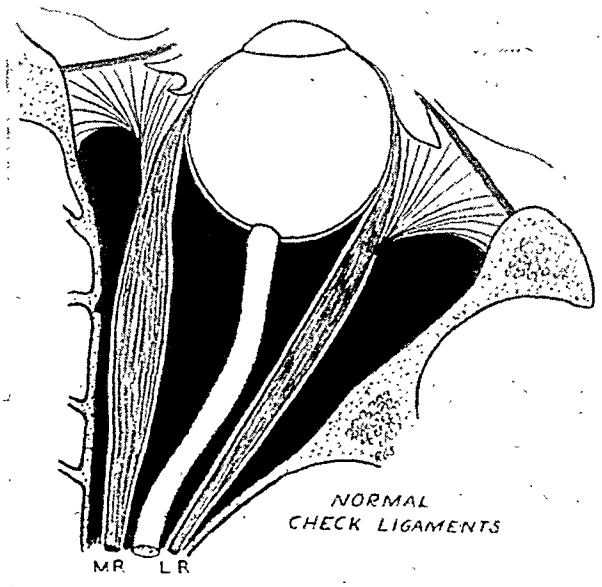


Fig. 4a (Scobee). Schematic diagram of the check ligaments of the horizontal muscles of the right eye as viewed from above.

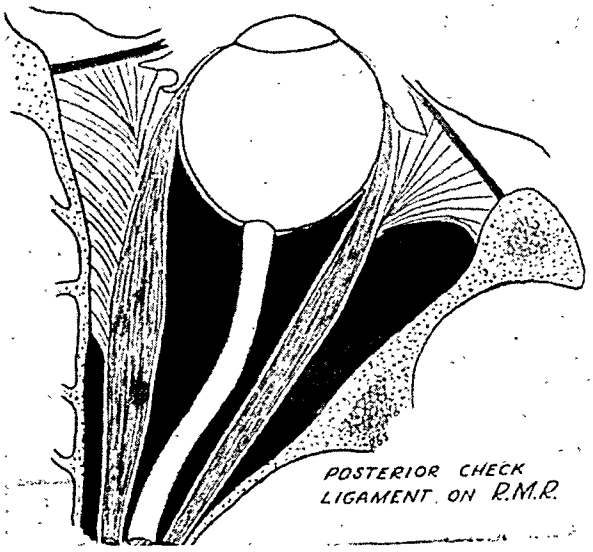


Fig. 4b (Scobee). The same as Figure 4a except that a posterior check ligament is present on the right medial rectus, and this is a definite anatomic anomaly.

(1) Extra and thickened check ligaments, (2) fused check ligaments, and (3) posterior check ligaments. The existence of any one or of all three together will prevent proper abduction of the globe with a muscle hook under general anesthesia, and may cause retraction of the eyeball if abduction is forced. The conscientious surgeon can, therefore, predict an abnormal check ligament or some other anatomic abnormality before he ever makes any incision at all.

free and unattached to retract indefinitely back into the orbit. On the contrary, the cut tendon retracts only from 3 to 5 mm. or even less because the capsule of Tenon which envelops the muscle is attached to the sclera at about the same distance from the cornea as the tendon insertion, and its connection with the muscle is sufficiently firm and intimate to serve as a secondary attachment for the muscle."

This structure running between the rec-

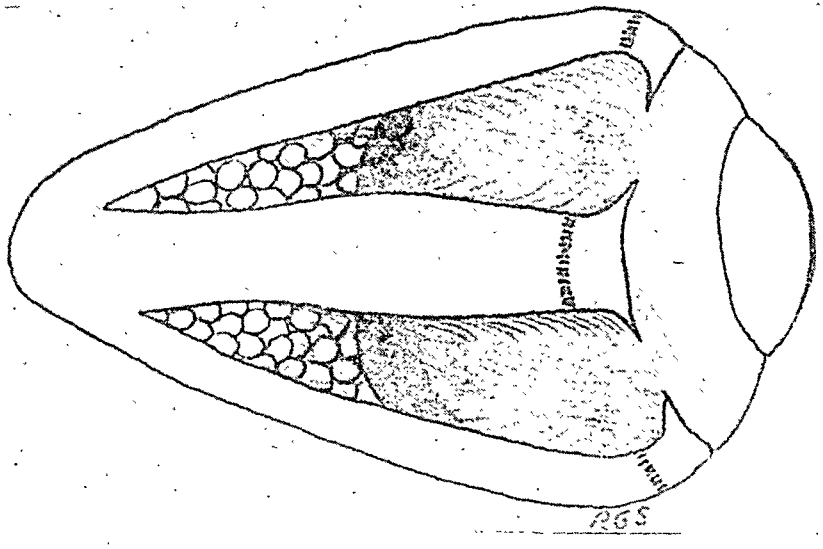


Fig. 5 (Scobee). View of the left eye from the medial surface to show the intermuscular membrane. The superior, medial, and inferior rectus are shown; running between them is the intermuscular membrane which is fairly dense anteriorly and thins perceptibly as it is traced posteriorly.

Two other check ligaments are invariably found on all of the rectus muscles, although they have not been called by that name. Lancaster[3] described them as follows: "The rectus muscles are inserted into the sclera by tendons the length of which is about half the diameter of the cornea. The width of the insertion is about equal to the diameter of the cornea. But these tendons and insertions do not represent the whole method of attachment of the muscles to the eyeball. Both surfaces of each muscle are covered with a thin layer of connective tissue which is the capsule of Tenon. These layers blend or unite at the edge of the muscle and continue as a single layer to the edge of the next muscle where it splits to cover both surfaces of this muscle, and so on around the eyeball. When the tendon is cut at its insertion into the sclera, the muscle and tendon are not left

tus muscles has been called the *intermuscular membrane* and it is shown in Figure 5. The check ligaments are fascial extensions of the muscle sheaths. The intermuscular membrane is an extension of the muscle sheaths. The check ligaments insert primarily into the periorbita while the intermuscular membrane inserts into the sclera. Both the check ligaments and the intermuscular membrane serve as secondary attachments of the muscles, both are subdivisions of the fascia of Tenon, and both may exert a checking action on excursions of the globe. Jameson[4] described the checking action of the intermuscular membrane and this will be considered in some detail in a subsequent paragraph. Suffice it to say that both the check ligaments and the intermuscular membrane can be considered as *check ligaments.*

There are three points about the check

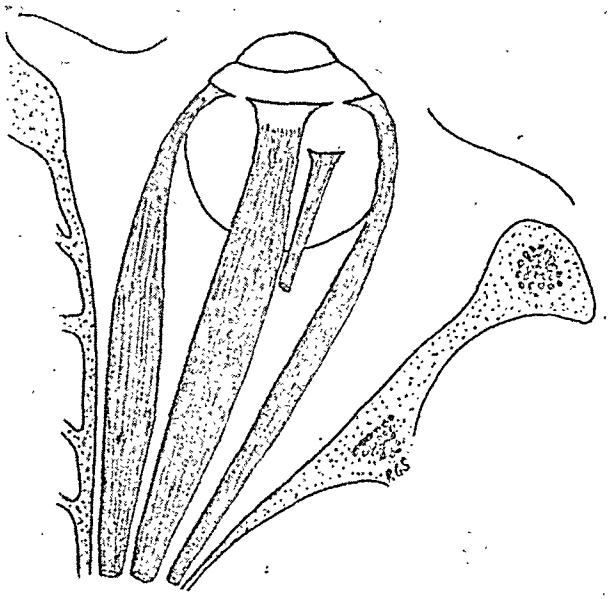


Fig. 6 (Scobee). Schematic diagram of the right eye as viewed from above showing the insertion of an abnormal muscle slip laterally and somewhat posteriorly. The slip appears to have arisen back in the orbit from the superior rectus but, since this is not certain, no definite origin is shown. A similar situation was found on the left eye of the patient mentioned in the text.

ligaments in heterotropia which must be emphasized:

(1) All anatomists have implied that any fascial expansion of the muscle sheaths are check ligaments. Therefore, the intermuscular membrane is a check ligament.

(2) The externally directed check ligaments, that is, those running to the orbital walls, are not a single fascial plane in the patient with heterotropia, but there may instead be several fanning out from each muscle sheath and running to the periorbita. In the case of esotropia, they fan out from the sheath of the medial rectus muscle.

(3) With but a single exception, all writers have pointed out that the check ligaments check *over-action* of the muscle from whose sheath they arise, but the fact that they may also *prevent adequate relaxation* when the antagonist of that same muscle contracts does not seem to be generally recognized at all.

Abnormal muscle slips

Abnormal muscle slips may either arise well back in the orbit and diverge slightly from the course of the rectus muscle which is their apparent source to become inserted into the globe at a point somewhat behind and to one side of the insertion of their parent muscle, or an abnormally large collection of muscle fibers will be found in the intermuscular membrane. The latter condition is by far the more common of the two. Abnormal muscle slips appear in association with the rectus muscles in the following order of frequency: (1) Superior rectus, (2) lateral rectus, (3) medial rectus, and (4) inferior rectus.

As an example of the first type—the abnormal slip inserted posterior to and to one side of the apparent muscle of origin—a 15-year-old girl with intermittent left hypertropia was subjected to two operations. At the first operation, the left superior rectus was receded to the equator. At the second operation, the left inferior rectus was resected some 4 mm. Neither procedure seemed to have any effect on the left hypertropia which became particularly evident in levoversion with the right eye fixing. At a third operation, the left superior rectus was severed from the globe and a muscle hook passed over the entire upper surface of the eyeball.

A muscle slip was hooked in this maneuver which seemed to arise from the superior rectus about half-way back in the orbit; it ran forward and slightly laterally to become inserted into the globe about 4-mm. lateral to the course of the left superior rectus and about 2-mm. anterior to the equator as shown in Figure 6. When the slip was sectioned and the left superior rectus reinserted in its receded position, the left hypertropia disappeared entirely.

A similar case was that of a 5-year-old boy with marked esotropia which appeared, according to the history, at about the age of one year. A slip which appeared to arise from the inferior border of the medial rectus was found and it was inserted below and about 4 mm. behind the normal inser-

tion of that muscle. Section of this slip corrected the deviation entirely and nothing was done to the medial rectus.

The second type of abnormal muscle slip —collections of muscle fibers running in the intermuscular membrane—is encountered much more frequently than the first type. The intermuscular membrane is normally thickest between the superior rectus and the lateral rectus. Not infrequently, patients with an apparent paresis of an inferior rectus and a consequent hypertropia on the same side are encountered. When the forced duction test is applied, definite resistance to infraduction is found in the eye in question. Surgical exploration will usually reveal what appears to be an abnormal and asymmetric insertion of the superior rectus; actually, the superior rectus has a normal insertion but a thick band of muscle fibers runs in the intermuscular membrane toward the lateral rectus and these fibers have a curving insertion into the sclera which extends laterally from the insertion of the superior rectus as shown in Figure 7. A small recession of the superior rectus plus sectioning of this lateral extension of the normal insertion is usually sufficient to correct the hypertropia entirely. Postoperatively, it is obvious that the inferior rectus was never paretic at all but that the abnormal muscle slip associated with the superior rectus prevented adequate relaxation of that muscle when its antagonist was contracting; naturally, the conclusion preoperatively was one of paresis of the inferior rectus.

In exotropia, it is not at all unusual to find an abnormally thick intermuscular membrane running between the lateral rectus and the inferior rectus and it often will contain abnormal bands of muscle fibers. Recession of the lateral rectus plus section of these fibers in their membrane is almost invariably sufficient to correct the deviation. And these abnormal bands, or merely the thickened intermuscular membrane without them, is sufficient to produce a definite feeling of resistance preoperatively when the forced duction test is applied. No resection or advancement of the medial rectus is necessary or even indicated in such cases, and yet they are often mistaken for paresis of a medial rectus and a so-called strengthening operation is performed on that muscle.

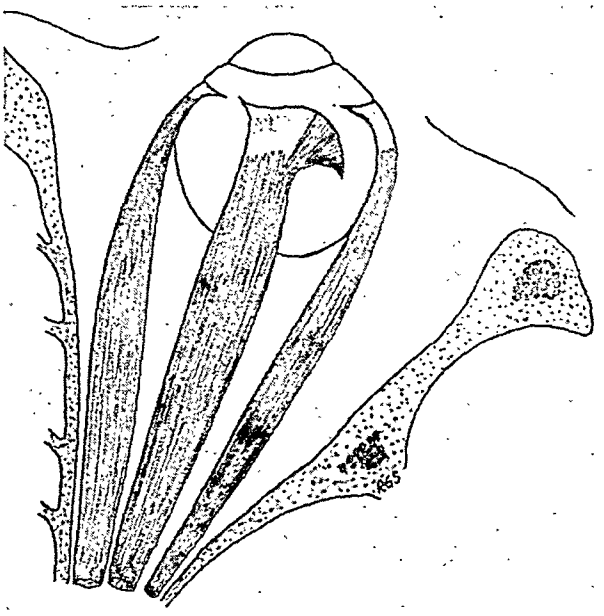


Fig. 7 (Scobee). Schematic diagram of the right eye as viewed from above and showing an abnormal insertion of the right superior rectus. The usual insertion is extended laterally and posteriorly in a curve and the extra insertion contains muscle fibers. Such an insertion is fairly common in patients with hypertropia with a preoperative diagnosis of paresis of an inferior rectus.

Abnormal insertions

At first glance, this category might seem to be an overlapping of the previous one. It is not, however, because what is meant by an abnormal insertion is a foot-plate type of insertion. The insertion line of the muscle at the usual distance from the limbus appears to be normal both in length and in direction. The intermuscular membrane is of normal thickness and contains no bands of muscle fibers. The check ligaments may appear to be perfectly normal.

When the linear insertion of the muscle is severed, however, the muscle will be found to be solidly attached to the globe backward from its linear insertion for a distance varying anywhere from 2 to 7 mm. This large,

broad insertion is solid—in short, a foot-plate—and is depicted in Figure 8.

Prior to surgery, the heterotropia in these cases is often erroneously attributed to paresis of, for example, a lateral rectus because esotropia is present, abduction of the eye is definitely limited, and fixation with that eye results in greater esotropia than fixation with the opposite eye. The latter point is strongly suggestive, of course, of

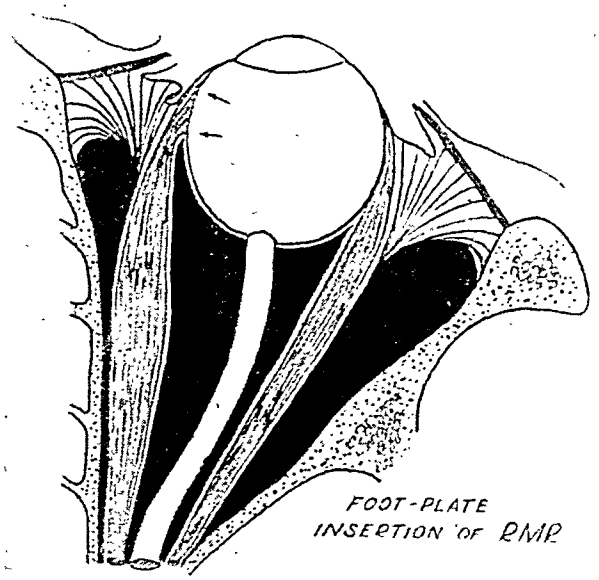


Fig. 8 (Scobee). Diagram of the right eye viewed from above and showing a foot-plate insertion of the right medial rectus. The right lateral rectus has a normal insertion. This solid insertion extends backward about 6 mm. from the normal linear insertion.

primary and secondary deviation following paresis. Indeed it is primary and secondary deviation although it is doubtful that paresis, at least in the usual sense of the word, had anything to do with the origin of the deviation. A muscle that is so attached is usually normal in size and elasticity.

Occasionally one finds such a muscle that has lost some of its elasticity and has apparently become contracted or perhaps even slightly fibrotic; this could well be due to its inability to relax properly over a long period of time when its antagonist contracted. After all, when an agonist is paretic, it is a commonly accepted idea that its antagonist may become contracted and even fibrotic for these same reasons. The presence of such a broad foot-plate insertion is invariably revealed preoperatively in the form of resistance to free rotation of the globe in the forced duction test applied under general anesthesia.

The forced duction test

When the patient with heterotropia is placed under general anesthesia, the tonus of all of the voluntary musculature of the body is markedly reduced. With respect to the oculorotary muscles, this means that they should all relax to the point where forced rotation of the globe in any direction, produced by placing a muscle hook in the conjunctival fornix and depressing it, should be free and easy. In at least 90 percent of all patients with heterotropia which became evident before the age of six years, forced ductions are not free and easy in all directions.

If a patient has esotropia, for example, and under general anesthesia the surgeon forcibly rotates first one and then the other eye outward (in forced abduction) by depressing the lateral conjunctival fornix with a muscle hook, unequal or at least increased resistance of the forced duction will be encountered on the two sides in 90 percent of the patients whose deviation appeared before the age of six years. In addition, the eye offering the greatest resistance to this forced abduction will also often be noted to retract.

When one explores the check ligaments and other attachments of the medial rectus of that eye, almost invariably the cause of the resistance to forced abduction and frequent retraction of the eye will be found. It seems obvious that the retraction is the same, at least on mechanical grounds, as that seen in Duane's retraction syndrome, and is indicative of inability of the medial rectus muscle of that eye to relax adequately

for one reason or another when its antagonist contracts.

O'Connor[5] is certain that the antagonist of a paretic muscle will become contracted before the expiration of the usual one-year waiting period following development of the paresis. He employs a procedure somewhat similar to the forced duction test but with the object of determining whether or not contracture has developed in the antagonist of a paretic muscle. His plan, however, is that of grasping the tendon of the suspected muscle through the conjunctiva with a fixation forceps, the eye having been anesthetized, and exerting traction. If either undue resistance is felt or the eye cannot be rotated through a normal excursion, O'Connor quite justifiably assumes that contracture is present. If one judges correctly from his papers on the subject, he only applies this test to patients with relatively recent paresis and then only in an attempt to determine the time of onset of contracture of the antagonist in order to select the proper time for surgical interference.

The forced duction test can be quickly and easily carried out prior to the beginning of an operation and will yield invaluable information. Its practical application will perhaps be more evident if a few illustrative and typical cases are cited.

A 4-year-old boy who had developed marked alternating esotropia at the age of three had no difference in the angle of deviation with either eye fixing. All available tests indicated what appeared to be a truly concomitant heterotropia. The angle of the deviation measured 25 degrees. Under general anesthesia, marked resistance to abduction was encountered in the left eye with the forced duction test. Surgical exploration of the left medial rectus revealed a fused type of check ligament. This was sectioned and the muscle receded to the equators. The result was 25 degrees of correction and the patient had good second-degree fusion within four months following the operation.

Another patient was a 5½-year-old girl with right esotropia which had become apparent at about three years of age. The deviation measured 32 degrees without her glasses and decreased to 20 degrees with glasses. Her correcting lenses were: +4.0D. sph. ⊃ +0.50D. cyl. ax. 90° in each eye. Voluntary abduction of the right eye was subnormal. The preoperative diagnosis was one of mild paresis of the right lateral rectus. Forced duction tests under general anesthesia elicited definite resistance of the right eye to abduction. The right medial rectus was explored and found to have five large check ligaments fanning out from the muscle sheath to the periorbita. These were sectioned and the muscle was found to be of normal size and elasticity; the muscle was receded 4 mm. The result was 22 degrees of correction. The plus spheres were slightly weakened and the patient soon developed fusion.

Patients with intermittent heterotropia have been the most difficult and unsatisfactory to classify in the past. These are the patients who have relatively high degrees of heterophoria and who lapse into heterotropia with fatigue or any undue usage of the eyes. The patient with between 20 and 30 prism diopters of exophoria who goes into frank exotropia with fatigue is a good example. Careful examination reveals only what appears to be convergence insufficiency or "divergence excess." The deviation, when elicited, is the same with either eye fixing. And yet forced ductions will almost invariably reveal increased resistance to adduction in both eyes, often unequal on the two sides. Surgical exploration of the lateral recti will usually reveal large check ligaments, particularly in that portion of the intermuscular membrane running downward to the inferior rectus. Often enough, this thickened membrane between lateral and inferior rectus will contain a band of muscle fibers. These abnormal bands have already been discussed as abnormal muscle slips. Section of all check ligaments and bands and

recession of the muscle are all that is needed if the deviation be not too great. If it is great, both lateral recti must be receded.

Dealing with anatomic factors

One might inquire as to why simple division of the abnormal attachments previously described should not be enough to correct the deviation, provided they were responsible for the deviation originally. In the first place, check ligaments acting in two directions can prevent adequate relaxation as well as over-contraction and thus lead to some degree of loss of elasticity, even to contracture and fibrosis in a muscle. Certainly it is not reasonable to expect that correction of the anatomic anomaly alone will correct the heterotropia in the face of the subsequent changes—that is, loss of elasticity, contracture, and fibrosis—which have occurred. In the second place, there may have been other etiologic factors in addition to the anatomic one.

Consider the patient with esotropia which appeared at about the age of three years. The eyes and the orbits are markedly divergent before birth, become less so at birth, and as the skull and its contained structures grow in infancy and childhood, the tension on the anatomic anomaly in the attachment of the medial rectus increases. This would mean that the position of rest in such a patient would be one of less-than-normal divergence at birth and one of decreasing divergence as growth proceeded. Meanwhile the growing child is discovering his developing powers of visual acuity and of accommodation. As he begins to see objects more clearly, he begins to attempt and to succeed in exerting more and more accommodation with its associated convergence. We have seen how the position of rest in such a patient instead of being one of frank divergence is one of little or no divergence—almost parallelism; furthermore, full abduction is impossible because of the anchoring effect of the anatomic anomaly on the medial rectus. The exercise of accommodation and convergence, when beginning from a position of rest of near-parallelism, is sufficient to produce frank esotropia. And this would be true *irrespective of the refractive error of the individual,* as long as anatomic anomalies were present either in the check ligaments, the muscle insertions, and so forth.

Hypermetropia is considered by many as a developmental anomaly in that the hypermetropic eye is usually a small eye, presumably one whose growth was arrested before attaining emmetropia. Abnormal anatomic attachments of the muscles are certainly developmental anomalies. The finding of one anomaly frequently means that others are present. This, then, is a possible explanation for the frequent association of hypermetropia with esotropia. However, the refractive error need make no difference, and esotropia in the myopic infant can also be explained on the basis of an anatomic anomaly; the same is true for anisometropia.

It does not seem likely that the majority of anatomic anomalies described in the muscle attachments could be sufficient in themselves alone to produce heterotropia except in such rare instances as strabismus fixus. However, the addition of the accommodation-convergence relationship, for one thing, can act as a precipitating factor in producing the deviation. Thus it is that a majority of cases of heterotropia have a definite and demonstrable accommodative element but almost invariably there can be demonstrated some underlying anatomic defect; otherwise the eyes would never have deviated in the first place except in a few instances.

When one operates on patients with paretic heterotropia of recent origin, these anatomic anomalies—that is, abnormal check ligament, abnormal muscle slips, abnormal insertions—are not found. And when one dissects the nonheterotropic cadaver orbit, these anatomic anomalies are not commonly found. They occur only in patients with heterotropia or with marked degrees of heterophoria. Surely their almost invariable

presence in patients with heterotropia and their invariable absence in patients without heterotropia is significant.

It does not seem likely that the existence of heterotropia could result in changes in the fascia of the check ligaments, and certainly it could not cause the development of abnormal muscle slips and abnormal insertions. Such an idea has been considered before, however, because Jameson[4] wrote:

"I think that it is not exceeding rational reasoning to consider that any eye deflected for many years acquires fascial contractions conforming to the fixed position of the globe in which the capsule (he refers to the intermuscular membrane) is an important part, and it is still within reason that a check ligament not called on to perform its function of a shock deterrent on the opposing side for a number of years may lose some of its elasticity and capability of stretching and assuming contractility, and may act as a deterrent to outward rotation."

One cannot disagree with Jameson on factual grounds about the patient who has had esotropia for 20 years; definite argument can be raised, however, about the child patient whose esotropia did not appear until the age of three years and who is subjected to surgery within 3 or 4 months after the deviation appeared because the same anatomic anomalies are found in the 3½-year-old child as in the 23-year-old adult patient.

The conclusion is therefore thrust upon us that the anatomic abnormalities preceded the heterotropia in point of time and that the heterotropia is at least partly due to these anatomic findings which have been described.

Method of inspection

The technique of searching for the anomalies described is simplicity itself and yet is followed by only a few. The muscle toward which suspicion is directed by the forced duction test, as well as by examinations preoperatively, is exposed on a muscle hook. A double-armed suture is placed through the tendon as close to the insertion as possible, the suture locked, and the tendon then severed from its insertion. Traction is made on the severed muscle by means of the double-armed suture and the muscle is pulled first away from the globe. This maneuver enables the operator to see whether or not a foot-plate type of insertion is present; if found, it may be divided.

The muscle is next pulled forward and toward the globe and the lips of the conjunctival incision are held apart by an assistant using forceps; the external check ligaments are thus put on a stretch and may not only be visualized but sectioned with scissors. It is to be emphasized that this is not a procedure of stripping the muscle of its sheath (to which there are serious and valid objections) but merely one of cutting the fascial extensions from the muscle sheath; no bare muscle is exposed. The check ligaments should be sectioned as far posteriorly as they may extend. If visibility is not good as one goes backward into the orbit with the inspection, a muscle hook can be passed gently backward along the orbital or external surface of the muscle. The check ligaments are not properly severed until this hook can be passed well beyond the posterior pole of the globe without encountering resistance.

Finally, in the case of the medial rectus, the muscle is pulled first upward and then downward in order that the intermuscular membrane can be inspected for thickness and the presence of abnormal muscle slips; the membrane should then be sectioned parallel to the borders of the muscle and a millimeter or so away from it, as shown in Figures 9 and 10.

When all anatomic anomalies of attachment are properly and completely sectioned, the muscle will usually retract promptly out of sight into the orbit when the tension on the muscle suture previously placed in the tendon is released. Once the muscle is thus freed, one may estimate its elasticity because this has an important bearing upon the amount of recession to be performed. As

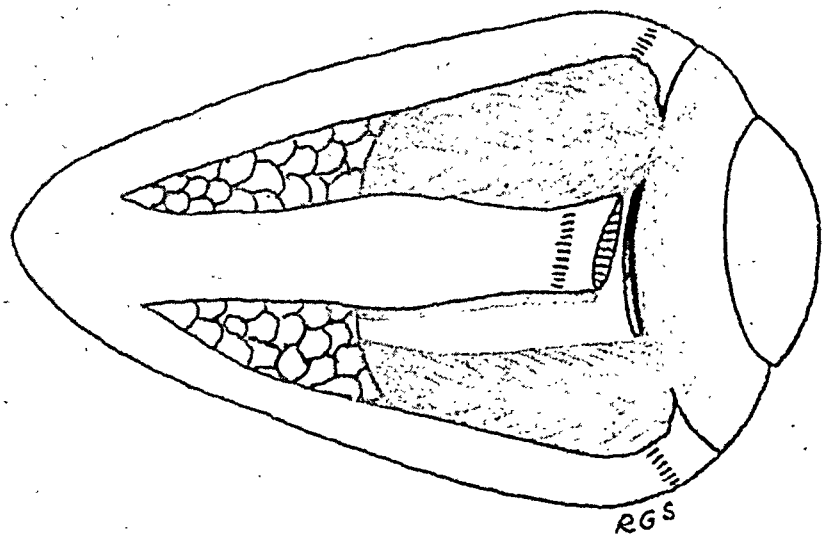


Fig. 9 (Scobee). View of the left eye from the medial surface showing the left medial rectus severed from the globe and the intermuscular membrane sectioned parallel to the lower margin of the muscle. Sclera is visible where the muscle has retracted and the intermuscular membrane pulled aside.

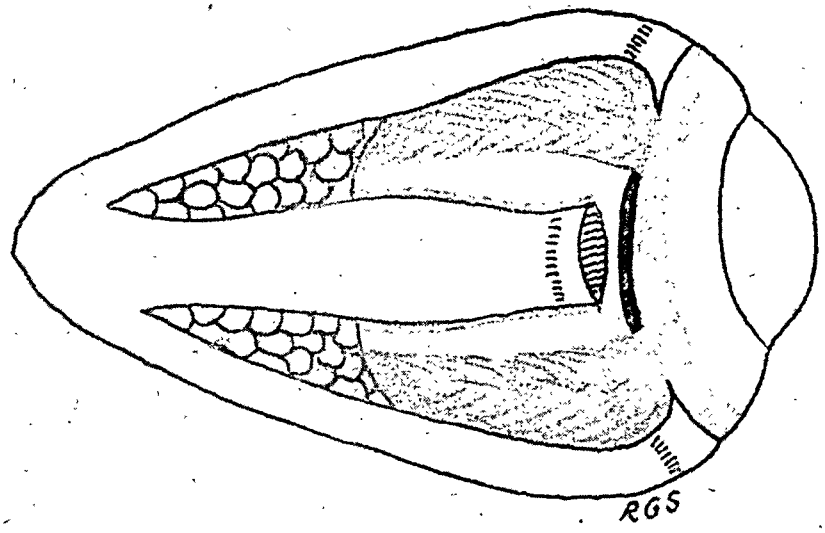


Fig. 10 (Scobee). The procedure of sectioning the intermuscular membrane (begun in Figure 9) has been completed. The muscle is now freed completely both superiorly and inferiorly. The other check ligaments are not shown.

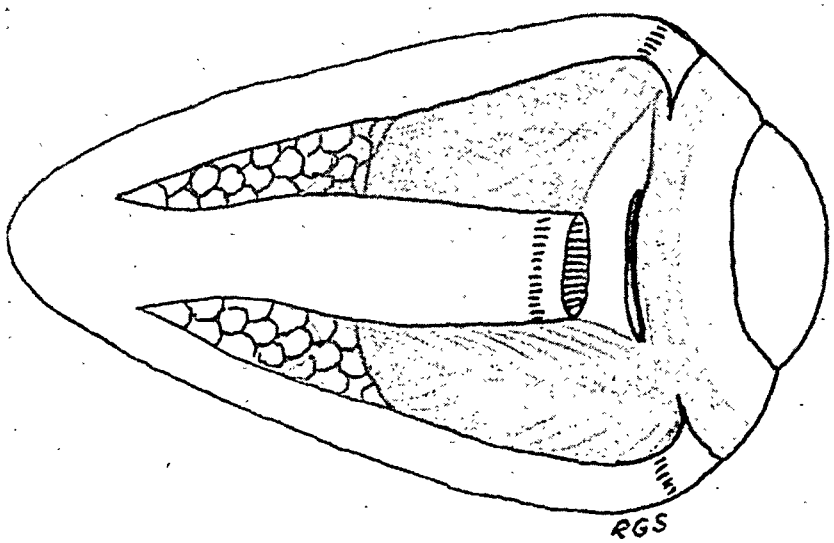


Fig. 11 (Scobee). The left eye viewed from the medial surface and illustrating Jameson's method of cutting the intermuscular membrane vertically. The left medial rectus has been severed from its insertion and a vertical cut started in the intermuscular membrane running upward toward the superior rectus. Jameson advised making a similar cut below toward the inferior rectus.

a final step, a muscle hook should be swept over the portion of the globe involved in a search for any abnormal muscle slips attached behind and to one side of the muscle under inspection.

The check ligaments should always be divided by sharp dissection, that is, with scissors, and never by blunt dissection as by tearing them with a muscle hook forced along the muscle edges because the latter procedure rarely severs all of the check ligaments, often tears the sheath from the muscle leaving bare fibers exposed, and almost invariably leads to the formation of troublesome adhesions which may partially negate the effect of the operation. When the muscle is properly freed, it may then be reinserted at whatever site is desired and the conjunctiva closed.

Objections to sectioning check ligaments

Many surgeons raise objections to any suggestion of cutting the check ligaments in the manner described in previous paragraphs. When pressed for reasons for their objections, a vague reference to retraction of the caruncle is the usual answer. Jameson[4] was one of the most prominent to counsel avoidance of the check ligaments and he, apparently, was also saddled by the bogey of "retraction of the caruncle." In speaking of his recession operation, he wrote ". . . the semilunar conjunctiva is also undermined in the direction of the caruncle, with care not to disturb the fascial trabeculae or areolar tissue on the surface of the muscle." And ". . . the areolar tissue in which the muscle is deeply imbedded in the region of the caruncle should not be sliced. If this is done, the muscle is endangered, the anatomy disarranged, and the reaction will be greater." And yet Jameson was the first exponent of complete division of the intermuscular membrane and he cut it vertically as shown in Figure 11. When first reporting his operation in 1922, he cautiously wrote that ". . . there has been but slight retraction of the caruncle and that difficult to distinguish and of negligible quantity." After 10 years of experience with his operation, he confidently reported in 1931[6] that ". . . it has been most noticeable that no caruncular retraction or inversion has occurred."

It will be recalled that some of the worst instances of retraction of the caruncle followed free tenotomy of the medial rectus. When one considers the anatomy, the reason is obvious. The medial rectus is attached by means of its check ligaments to the caruncle. When a free tenotomy is done, the muscle naturally retracts somewhat, tensing its check ligaments, and retracting the caruncle. On theoretic grounds, one would expect less retraction of the caruncle when the check ligaments are severed than when a recession is done and they are left intact. This is adequately borne out in a series of over 120 patients in whom the check ligaments of the medial rectus were completely divided by the technique previously described and not a single patient had a retracted caruncle.

It is difficult to see how Jameson could claim that sectioning the check ligaments would "disarrange the anatomy" any more than his free vertical sectioning of the intermuscular membrane. And he would have come much closer to the truth, perhaps, if he had not avoided them. He wrote[6] that ". . . even after this vertical capsulotomy is accomplished, forcible traction meets with obstruction to rotation in a few cases. The reasons are hard to fathom when both muscle and capsule are freed." The reasons would not have been difficult to fathom if he had not so religiously avoided the check ligaments!

One cannot admire Jameson enough for his forthright and scientific studies of the role of the intermuscular membrane in the etiology of heterotropia. He was one of the first to make the point that no final decision as to what surgery should be done could be made until the muscles were exposed at the time of operation. He wrote that ". . . when

exposure yields information that runs counter to the preoperative computation, one can close the wound and proceed on the opposing side." He was among the first to point out that a muscle might appear to be paretic when actually the true situation was anatomic abnormalities on the direct antagonist; section of these abnormal attachments, of course, led to complete "restoration" of function in the "paretic" muscle.

Esotropia, being more common than exotropia in young patients, will yield to recession of one or both medial recti in the majority of cases, *provided one carefully sections all abnormal attachments of the medial recti* and provided the medial recti are not too inelastic as a result of their inability to relax adequately; if they are inelastic, a shortening procedure may be necessary on one or both lateral recti in addition to recession of both medial recti. A deviation of 20 degrees in one patient and of 30 degrees in another may yield to recession of a single medial rectus *if* that muscle's abnormal attachments are severed. This is far more correction than might be expected with mathematical computation but is easily explainable in view of the anatomic anomalies encountered.

The writer does not ask the reader to accept without question these ideas which are presented, and indeed there will probably be few who will be so inclined. If the reader will, however, apply the forced duction test prior to operation and then carry out a search for anatomic anomalies as described, it is believed that the results will speak for themselves and that the individual operator will convince himself.

A classification of heterotropia

The statement has been made that 90 percent of all patients with heterotropia which developed before the age of six years have some anatomic anomaly underlying their heterotropia.

If the foregoing views are acceptable, or are found to be so at a later date, one may then elaborate what may perhaps be a more satisfactory classification of heterotropia. There would still be three main categories. (Monocular or alternating—exo-, eso-, hyper-, cyclo-).

A. Anatomic

1. Abnormal origins of muscles
2. Abnormal insertions
3. Abnormal muscle slips
4. Abnormal check ligaments
5. Abiotrophies

B. Innervational

1. Nervous (anomalies of convergence and divergence)*
2. Refractive (accommodative)*
3. Amblyopic (any organic obstacle to fusion)

C. Paretic

1. Toxic
2. Traumatic
3. Congenital

It will be noted that "a weak fusion faculty" or a "defect of the fusion faculty" has been omitted entirely in the classification and this is a radical departure from custom. The fusion mechanism is a well-recognized entity although it has never been demonstrated anatomically. It seems to attain its full development at about the age of six years, on the average. In the opinion of many, the fusion faculty is inherited just as brown eyes are inherited; it is said to be possible for a parent with a "weak fusion faculty" to pass on this defect to his or her offspring, and this is one explanation offered for the definite familial incidence of heterotropia. Chavasse[1] typifies the opposite view when he said ". . . we need no longer vainly gesticulate before the fireless altar of defect of the fusion faculty any more than we need to be content to regard lameness (with which strabismus has so

*This is frequently found superimposed upon some anatomic factor.

much in common) as a defect of the walking faculty."

It is believed that a careful search for anatomic abnormalities in every patient with heterotropia in every case that comes to surgery will soon convince the surgeon that Chavasse was right. Truly the role of anatomic abnormalities in heterotropia makes that entity very similar to lameness which is usually due to organic causes. One wonders if we have not been mentally lazy in the past and willing to speak of many cases as being due to a defect of the fusion faculty when a more thorough search would have revealed a more easily demonstrable and hence more acceptable cause for the deviation.

It is much easier to accept the idea of the inheritance of some anatomic abnormality from the parents, a common and well-recognized occurrence, rather than the inheritance of a weak fusion faculty. Anatomic abnormalities can be demonstrated in both parent and child while a defect of the fusion faculty is a nebulous entity whose existence can be shown only by inference.

In conclusion, one might well ask the value of such a classification to the clinician, even if he is willing to accept it. The answer is that it will lead to a far more successful therapy of heterotropia. The so-called "strengthening" operations alone will have nothing to recommend them except as they are used in conjunction with the recession. Cases of esotropia in children, for example, which appear to be due to a unilateral or a bilateral paresis of the sixth cranial nerve, may well be found to be due to abnormal check ligaments on the medial rectus muscles instead (as indeed so many of them are) which prevent adequate abduction of the eyes. The futility of trying to "strengthen" an apparently paretic lateral rectus when in reality the difficulty lies in a group of abnormal check ligaments or some other anatomic anomaly on the direct antagonist, that is, the medial rectus, should be obvious. One might as well double or triple the number of tugs used in an attempt to move the *Queen Mary* away from the dock when her anchoring shore-lines have never been cast off.

Lancaster[3] wrote that ". . . the two things for which we strive in operating are a position of orthophoria since, other things being equal, the nearer the eyes to a position of orthophoria, the less the task of the neuromuscular mechanism in maintaining binocular vision. Second, an effective range of fusion, this being, if possible, even more important than the former. A neuromuscular mechanism which, because of defective working of the controls, produces an exophoria, for example, may be made to produce an orthophoria by so shifting the position of the eyes in the orbit that approximately the same working of the controls will now result in orthophoria because the eyes start from a position nearer to the ideal one. *The idea that the purpose of operating on the ocular muscles is to weaken or strengthen some muscle which is too strong or too weak is unsound physiologically* (italics my own)."

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REVIEW OF 100 CASES OF RETINAL DETACHMENT*

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This paper is an analysis of 100 consecutive cases of idiopathic retinal detachment examined between January, 1945, and October, 1946, operated on with the electrodiathermy technique, and subsequently followed by us. Excluded in this series were 3 Linder underminings, 4 scleral resections done on aphakics, and 6 scleral resections done as a primary procedure by us on patients who had had previous diathermy operations. With the realization that 100 cases is an insufficient number on which to base any definite statistical conclusions, the figures herein presented serve to emphasize certain important features of retinal-detachment work. Inasmuch as the adverse outcome of an untreated case is well known, surgery was not denied anyone if they wished it, regardless of the appearance, duration, or apparent hopelessness of the case.

INITIAL EXAMINATION

Initial examination included vision tests, external examination, measurement of tension with the Schiøtz tonometer, slitlamp observation with dilated pupil, and inspection of the vitreous with the contact lens and slitlamp (Linder's offset corneal microscope). Perimetric fields were done with the smallest isotope visible to the patient.

Extremely careful fundus study and search for a retinal tear or tears was made with a sketch of the fundus diagraming the extent and elevation of the detachment. We have frequently found that, while tracing the retinal vessels and their branches, a tear may be located which has escaped notice in an overall fundus examination. The careful search for and localization of retinal tears cannot be overemphasized, since successful reattachment depends on closure or sealing of these tears.

FINDING TEARS

In regard to finding tears it must be remembered that a tear is not necessarily in the area of greatest detachment especially in those cases where the separation begins superiorly. Here the subretinal fluid gravitates inferiorly, and the tear may be found in a flat or apparently attached area of the retina. If a tear is not found at the first examination it may be hidden by an overhanging edge of the retina or in a deep fold, but when the retina settles back toward normal position following bed rest with binocular bandages, the tear may be revealed. Contradictorily, when the retina settles back the tears previously seen are often difficult to see because they become displaced far into the periphery or may not stand out because of the lack of color contrast.

When no tear has been found and the detachment settles out after several days of bed rest, the patient may be allowed to get up or to wear peephole glasses. Repeated examination may then show where the detachment reappears giving either a clue as to the location of the tear or the actual finding of it. A clue may also be obtained from the history as to where the detachment has commenced, and hence where the tear exists, if the patient noticed the location of the appearing shadow or curtain.

The tears are localized carefully with the hand perimeter as to arc and meridian. An arc of 50 degrees is considered to be 15 mm.

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posterior to the limbus, and each 5 degrees of arc is equal to approximately one millimeter.

Surgical management

Surgical management has been conducted in a similar way in these 100 cases. Preoperatively both eyes are bandaged, and the patient put at absolute bed rest in a position so that the retinal tear is in the most dependent part of the eye. In approximately half the cases, the retina had settled back markedly after this period of four or five days rest. No change was noted in 15 cases, and there were three cases in which the detachment increased in extent.

Surgery was done under local or combined local and avertin anesthesia. The horizontal meridian of the eye was marked at the limbus prior to the retrobulbar injection. The conjunctiva was incised 8 mm. from the limbus and, with Tenon's capsule, was separated from the sclera posteriorly.

Traction sutures were placed in the conjunctiva, and sling sutures through the muscle insertions to obtain better rotation. There was no hesitation in tenotomizing one or even two muscles to assure adequate exposure. The cornea was kept moist with normal saline, but covering it with the lid into which a traction suture had been placed was found to keep the cornea clearer than saline, glycerine, or other agents that have been recommended for this purpose.

The tear was localized directly with the ophthalmoscope (which is conveniently draped so as to be ready for use at all times), using an Arruga spoon and gentian violet to mark the relative position of the tear as it corresponded to the scleral surface. Rarely did the preoperative localization have to be transferred to the Walker rule and Linder dial for mathematical localization.

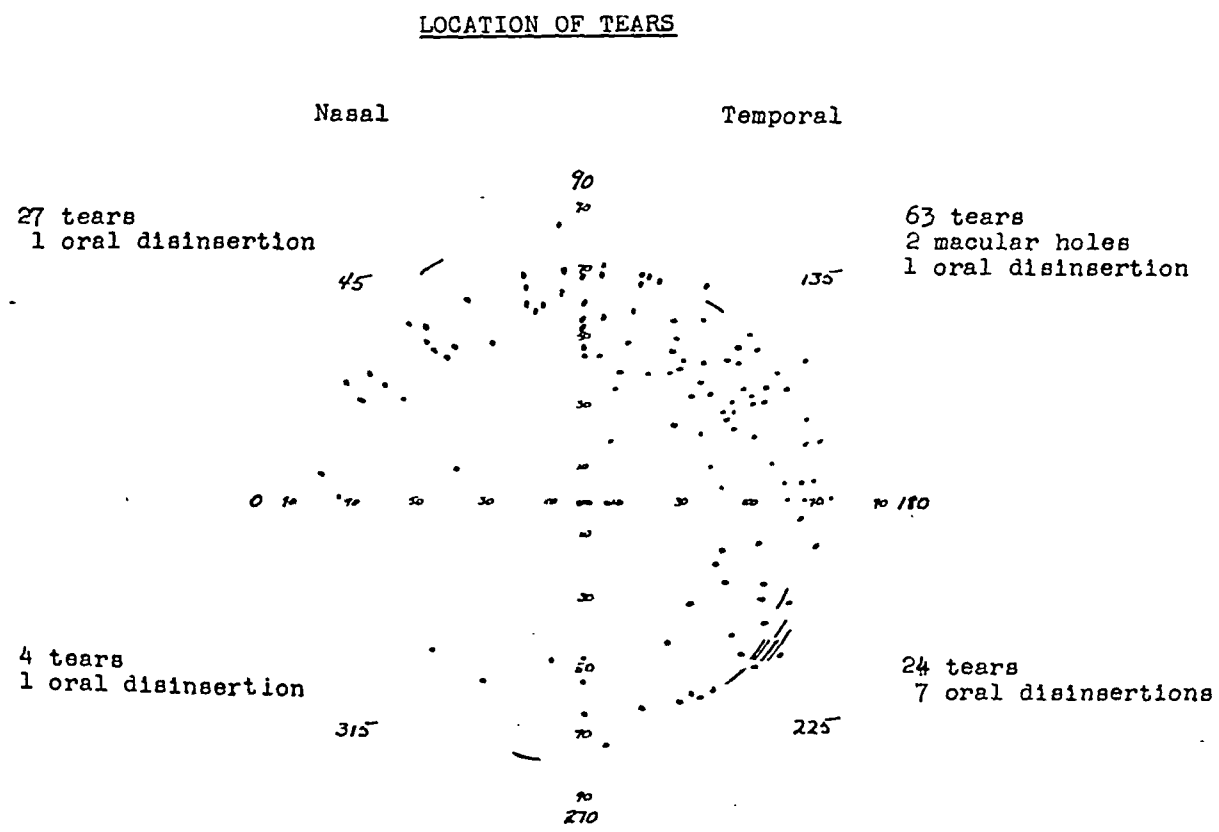


Fig. 1 (Appleby and Pischel). The location of tears in the present study was in agreement with the findings of other authors.

Partial penetrating Pischel electrodes and the Rose Walker diathermy machine were used, employing 50 milliamperes for 2 to 3 seconds. Two or three spots of diathermy were placed 1 to 2 mm. behind the localized tear, and the fundus was examined to see where these were in actual relation to the tear.

These spots usually showed well in the fundus, but if the retina was so elevated that they were not visible, a Pischel pin was inserted over the localized area on the sclera (done in 37 of these cases). This pin was almost invariably easily seen and served as an accurate guide to the location of the diathermy coagulations, assuring complete surrounding of the tear.

A double row of coagulations was placed about the tear coming up to the ora serrata (8 mm. in emmetropes, and 9 mm. in high myopes). Cystic areas were likewise included. Pischel pins (usually 9 to 12 of them) were inserted *within* the loop of diathermy barrage for drainage. Very frequently these pins could be seen to perforate the retina; therefore, it was decided that these newly formed retinal holes should be within the diathermy loop resulting in their being sealed also.

Occasionally, if no drainage was obtained from the pin openings, perforating electrodes or trephine openings were used. Frequently considerable more subretinal fluid could be aspirated from these openings in the sclera. In only 10 cases was air injected into the vitreous chamber to push the retina toward the choroid.

Postoperative care

The patients were kept in bed with binocular bandages for two weeks. The first of daily dressings was done on the second postoperative day, and stitches were removed the 7th to 10th day. The fundus was not examined until the 7th to 10th day. After 14 days, peephole glasses were substituted for bandages, and these were worn for an additional six weeks, with the patients' activities limited. During this period, the pupil was kept dilated with atropine or scopolamine.

Statistical analysis

Age and sex

Of the 100 cases analyzed 58 percent occurred in males, and 42 percent in females. Berens'[1] figures, 63 percent and 37 percent respectively, correspond closely to those reported by others, and the predominance shown by men has been explained by their predilection to trauma. In this series, 57 left eyes and 43 right eyes were affected, and in 13 cases both eyes had developed detachments; the time interval of involvement of the second eye varied between 5 months and 18 years. The maximum number of detachments occurred in patients aged between 60 and 65 years, but the average age for the entire series of cases was 49.5 years.

Refractive error

Myopia existed in 56 percent (31 cases 0.0D to −3.0D., 13 cases −3.0D. to −6.0D., 8 cases −6.0D. to −9.0D., the highest being −17.0D.); while 25 percent occurred in hyperopes (22 cases 0.0D. to +3.0D., the highest being +4.25D.). There was no record on the remaining cases. (Dunnington and Macnie[2] reported myopia existing in 53.8 percent and 66.6 percent of retinal detachments; Berens, in 68 percent; Shapland,[3] in 62.3 percent and Hine,[4] in 40 percent).

Precipitating factors

Of our patients, 43 percent gave a definite history of trauma which was believed to be the precipitating factor in producing the detachment. Seven of these were a direct blow on the eye, the remainder being indirect trauma such as a bump on the head, a hard fall, or heavy lifting. In three cases severe coughing and sneezing were implicated. Thirteen percent of the patients could recall no such trauma, and no history of trauma was recorded in 40 percent of the cases. It is of interest to note the time inter-

val between the so-called trauma and appearance of symptoms, as this is a frequent problem in establishing etiology.

We found it to be as follows:

60-90 days	6 cases
30-59 days	7 cases
14-29 days	2 cases
7-13 days	3 cases
1-6 days	13 cases

Symptoms

The most common presenting symptom was a shadow or curtain coming across the eye. This was noted by 44 patients; black spots or floaters by 31 (these are believed to be caused by slight hemorrhage into the vitreous from a ruptured blood vessel in the region of the retinal tear); flashes of light (resulting from mechanical stimulation of the retina) were noted by 14; and 39 complained only of blurred vision. Eight cases had been previously diagnosed as vitreous hemorrhage.

Parenthetically, it should be emphasized that all patients complaining of the sudden appearance of black spots before their eyes should be carefully examined for the presence of a retinal tear. Peripheral fields must be done and the examination repeated if nothing is found at the first examination. Arruga has 47 cases of retinal holes without detachment, and it is probably true that many more exist in those who do not consult a physician because of passing photopsia or black spots.

In this series, only one patient who had previously had a detachment in one eye noted black spots and flashes in the other. Several small holes were found in the periphery but no detachment developed (followed 10 months).

Retinal tears

Retinal tears were found in 88 percent of the cases, while in the remaining 12 percent no tear could be found. This is considerably higher than reported by others (Berens, 29 percent; Dunnington and Macnie, 56 percent; Shapland, 76.2 percent; and Meyer,[5] 57 percent) with the exception of Hine who in 120 cases found no retinal tear in only six cases. As Meyer pointed out, tears can usually be found if the ophthalmologist exercises sufficient care in his examination. We do not agree with those who believe that the finding of a retinal tear is unimportant in obtaining a reattachment. The mechanism of a detachment need only be considered to realize the necessity of finding and sealing off the tear in the retina to assure success.

The horseshoe-shaped tear was most common, occurring in 58 percent of the cases. Round holes were found in 33 percent, macular holes in 2 percent, linear and oval holes, each 7 percent, irregular rents in 5 percent, crescent shaped in 3 percent, and oral disinsertions in 10 percent. Multiple holes were found in 27 percent (2 to 8 tears). The location of tears can be seen in Figure 1 and is in agreement with the finding of others. Tremendous tears or large multiple tears decrease the chance of successful reattachment, but beyond this there was no relation to the type of tear and cures.

Type of detachments

We found that 35 percent of the detachments were classified as bullous in type, 33 percent as flat, and 32 percent as combined bullous and flat. A total detachment existed in 21 of the cases, 15 of which were cured despite the general opinion that these cases are hopeless. In 5 cases over three fourths of the retina was detached; in 12, three fourths was involved; in 36, one half; in 21, one fourth; and in 6 cases, the extent of the detachment involved less than one fourth of the retina, or was limited to the area of the tear. Comparison of the above findings with final results shows that the chance of surgical success is greater, the less the extent of the detachment. How-

ever, a detachment of total or marked extent should certainly not be disregarded nor considered hopeless.

Duration of detachment

The duration of a retinal detachment is difficult to determine and, in this series, was based only on the time of onset of symptoms regardless of the appearance of the retina. In this series, this time varied between one day and 11 years (the latter diagnosed by two ophthalmologists). The duration of the detachment is of importance in prognosis for anatomic and functional success. From Table 1 it may be seen that if the detachment had existed less than two months the chance of success was definitely enhanced. If the duration of the detachment was two months or over, the number of unsuccessful cases markedly increased. This bears out the necessity of treating cases of retinal detachment as emergencies, hospitalizing them immediately, and operating as soon as the retina has settled back toward normal position. This was usually found to be accomplished with 4 to 5 days of bed rest with binocular bandages.

TABLE 1

Duration of detachment

Duration in Months	Number of Cases	Number of Cases Unsuccessful
0 to 1	47	3 or 6.38%
1 to 2	11	1 or 9.09%
2 to 3	9	3 or 33.3 %
Over 3	23	5 or 21.7 %

Incidence of vitreous detachment

In 35 cases a posterior vitreous detachment was discerned with the contact lens and slitlamp, using Linder's offset corneal microscope; and in 6 cases no detachment was found; while in 9, the vitreous was noted as completely disorganized. Of the remaining 50 cases, there was no note of vitreous detachment. In this respect it must be remembered that no group of normal eyes was examined for comparison.

Complications

Out of the 100 patients, 6 had complications attributable to the retinal detachment. Four of these had iridocyclitis (2 inactive), and two had a tension of 40 mm. Hg (Schiøtz). One of the cases of increased ocular tension was controlled by eserine and pilocarpine in three days, following which mydriasis did not result in any elevation. In the other case a cyclodialysis was necessary to control the tension.

Criterion for success

The criterion for success in these 100 cases was based only upon permanent reattachment of the retina, regardless of the resultant visual acuity or peripheral field. With this as a basis, 86 percent of the cases were cured. It should again be mentioned that this series is not large, and that it was perhaps fortunate that we saw few bad cases in the time interval considered. With the inclusion of all detachment cases operated on by us during the period under consideration (Linder underminings, and scleral resections), 80.5 percent were cured.

A second diathermy operation to obtain reattachment was done on 15 eyes, 10 of which were successful. Two of the successes were on eyes that developed a second retinal tear and detachment completely isolated from the first. Six patients had been operated by diathermy elsewhere, two of whom had undergone two operations. These two and three of the others were cured.

In successful cases, an apparent reattachment is the usual finding at the time of discharge from the hospital. However, in five cases the detachment of the retina was still present at this time, only to become reattached within 4 to 6 weeks. Of those apparently successful, one became detached in the operated area after six months following a severe coughing and sneezing spell. This was an 83-year-old patient who refused fur-

ther surgery, and is listed as a failure. One other retina remained attached 1½ months and at the time, due to an unexplained cause suffered a practically complete detachment which increased in extent in spite of bed rest with binocular bandages. The two other cases of redetachment occurred after two months and 2½ weeks and were cured by reoperation.

Postoperative complications

Postoperative complications were minimal. One patient had a severe iridocyclitis which cleared with typhoid-fever therapy; another one had a hyphemia, while a 44-year-old woman became hysterical and had to be transferred to the psychiatric service (all failures).

One patient became so disoriented that she was allowed up with peephole glasses for the first three postoperative days, after which the routine was carried out in full (cure). Two others had small vitreous hemorrhages immediately following surgery (cures).

In no cured case was any change noted in the lens. It has been stated above that recti muscles were tenotomized without hesitation to assure adequate exposure. In those cases where the horizontal muscles were cut from their insertions, no important change in muscle balance has been noted. Of the vertical muscles tenotomized 9 cases showed a hypophoria, with 3 requiring prismatic correction for comfort. A hyperphoria resulted in 24 cases, requiring prism correction in 5; while 7 had orthophoria. In 12 cases, muscle balance was impossible to obtain, and in 7 none was recorded. In those cases where the muscle had not been cut, equal degrees of hypophoria and hyperphoria resulted, but in no case was it sufficient to be annoying to the patient.

In 49 cases, the retina was seen to recede toward the choroid to a considerable extent after drainage of subretinal fluid; moderately in 17; slight in 19; and no change was noted in 15. This had no apparent effect on the final outcome. Air was injected in 10 cases, and trephine openings were made in six.

Perimetric fields

Perimetric fields are taken at each postoperative visit at one-third meter distance with a 1-mm. test object (rarely 3 mm.). The immediate result in those cured cases was a return to a normal, or an almost normal, peripheral field, except in 13 cases. Twelve cases showed a constriction corresponding to the area of operation, and two were concentrically constricted. The only cases showing any gradual improvement of field were those five mentioned previously in which the retina became reattached over a period of time. Late loss of field was noted in four patients. In the first two, the loss was limited to the area of operation after six months and one year had elapsed, respectively. The third showed a shrinkage of field similar to that prior to surgery, and the fourth developed a concentric constriction of 20 degrees in five months. There was no relation between the duration of the detachment and the maintenance of peripheral vision or the late loss of it.

Visual results

The overall visual results may be seen in Table 2. In our 100 cases the visual

TABLE 2

Visual Results

Vision	Number of Cases	
	Preoperative	Postoperative
HM ½–6′	14	
CF 3–8′	13	
CF 1–3′	19	
20/400	7	3
20/300	3	
20/200	5	15
20/100	4	4
20/80	1	
20/70	1	3
20/60		4
20/50	3	11
20/40	2	8
20/30	4	10
20/25	2	4
20/20	8	22

acuity was found to be maximal after sufficient time had elapsed to allow for vitreous clearing. In no cases did improvement of vision continue over several months as has been noted by Kronfeld[6] and Sallman.[7]

Over a postoperative period varying between 2½ months and one year, five patients were found to have lost vision over that originally regained. In one, a definite macular cyst could be seen. In the others no definite ophthalmoscopic explanation was found, although the macula had been detached prior to surgery. The visual loss was as follows: 20/20 to 20/30, 20/30 to 20/70, 20/60 to 20/200, 20/50 to 20/100. Reese[8] in his detailed study showed that cystic degeneration occurred first in the macula, attaining its largest size in this area. He attributed this change to altered arterial circulation resulting in stasis of fluids. He also concluded that defective central vision suggests that macular detachment and cystic formation have existed even though not seen clinically. This late visual loss in the above cases may be the result of degenerative changes from circulatory impairment.

In the cases where the macula was not definitely detached, 21 obtained an acuity better than 20/30, one had 20/40, and two had 20/50.

Macular detachments

An attempt was made to study the return of function in those cases where the macula was included in the area of detachment. In 53 percent a total macular detachment existed, being based only on definite ophthalmoscopic findings. Questionable cases, as well as those in which the macular area was invisible due to an overhanging bulla, were not included.

The duration of the detachment was again only estimated according to the time of onset of symptoms. This was, however, believed to be frequently inaccurate as it was perhaps the time that central vision was affected rather than the onset of the original detachment. Kronfeld,[6] in 1933, after a meticulous study of his six cases and those reported in the literature, concluded that in complete macular detachment of not over eight weeks' duration, fair acuity could be expected (0.3 to 0.1), and if over two months functional recovery was rare but did occur. Gradle,[9] in 1943, felt the resulting central acuity was determined by the duration of the detachment and the patient's age, concluding that in cases of macular detachment the chance of functional return was good if the patient was not over 35 to 40 years. Subsequent to this age, he found a high percentage of macular cystic degeneration; and under 25 years, he believes that there is apt to be no degeneration despite the duration of the detachment.

TABLE 3

Macular detachments

Final Vision	Number of Cases	Age	Average Age	Duration of Detachment	Average Duration
20/20	5	14–66	44.4	7 days – 2 months	0.83 month
20/30	6	30–69	51.3	5 days – 1.5 months	0.69 month
20/40	7	42–69	60.0	3.5 weeks – 4 months	1.85 months
20/50	3	54–70	61.4	3 days – 2.5 months	1.60 months
20/60	3	44–68	56.0	10 days – 5 months	1.37 months
20/70	4	46–67	59.3	10 days – 5.5 months	3.38 months
20/100	15	45–76	59.5	9 days – 1 month	1.25 months
20/200	3	16–69	47.2	3 days –11 years	29.2 months
20/400	3	19–55	35.6	1.5 months–11 months	4.8 months

Our 53 percent of macular detachments has been recorded in Table 3 as to the duration of the detachment and the age of the patient related to final acuity. (In Table 4 each case has been tabulated separately.)

From this it can be seen that the return of good central vision is more closely related to the duration of the detachment than to the age of the patient. Although not entirely consistent, if the detachment has existed less than one month, a good visual restoration can be expected (20/30 or better), and if less than two months a fair acuity may result (20/60 or better). However, in cases of long duration one should not hesitate to attempt an operation, since useful vision for practical purposes may be achieved. The two patients with macular holes obtained 20/200 and 20/400 vision.

Unsuccessful cases

In reviewing the 14 unsuccessful cases, the age of the patient varied between 1½ to 83 years, with three in the 55 to 60 age group, and four in the 60 to 65 group. Sex played no role. There was no record of refraction in seven cases, but one was a high myope of −13.0D., and three had between −1.0D. and −2.0D. The duration of the detachment varied between 3 days and 10 months, five existing from 1 to 3 months. In two cases, no retinal tear was found, and of three reoperated cases, two had no visible tear, and one had a small secondary hole. Among these 14 cases there were four horseshoe-shaped rents (two very extensive), a very large oval tear, one round hole present between the macula and disc, and six in which multiple tears occurred. These varied from 2 to 6 in number.

Six cases had total detachments, while in three the detachment involved three fourths of the eyeball, and in the remaining five only one half of the retina was detached. Three of the detachments had stiff white folds agglutinated together by vitreous strands. Prior to surgery following bed rest with binocular bandages, the retina receded markedly in three cases, slightly in four, with no changes noted in four. In three cases, the detachment progressed despite bed rest.

The surgery on all these cases was performed in the usual manner. It was uneventful with the exception of one instance when the electrode perforated an old diathermy spot resulting in vitreous loss. Drainage was good in all cases, although in two cases, trephine openings had to be made to obtain adequate release of subretinal fluid. In seven

TABLE 4

Macular detachments

Duration of Detachment	Age	Vision Before Surgery	Vision After Surgery
3 days	54	CF 4′	20/50
3 days	56	CF 6′	20/60 to 20/200
4 days	64	20/400	20/200
4 days	66	HM	20/20
5 days	54	20/300	20/30
7 days	55	CF 2½′	20/20
7 days	61	HM 2′	20/100
7 days	63	CF 1′	20/200
9 days	56	HM	20/100
10 days	30	CF 2½′	20/30
10 days	46	CF 2′	20/80
10 days	68	CF 8′	20/60
10 days	70	CF 3′	20/50
2 weeks	47	HM	20/60
2 weeks	69	CF 4′	20/30
2½ weeks	69	CF 2′	20/40
3 weeks	59	CF 8″	20/30
3 weeks	63	10/200	20/50
3 weeks	66	20/200	20/40
3 weeks	69	HM 3′	20/200
3½ weeks	42	CF 10′	20/40
1 month	24	20/100	20/20
1 month	45	CF 2′	20/50 to 20/100
1 month	61	CF 5′	20/30
1 month	65	CF 2′	20/70
1 month	66	HM	20/50
1 month	72	CF 3′	20/40
1½ months	35	20/70	20/30
1½ months	55	HM 2′	20/400
2 months	33	CF 3′	20/200
2 months	61	HM 2′	20/400
2 months	62	HM	20/50
2½ months	55	20/300	20/50
3 months	60	CF 1′	20/100
3½ months	76	20/300	20/100
4 months	37	10/200	20/200
4 months	54	20/400	20/40
4 months	57	HM ½′	20/40
5 months	53	20/400	20/60
5 months	69	CF 2′	20/400
5½ months	47	20/400	20/200
5½ months	67	20/200	20/30 to 20/70
6 months	60	CF 6′	20/50
8 months	62	CF 1′	20/200
8 months	64	HM	20/200
11 months	19	HM	20/400
1½ years	16	20/400	20/200
4 years 4 mo.	24	CF 2′	20/200
8 years	23	20/600	20/200
8 years	20	?	20/200
11 years	39	20/400	20/200

cases 1½ cc. of air were injected into the vitreous chamber in an attempt to approximate the retina and choroid. In two cases, scleral resections were done following unsuccessful diathermy operations without further improvement.

Postoperative complications have been included in those above.

In one case the extensive horseshoe tear was seen to be still open at one small area, but reoperation was refused by the patient. In two others the tears were not closed at all.

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PROBLEMS IN RESEARCH IN ORTHOPTICS*

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Orthoptics is a comparatively new field of science. It has not yet evolved from the "trial and error" stage which is typical of all beginnings. If orthoptics is to continue its present rapid growth and to reach maturity with universal application as well as acceptance of its principles and methods, research is imperative to improve the results of our "trials" and to eliminate the wasted time and effort that constitute the bulk of "errors." We need to be able to give specific answers to specific questions, and these answers need to be substantiated by accurate data in order to gain the respect and confidence of the ophthalmologist and of the parent whose complete coöperation with the technician is so essential for worthwhile results.

The dictionary defines research as "the effort to find new information by experiment or by thorough investigation of sources; a careful inquiry or diligent investigation to discover facts by study." The key words in these definitions are: *new information, facts*—these are our immediate goal; *experiment, investigation of sources, inquiry, study*—these are the methods.

INFORMATION AND FACTS

If one applies this definition to orthoptics and considers what new information and facts would make the daily routine of treatment more effective, he realizes that the field for research is wide and its possibilities manifold. One does not have to search for a suitable topic for study, for every day some problem arises for which there is no satisfactory solution to be found in current orthoptic literature.

Motivation for research is not a basic problem. One does not have to be inspired with lofty ideals of service or with a consuming ambition for fame and recognition. The common sense that inspired the adage, "build a better mouse-trap," is sufficient. The answer to our daily problem makes our task easier and more pleasant and helps us to avoid the tedium of purely mechanical repetition.

You may say, "But I have had no training, no experience in research methods. Where shall I begin?"

Begin thinking about that daily problem. Method will evolve from trial and error, if necessary, and "know-how" will come with momentum.

COLLECTING OF SOURCE MATERIAL

The first step in any research problem is the collecting of source material. One usually thinks of source material as all printed matter pertaining to his subject. Extensive reading is required and is greatly facilitated if one is acquainted with available library resources. Find out how you may obtain library privileges, inquire into procedures for using or borrowing books, learn the arrangement of periodicals, general reference books, dictionaries, and textbooks so that it is a quick and easy matter to find any specific reference. Some cities have a Union Catalogue Service which one may call to find out in which library any book is obtainable.

Since most articles on orthoptics and many on strabismus have been written in recent years and published in current periodicals, they can easily be found by consulting the *Index Medicus,* a reference book published twice yearly which lists all articles published in medical journals during the six months' period. The articles are listed both by author and by subject. Subheadings give the full title. There are often cross refer-

* From the Orthoptic Clinic, St. Vincent's Hospital, Erie, Pennsylvania. Read before the sixth annual meeting of the American Association of Orthoptic Technicians, Chicago, Illinois, October 12, 1947.

ences to a specific topic which might be listed under two general subject headings. Unfortunately, there is no such listing for books. One usually can obtain all important references by consulting the bibliography given at the end of articles published in periodicals. Textbooks often give excellent bibliographies at the ends of chapters on the specific material in that chapter. It is advisable to start with the latest publications and work back, as older articles may be made obsolete by more recent discoveries and study.

Studying periodicals

It is an excellent idea to keep up one's background reading as articles are published. Certainly the *American Journal of Ophthalmology* and the *Archives of Ophthalmology* are available to all of us. The *British Journal of Ophthalmology* has excellent articles. If one abstracts an article as he reads it, he has a permanent record of its usefulness available at any time. The length of the abstract and the amount of information in it may vary according to the value of the article for one's particular needs. It may be only a notation, such as good bibliography, or it may be a fairly complete summary of the entire paper. Frequently it may consist of the conclusions drawn at the end of the article. It is sometimes valuable to note for future reading references given to some other Journal not immediately available. I formed the habit of filing abstracts on white cards by general subject, such as diagnosis, treatment, statistics, tests, and so forth with author, title, periodical at the top of the card, so that they are immediately accessible. The abstracts compiled in the past two years by the American Association of Orthoptic Technicians are complete and most helpful.

Analysis of cases

Our second consideration is analysis of cases. This forms the bulk of orthoptic research. The patient is our first-hand material, and the study of his condition, reactions, and progress constitutes our original contribution in the field of research.

In everyday planning for clinic efficiency, preparation for case analysis can be started. Infinite time will be saved if records of diagnosis and daily treatment are complete, uniform, and well arranged. To illustrate, measurements by various methods should be in one space where they are easily compared. Tests for correspondence should be listed together. Printed forms which can be filled in save time and are clearer. A definite system of follow-up for discharged patients is valuable for comparative data.

Another time-saving device is a diagnostic file. When the diagnosis of each case is complete, that record should be classified under headings of possible investigation; for instance, causal factor, correspondence, amblyopia, phorias, hyperphoria, and so forth. There is no regulation set of headings. Individual interest and needs dictate one's grouping. When one wants to make a study of any of these topics, he has at hand a list of all pertinent cases and is not faced by the laborious task of going over all his records. Such a file is of value also in quick compilation of data for reports.

Perhaps procedures in case analysis will be clearer if we take a hypothetical research project and trace our steps one by one. Let us take retinal correspondence to see what is its relationship to other factors present in convergent squint, and whether type of correspondence is conditioned by any one of these factors to the exclusion of the others. The following series of topics is complete for our purpose:

1. Causal factor
2. Angle of deviation
3. Age of onset
4. Years of duration
5. Amblyopia
6. Alternation

One finds in reviewing current literature that the last four topics have been consid-

ered by various authors to be determining factors in the type of correspondence found in any case.

Selection of cases for study. The first step is selection of cases for the study. Data on every case included must be standardized and complete. Standard data in the series above would involve: (1) The same test or tests for diagnosis of correspondence, (2) definite specifications for classification into any causal category, (3) uniform method of measuring the deviation, (4) reliability of history in age of onset and duration, (5) standard system of classifying degree of amblyopia, (6) specifications for differentiation between monoculars and alternators. Any history which does not have all the above information must be discarded. Ideally, in a study of this sort, all cases of convergent squint which come into the office or clinic should be usable to give a true overall picture and the most accurate results possible. One cannot attain such uniformity, but he should attempt to keep the cases he selects representative of the whole group.

Charting of cases is the second step. A chart on which all necessary material can be listed makes it possible to collect all data on one work sheet. Large sheets of cardboard or even a roll of white wrapping paper may suffice. A usable chart for our sample project might have the following headings (adequately spaced and reading from left to right): History number, correspondence (subdivided into two columns for normal and anomalous), causal factor, angle of deviation, age of onset, years of duration, amblyopia, alternation (with three columns for monoculars, borderline cases, and alternators).

Once this information is transferred from the case histories to the chart, we are ready to get percentages.

First comes number of cases of normal and of anomalous correspondence and the percentage of their occurrence. Next, the number of cases according to cause and the percentage of their distribution. Then comes correlation of causal factor and correspondence which shows the number of normal and of anomalous correspondence cases in each causal factor category. Two sets of percentages can now be obtained: (1) For distribution of each type of correspondence through the various causal groups; that is, what percentage of cases with anomalous and what

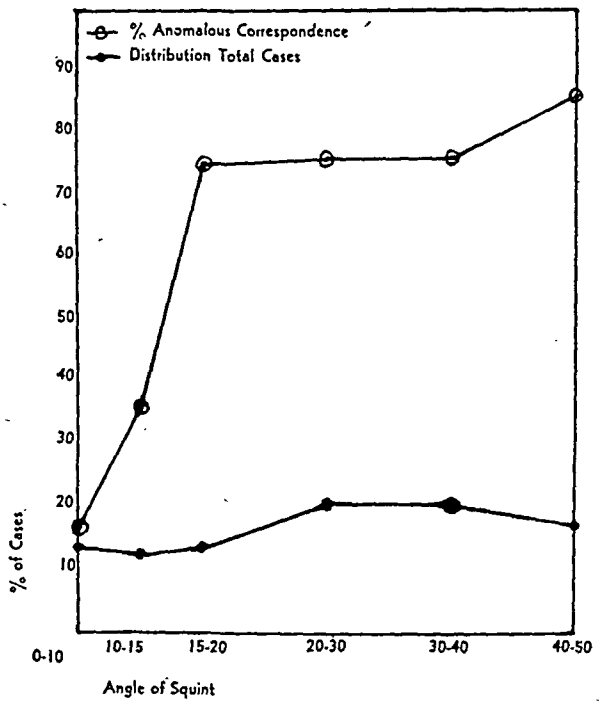


Fig. 1 (Jackson). In a graph, percentage of total cases will be the vertical component; the comparison factor, the lateral. A connected line or curve, or solid blocks may be used to show their changing relationship. A second curve or set of blocks may be used to show the incidence of anomalous or normal correspondence. When two lines or sets of blocks are used, they must have individual markings recorded in the graph key. The line or curve graph is used where the steps of the lateral factor are interrelated or show continuity. The block graph is clearer if the lateral factor is comprised of separate entities in order to emphasize comparison between them. To illustrate, a line graph works out very nicely in charting distribution of total cases and/or percentage of anomalous correspondence by angle of squint, since there is continuity in gradation of squint angle.

percentage of those with normal correspondence are accommodative, paralytic, and so forth, and (2) comparative percentages of the occurrence of both types of correspondence in each causal group, or what

percentage of cases of each of these groups have anomalous and what percentage have normal correspondence.

Our next column, angle of deviation, gives us figures on the size of the squint in our cases, and again, correlation with correspondence shows distribution of normal

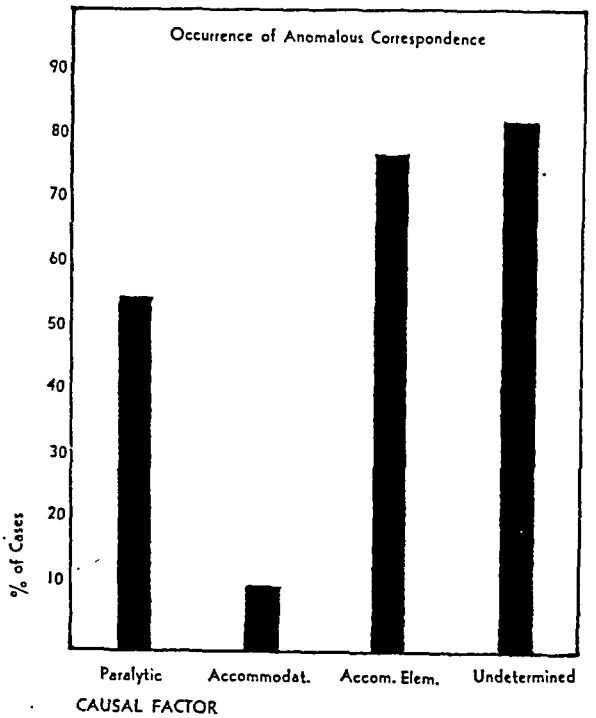


Fig. 2 (Jackson). A block graph shows distribution of total cases or percentage of anomalous correspondence according to causal factor more clearly since the entities listed are different, and we want to compare rather than to connect them.

and anomalous in varying amounts of deviation. Similarly with the other headings on our chart.

As figures are obtained for each column, they should be set down in percentage tables with headings across the page showing total cases and their distribution according to correspondence (table 1), the first column from top to bottom showing the related factor (angle of squint, age of onset, and so forth). It is a good idea to draw a graph of these figures in order to show their relationship more clearly (fig. 1).

We now have statistics on each entity and its relation to correspondence, but in order to evaluate these figures properly and to eliminate, if possible, 5 of the 6 factors, we must have relationships between the factors (disregarding correspondence for the time-being); that is, angle of deviation and causal factor, angle of deviation and alternation, causal factor and alternation and so forth.

Correlation of Facts

The material is now analyzed, and the next step is synthesis or correlation of the facts so far obtained. These isolated figures are like pieces of a jig-saw puzzle which must be put together to form a meaningful picture.

Conclusions must be based on careful evaluation, comparison, checking and re-checking to make certain that no item which might alter the results has been overlooked. If statistics are accurate, certain facts become apparent, and definite conclusions can be drawn.

The principal value of a statistical survey

TABLE 1

Cases and their distribution according to correspondence*

Angle	Correspondence				Total Cases	
	Normal		Anomalous			
	No.	%	No.	%	No.	%
0–10°	20	83	4	17	24	14
10–15°	12	63	7	37	19	12
15–20°	6	25	18	75	24	14
20–30°	8	24	26	76	34	21
30–40°	8	24	25	76	33	20
40–50°	4	14	25	86	29	18

* Figures for percentage table and graphs taken from a study of 175 cases of convergent squint by Adler and Jackson: *Correlations Between the Sensory and Motor Disturbances in Convergent Squint.* Arch. Ophth., **38**: 289 (Sept.) 1947.

of this sort is elimination of extraneous factors. By clarifying the basic problem, it leads the way to further study without waste of time or effort.

The worth of any large study lies in the elimination of variables. There are always three variables in orthoptics—the child, the

methods and tools, and the technician. By standardizing diagnostic or treatment methods in the cases reported, we have eliminated one variable. We can never totally eliminate the individual factor in the other two variables. However, the more cases studied, the more are the individual differences of the child minimized. If coöperative comparative analysis could be made at various clinics, and the results pooled and evaluated as a whole, the technician variable would be reduced.

Comparison study

Another type of research project of great value in the field of orthoptics is the comparison study. Evaluation of treatment method and results would come under this heading. By comparison, one method will prove itself best, and other less efficient treatments can be discarded. In a study of this sort, it is essential to have a control group, that is, a series of cases to which cases under analysis can be compared. For instance, in evaluation of results of orthoptic treatment, we should have a group of patients who have had no treatment to give us a basis for claiming the value of orthoptic procedure. Here again, the larger the series of cases studied, the less will individual variation in cases affect the final figures.

Report of individual cases, or small series, is another method of research. Its aim and value lie in pointing out some particular phenomenon or in suggesting some form of therapy, in calling attention to some important factor not stressed by previous authors. As a classic example, I refer you to Dr. Kenneth Swan's article on "Esotropia Following Occlusion" (Arch. Ophth., 37: 444 (April) 1947). It has aroused great interest and stimulated better therapeutics generally, besides pointing out the one factor which is basic in a condition sufficiently unusual to be puzzling when it occurs.

Writing reports

A few practical suggestions for the actual writing of papers and reports may be useful.

1. Standards of analysis must be given, so that the reader has some measure by which to evaluate the findings reported.

2. Any quotation or information from another source which you may use must be acknowledged, and the author, book or article title, periodical or publisher given in a footnote reference. Medical publications have a standard method of footnote reference which you can check on in the *American Journal of Ophthalmology* or the *Archives of Ophthalmology*. If your paper consists largely in compilation and reorganization of reading material, a complete bibliography of material referred to should be given at the end of the paper.

3. Only pertinent information must be included. Extraneous material, although interesting, detracts from the point in question. Choose a title to fit the purpose of the paper. Study your findings, and once having decided what you are trying to prove, outline the steps by which your material will build up to the final conclusion logically. Relate the introduction to the conclusions.

4. Evaluate your reader's background for the information you have to offer. You will have done extensive reading in your subject. Has this material been easily accessible to your anticipated readers? What do textbooks give on your subject? They are a good key to your reader's mind-set. Does textbook terminology coincide with yours, or will you have to simplify and explain the terms used. Consider how much background material will be necessary for your reader's understanding. It is a safe rule to err on the side of simplicity.

Topics for consideration

The problems of research are synonymous with the problems of orthoptics. The solving of individual problems carries with it a solution to basic but less specific inadequacies of the profession.

To offer a few topics for consideration:

1. There is a great need for clarification of orthoptic terms on the basis of ophthalmic terminology. Many ophthalmologists think of sensory phenomena in the terms of Worth. Since his time, the major amblyoscope has provided an entirely different group of findings. The use of Worth's terminology as applied to present-day orthoptic methods has resulted in a state of confusion which makes coöperation with the ophthalmologist difficult for lack of common understanding.

2. Comparative evaluation of method. A statistical survey of results would not only improve results but would give much needed standards for their evaluation.

3. A study of the basic principles of child psychology as they apply to orthoptics would give knowledge of what can be expected of the child at various age levels and of how to motivate the tasks which are set for him, thus helping to eliminate age and coöperation variables.

4. The collection and analysis of sensory data is needed to stimulate and direct further ophthalmological study into etiology, manifestations, and over-all treatment of squint. Further analysis of retinal correspondence and divergent squint come to mind as examples.

One of the outstanding values to be gained from research is a truer perspective of the whole field of binocular training. Faced by the constant variability of our daily cases, we are too prone "not to see the woods for the trees."

Summary

Much time and preliminary effort involved in research can be minimized by (1) a definite system in keeping records of diagnosis, treatment, and follow-up cases, (2) abstract file of current publications, (3) diagnostic file of case histories.

Analysis of cases represents the bulk of orthoptic research. Results of such analysis can be presented in three ways: statistical survey, comparison study, and report of individual cases.

Five benefits are to be derived from research in orthoptics.

1. Clarification of orthoptic terminology
2. Standardization for evaluation of results
3. Elimination of variable factors
4. Collection of sensory data
5. A better sense of perspective for routine treatment

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AGNOSTIC ALEXIA WITHOUT AGRAPHIA FOLLOWING TRAUMA*

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Agnostic alexia is an infrequent form of aphasia and is a variety of visual agnosia (mind blindness).[1] It is a disturbance of language function consisting of failure of recognition of the conventional meaning of graphic symbols, and may include inability to read letters, syllables, words, musical notes, and mathematical figures.

The terms alexia and word blindness, which are most frequently used for this condition, are somewhat objectionable in that inability to read may depend on many different focal cerebral defects. Agnostic alexia is more specific for it is used in contradistinction to aphasic alexia and semantic alexia.[2] In aphasic alexia there is loss of ability to comprehend statements of a simple character, the words being properly recognized. In semantic alexia the patient is unable to comprehend complicated statements while retaining the ability to grasp simple ones.

The act of seeing is a highly complicated procedure requiring the integrity of the optic apparatus and a considerable part of the cerebral cortex. Much of the mechanism of how it is accomplished is conjectural and controversial, and its study involves the fields of anatomy, physiology, and psychology.

Experimental and clinical investigations have proved that the calcarine area (area 17 of Brodmann) of the occipital lobe is the site of the primary cortical termination of the visual impulse.[3] Neurons from the retina maintain a precise spatial organization in their course to the external geniculate body and thence to the calcarine cortex, thereby producing point to point retinal representation throughout the radiation and calcarine area.[4, 5] Decussation of the nasal half of the optic-nerve fibers results in cortical representation of the nasal half of the contralateral retina and of the temporal half of the homolateral retina.

The question of the physiologic relationships concerned with the higher visual areas is far from settled. Many ingenious schemata of brain localizations have been worked out, based partly on experimental and clinical data and partly on psychologic premises. This has led one school of thought to accept more or less rigid conceptions of various centers and tracts. On the other hand, many neurologists believe that our knowledge of the various sensory centers and association tracts is not yet sufficiently accurate to warrant such concepts of localization.[6–13]

It is quite generally agreed that the occipital lobe is primarily concerned with vision, and that area 18 of Brodmann which surrounds area 17 (the calcarine cortex), and area 19 which surrounds area 18 are concerned with visual association and organization[6] (fig. 1). There is less agreement regarding other salient features. Definite proof of the specific functions of areas 18 and 19 is lacking. Area 18, receiving impulses from area 17 only, is believed to be the center for recognition of objects and probably of colors.[2, 14] Area 19, which receives impulses from all parts of the cortex, serves as a center for coördinating visual and other reflexes.[6] Its chief function seems to be that of revisualization.[15] Area 37 and the region immediately anterior to it is believed by many neurologists to form a field in which language is formulated.[2]

Ferrier,[16] in 1875, concluded that the area of cortex chiefly concerned with recognition of written or printed words was the dominant angular gyrus (area 39). This opinion

* Presented at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947. From the Department of Ophthalmology, Syracuse University College of Medicine.

was not generally accepted for a long time and is not universally accepted even now. However, most neurologists, due to the investigations of Dejerine, Henschen, Pötzl, Hinshelwood, Nielsen, and others, maintain that the angular gyrus and the area immediately beneath it are essential for the visual recognition of letters, words, and musical notes. The center for mathematical figures is believed to be closely adjacent in the parieto-occipital region, and according to Henschen[17] is situated about the borders of the interparietal sulcus.

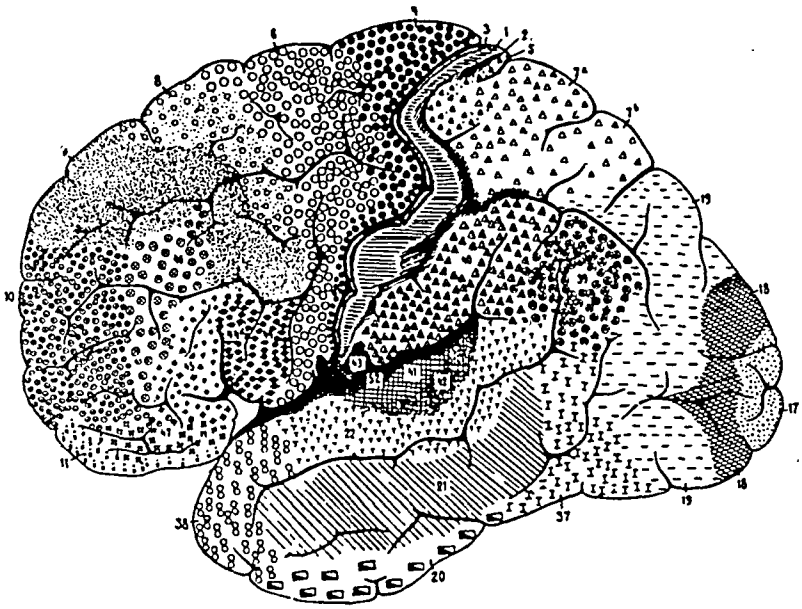


Fig. 1 (Joy). Brodmann's architectonic chart of the cerebral cortex. Lateral aspect. A large part of area 4 actually lies within the fissure of Rolando and areas 41, 42, 43, and 52 lie within the fissure of Sylvius. (From: Ford, F. R.: *Diseases of the Nervous System in Infancy, Childhood, and Adolescence.*)

The angular gyrus apparently has two functions, one for recognition and the other for the revisualization of the written or printed word symbol.[2] In this cortical zone the optic images of words are thought to become integrated with the corresponding representatives of the other sense organs, and only when such integration takes place does a word take significance.[18]

Symbols are in the sphere of language and unilateral dominance is much more pronounced in all language functions than in recognition of objects in general; thus, the major or dominant angular gyrus is essential to reading function.[7] The minor angular gyrus in most instances has its engrams so crudely made that it functions poorly unless forced to do so by lesions on the dominant side.[19] Even then, except in the very young, it usually takes years to function well.

The various subdivisions of the higher cortical visual field have more or less intimate association with each other in accordance with the degree of association between their functions. The angular gyri of the two hemispheres seem to be connected with each other, with the primary cortical areas of vision in both hemispheres, with the optic thalamus, and with other special sense centers, including Wernicke's auditory-word center and Broca's motor-speech center.[20] It apparently has numerous associating tracts with other centers contributary or coördinate in function, like those for object seeing and for stereognostic function.[21] It is also believed to be connected with the language formulation area whose chief function is the association of names with objects, concepts of which are obtained from the special senses.[21]

The functional relationship of the angular gyrus to Wernicke's center in most individuals and to Broca's center in some individuals is particularly close. In childhood word impressions are first received through the auditory mechanism, and the word is thus interpreted as it is heard. In most instances this habit continues throughout life. However, so-called sight readers, who are strongly visually minded, learn in time to read without reliving the sound-memories of each word and acquire independence from Wernicke's center.[2]

Also in childhood, word impressions are closely associated with the motor-speech center. As the child learns to read he enunciates, and as a result the printed image of the word becomes intimately tied up with the sound of the word. If his training in reading doesn't advance beyond the point of enunciating, this close association persists throughout life. However, most educated individuals develop silent reading ability and ultimate independence from Broca's center.[2]

Thus, the perfect functioning of the visual word center presupposes the integrity of the center, of all of its association tracts and of the other special sense areas.

Agnostic alexia

The most frequent type of agnostic alexia is blindness for letters and words.[21] Although letter blindness may appear without word blindness and word blindness without letter blindness, the two are usually associated and are almost always accompanied by inability to read musical notes, and much less frequently by blindness for mathematical figures.[2] The degree of alexia may vary considerably; some patients are able to recognize one or two or several symbols, while others exhibit complete loss of identification.[21]

Several bizarre types of alexia have been recorded; for example, in bilingual individuals there may be blindness for one language while ability to read another with similar characters is retained.[22] It has been assumed that such cases indicate that the engrams of different languages are laid down in separate areas.[21,22] However, the more modern conception is that such cases represent incomplete alexia. It is believed that in the disorganization that takes place in alexia the more complex and more recently acquired language functions are lost first.[2, 18] Thus, a foreign language is lost before the native language, and words are lost before letters. This order also holds true in the return of function in favorable cases, the more simple and basic functions returning first.

The faculty of reading is not only confined to letters and words but also applies to mathematical figures. The relatively infrequent occurrence of numeral alexia has received much comment in the literature. In the classic picture of pure alexia described by Dejerine,[23] and in a great many cases recorded since, the reading of figures and the ability to calculate were entirely conserved. This frequent sparing of mathematical figure language in agnostic alexia has led to the assumption that numbers and calculations are functions independent of letter and word language, and that they have their own cortical center and connecting pathways, which, although independent of each other, lie in the same vicinity.[2, 17, 21, 23, 24]

On the other hand, many neurologists consider it unlikely that the various symptoms of optic agnosia have a separate localizing significance. A. Adler[9] expressed the belief that agnostic patients recognize numbers more easily than letters because there are only 10 numbers and it is comparatively easy to recognize them by a few characteristics.

Agnostic alexia in itself is not pathognomonic of a lesion in a certain cerebral area, for language is a very intricate function requiring for its use the entire brain.[1] A lesion in any one area may so affect the mechanism as to interfere with activities other than those mediated directly by the involved area.[25] Moreover, when language function is disturbed mental functions may

also be affected and they, in turn, influence the language disturbance.[18] Therefore, to determine the site of the lesion producing alexia other factors must be taken into consideration.

Because of the fact that agnostic alexia is a disturbance of language function the lesion producing it is almost always in the dominant or major hemisphere (left in right-handed individuals). Atypical cases in which necropsy has revealed a right-sided lesion in right-handed individuals have been explained on the basis of unrecognized left-handedness, an unrecognized lesion of the left cerebrum, or ipsilateral cerebral dominance.[2] Chesher has shown that in about 6 percent of persons the major hemisphere in language is ipsilateral to the major hand.[1]

All lesions within the secondary visual area produce impairment of visual memory.[20] These disabilities represent the loss of previously acquired engrams of memory and concepts in which visual memory was a component. Cortical lesions which destroy engrams of visual memory cause a loss of both recognition and revisualization, but subcortical lesions which interrupt connections between these areas and the calcarine fissure of both occipital lobes cause only loss of recognition.[23]

On this premise destruction of the dominant angular gyrus destroys both recognition and revisualization of letters and words resulting in inability to either read or write: cortical agnostic alexia. On the other hand, if the association tracts connecting the angular gyrus with both calcarine areas are interrupted, only recognition is lost. The individual, although unable to read, can write to dictation and usually spontaneously, for revisualization is not affected. However, as recognition is lost, he is unable to read what he himself has written. This condition, the pure word blindness of Dejerine, is produced by a subcortical lesion in the dominant occipital lobe, which, due to its anatomic location, almost always impinges upon the optic radiation.[24] As a rule the affected fibers are destroyed, resulting in a permanent congruous contralateral homonymous field defect. In most cases there is complete hemianopia, but if only part of the fibers are affected a quadrantic defect may occur.[28-31]

Quadrant defects are produced by lesions affecting the upper or lower contralateral quadrantic fibers of the optic radiation or the upper or lower lip of the calcarine fissure. The field defect is usually bounded by vertical and horizontal radii in lesions of the radiation, and the temporal lobe is more frequently affected than is the occipital lobe.[32] Holmes[5] explains the reason for the contour of the field in quadrantanopia by assuming that the fibers corresponding to the upper and lower quadrants may be separated by an anatomic interval, an opinion that has also been expressed by other authors.

Inferior-quadrant defects occur much more frequently than do superior defects, except in lesions of the temporal lobe. In these cases the resultant field defects are characterized by their incongruity and their tendency to be right angled. On the other hand, occipital lobe lesions produce defects which are always congruous with angles of variable degree.[32]

In cortical lesions there is no anatomic reason why a quadrant defect should have a clean-cut horizontal boundary. Consequently, homonymous quadrantanopias with irregular outlines and steep edges are characteristic of affections of the calcarine fissure.[32]

All cases of agnostic alexia are not caused by cortical or subcortical lesions of the angular gyrus. Due to the close relation between the auditory function and reading in most individuals, and between motor-speech and reading in some, agnostic alexia may also occur in such patients in lesions of Wernicke's center or Broca's convolution, or in the connecting tracts.[33] Thus, in a given case one cannot tell by alexia alone where the lesion is.

The presence of pure word blindness without other aphasic symptoms or general cerebral disturbances is quite uncommon, for

anatomically it presupposes a highly restricted nonexpanding lesion.[26, 27] Such a lesion would have to miss the numerous other association tracts in the occipital lobe and the adjacent visual language areas. Moreover, the picture of any particular aphasia may change, depending on the nature of the lesion producing it, on cerebral substitution, and on reëducation.[18]

The relation between visual verbal alexia and numerical alexia has already been discussed. The presence of the latter, which is usually accompanied by impairment in calculation, may be explained on the same basis as that of verbal alexia; namely, interruption of the association tracts connecting the calcarine areas with the numeral center.[2] However, it is possible that the retention of ability to read numbers in cases of word blindness represents incomplete alexia.[9]

In the presence of subcortical lesions of the angular gyrus, agnosia may occur not only for symbols, but for objects (amnesic aphasia) and colors (color amnesia).[25, 34] In these disabilities, which are in the zone of language the patient may be unable to call an animate or inanimate object or a color by name even though he recognizes and comprehends it. Amnesic aphasia alone is of little localizing value, for it has been described in lesions of the frontal, parietal, and temporal lobes; in cases with no demonstrable pathology; and in toxic states, dementia, senile involution, and other conditions. It most commonly results from lesions in the language formulation area (area 37) or the temporal isthmus.[2] Due to the close proximity of the isthmus to the angular gyrus, Nielsen[2] expressed the belief that lesions in this locality which cause amnesic aphasia are responsible for angular and adjacent parietal lobe defects. Color amnesia is thought to be due to an occipital lesion affecting area 18.[2]

Westphal,[21] over 75 years ago, recorded the first case of alexia without agraphia. However, Dejerine,[23] in 1892, gave the first complete and detailed physiologic and anatomic description of the differentiation of the subcortical from the cortical type. Within the next few years Dejerine's and Serièux's interpretation was confirmed by Bastian, Broadbent, Hinshelwood, and others.[24, 27]

Although ophthalmic literature has shown little evidence that such a condition existed, cases of subcortical agnostic alexia have appeared in the neurologic literature during the past 50 odd years with sufficient frequency to indicate that the condition is not particularly uncommon. However, this is not true of those cases following cranial trauma, for they are very rare.[30]

Although basically a neurologic problem, some of its most important features embrace the field of the ophthalmologist who, on occasion, may be the first physician consulted by the patient. Therefore, it is important that he be familiar with all of its aspects.

It is for this reason, as well as for the infrequent occurrence of the condition following trauma, that this case is reported.

Case report

History

Mr. C. S., a locomotive engineer, aged 62 years, was seen for the first time on October 1, 1946, 10 days after an apparently slight head injury.

On the evening of September 21st, while returning home from work as a passenger in the front seat of an automobile, he struck his head against the sun visor in a minor collision. Immediately after the accident he got out of the car by himself and stood upon his feet without any apparent difficulty. However, he appeared quite dazed, did not recognize people and complained of foggy vision. Full consciousness of his surroundings did not return until his arrival at St. Joseph's Hospital about one hour later. Examination at that institution revealed no evidence of injury except a deep laceration of the skin of the right forehead. Immediately after the wound was sutured, the patient returned home and was placed under

the care of his private physician, Dr. F. I. Bishop. Aside from some mental confusion, he felt no ill effects from the injury and noted nothing unusual until the following morning, when upon picking up the newspaper, he discovered to his astonishment that he was unable to read.

Physical examination

Dr. Bishop examined the patient on September 22nd. His report follows: A rugged muscular male with no apparent defect except a 7-cm. transverse irregular sutured wound across the right forehead. No evidence of vascular disease: blood pressure 134/78 mm. Hg; pulse ranges from 70 to 80. Urine negative. Wassermann reaction negative. No paralysis or anesthesia excepting for numbness about the wound. No headache or vomiting since accident. He denies serious illnesses and previous injuries. As an employee of the railroad he has been examined periodically at two-year intervals for many years. His general physical condition is unchanged since the last previous examination less than one year ago.

Ophthalmological examination

The patient was still unable to read 10 days after the accident and was referred for ophthalmic consultation, a procedure which extended over a period of three successive days. As he entered the office, his gait appeared normal and he exhibited no difficulty in following directions as to where he was to sit. In taking his history he proved intelligent, coöperative, and mentally alert. He seemed to understand all that was said to him, and spoke fluently and without hesitation. He did not appear apprehensive or depressed and was not unduly alarmed. His only complaint was inability to read, and he was confident that new glasses were all that he needed. There was no apparent disorientation of any kind: he had had no difficulty in finding his way about since the accident and readily distinguished right from left. He stated that he had always been right handed, as were his four children and that, so far as he knew, so were all of his forebears.

The visual test revealed that, although he could not distinguish letters, words, or numbers irrespective of size, uncorrected vision of 20/25 was obtained in either eye with the illiterate chart. Vision was correctable to 20/20 and the illiterate equivalent of J1 with glasses. Externally his eyes appeared normal. There was no derangement of the extraocular muscles, nor was nystagmus present. The pupils were equal in size and their reaction prompt. The lenses were only moderately sclerosed and the media were clear. Examination of the fundi revealed normal optic discs and very early senile sclerosis of the retinal vessels compatible with his age. The central fields were normal but the peripheral fields showed a right, homonymous, congruous, irregular upper-quadrant defect with sharply demarked edges (fig. 2).

He was able to write spontaneously and to dictation with promptness, but in no instance could he read a single letter, word, or number that he had written unless he traced the symbols with his finger. Even then, he did so in a stumbling, halting, and incomplete manner. Also, he could do none but the simplest calculations, being almost totally unable to add or subtract beyond two digits or to multiply beyond one digit. There was no evidence of geometric object agnosia; he copied squares, circles, and triangles correctly and also drew them spontaneously. As he had had no musical training, he was not tested for musical notes.

During the examination, it soon became apparent that the patient could not call by name even familiar objects although he knew what the objects were. He knew that a knife was used for cutting, a pen for writing, and a watch for telling time, but he could not call them by name, even though he handled them and listened to the watch.

He had similar difficulty in naming colors, although his color discrimination proved

normal with the Ishihara, American Optical pseudoisochromatic, and Holmgren yarn tests. While he showed no amnesia for animate objects, upon specific questioning he stated that for the first day or two following the accident he could not even call the members of his own family by name although he recognized them perfectly.

NEUROLOGIC EXAMINATION

On October 4th, Mr. S. entered Syracuse University Hospital for neurologic study by Dr. Wardner D. Ayer, the chief points of whose report follow:

The patient appears well orientated and coördination is excellent, but he shows definite anomia and complains of inability to recognize the printed word. He is right handed.

Cranial nerves are negative except for the field defect. In hearing tests, his tuning-fork responses are excellent and normal in both ears. There is no nystagmus nor vertigo. Facial movements are symmetrical. No facial anesthesia is present except that about the wound. Pharynx is normal. There is good gag reflex. The patient swallows normally. The tongue is in mid line. There is no dysarthria; good enunciation; no aphonia. The neck shows no rigidity.

The extremities show normal motor, reflex, and sensory status.

Careful studies for a right hemianesthesia show none. On testing for astereognosis, he apparently recognizes the objects and claims they feel the same in the two hands but he cannot name them. No pathologic reflexes are present. Abdominal and cremasteric reflexes are active and equal. Gait and station are normal.

Lumbar puncture: 5 cc. of very slightly xanthochromic (light picric-acid hue) spinal fluid were removed under no increase in pressure; cell count, 3 white cells, few red cells (actual count not made); protein, 33 mg. Wassermann reaction was negative. X-ray studies of the skull showed no fracture or other abnormality.

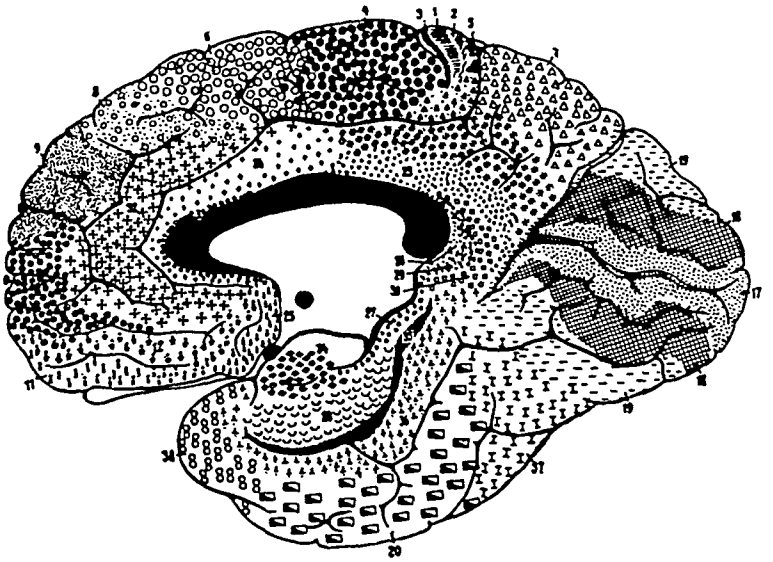


Fig. 2 (Joy). Brodmann's architectonic chart of the cerebral cortex. Mesial aspect. (From: Ford, F. R.: *Diseases of the Nervous System in Infancy, Childhood, and Adolescence.*)

For the three days in the hospital, the patient seemed very comfortable. On one observation the right pupil was larger than the left, but otherwise they were normal. His aphasia continued but seemed somewhat less marked on his discharge.

CLINICAL COURSE

This patient has been under observation over a period of eight months and is now apparently as well as ever except for persistence of the field defect which has re-

mained unchanged. During the first month, all aphasic symptoms subsided appreciably and, by the end of the month, there was only occasional difficulty in naming objects and colors. Ability to identify symbols returned more slowly, but by this time he was able to read fairly well and seemed to understand the meaning of the printed text. However, he missed many multiple syllable words, became fatigued after reading a few sentences, and was consistently confused by certain letters, particularly C & G, b & d, F & E, Y & X, y & x. Numbers caused him less trouble but he had difficulty in differentiating 3 from 8, and 6 from 9. Simple addition, subtraction, and multiplication were accomplished with few mistakes.

By the end of the second month there was no evidence of amnesic aphasia or color amnesia. He was now able to read the newspapers a little, but stated that he had to give up after 2 or 3 paragraphs because of fatigue. A reading test demonstrated frequent hesitation while he spelled out the longer words and he still confused b & d.

There was gradual improvement in the next two months and by the end of the fourth month he felt that he could read as well as ever and without fatigue. He stated that he had never been good at figures but believed he could calculate now as well as before the injury. All confusion of symbols had disappeared.

On January 14, 1947, he was referred to Dr. W. M. Cruickshank of the Psychological Services Center of Syracuse University for complete psychologic investigation. An epitome of the report follows:

On the Wechsler-Bellevue Intelligence Scale the subject received a verbal I.Q. of 97, a performance I.Q. of 94, and a total I.Q. of 97. This places him in the normal group intellectually.

In the advanced progressive reading tests covering seven areas, involving vocabulary and comprehension, and including mathematics, science, and literature, results correlating favorably with the subject's educational background and intelligence level were obtained. These tests showed no concrete evidence of anomia, and there is no evidence of the presence of any form of aphasia.

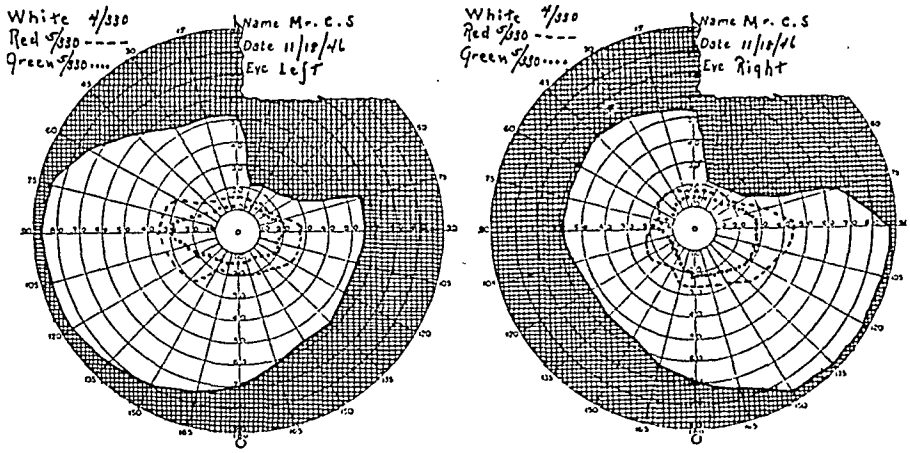


Fig. 3 (Joy). White 2/330 and 1/330 equal the same boundary in defect.

On March 17, 1947, six months after injury, Mr. S. resumed his occupation as a locomotive engineer, his employer feeling that the field defect was not a sufficient handicap to force his retirement. He has carried on to date (May 29, 1947) without incident or accident and feels as well as ever in every way. However, the field defect remains unchanged.

Discussion and Summary

In this case we are dealing with an apparently previously healthy individual who, following a seemingly minor head injury,

suddenly developed aphasic symptoms consisting of visual agnosia for symbols without agraphia, acalculia, amnesic aphasia, and color amnesia, along with right homonymous upper congruous irregular quadrantanopia. All aphasic symptoms disappeared within four months, but the field defect has persisted.

There was no paralysis or anesthesia, intelligence was not affected, and orientation was not disturbed. Motor speech was not involved and spoken words were perfectly understood.

The history of injury, the sudden onset of symptoms, the presence of blood in the spinal fluid, the limited disturbance of the lesion, and the rapid recovery without development of further symptoms all indicate a vascular lesion, probably hemorrhagic in character, with adjacent edema.

The disturbance was primarily that of language on the receptive side without involvement of the auditory or motor-speech mechanisms. Although the absence of a necropsy prevents positive proof of the site of the lesion or lesions producing the symptoms, there is sufficient clinical evidence to indicate with reasonable certainty that it was situated in the left parieto-occipital region.

The reasons for this assumption are as follows:

1. In almost all of the recorded cases of the subcortical type of agnostic alexia which have gone to autopsy the causal lesion has involved the occipital lobe, destroying the association fibers connecting the angular gyrus with both calcarine fissures.

2. Color amnesia is generally considered to be due to lesions of the occipital lobe.[2]

3. Although it is true that amnesic aphasia is usually caused by involvement of the temporal lobe, in the presence of subcortical agnostic alexia the lesion is more likely to interrupt the association fibers in the isthmus,[2] and such a lesion may be in the parietal lobe.

4. Homonymous hemianopia, or less frequently quadrantanopia in the lower field, is almost always present in subcortical agnostic alexia, due to impingement of the lesion on the optic radiation. The upper quadrant defect in this case does not necessarily conflict with the evidence at hand. The presence of congruity militates against an affection of the temporal lobe. It was probably caused by a vascular lesion involving the inferior fibers of the posterior segment of the optic radiation. Quadrant hemianopias are characteristic of vascular lesions in this region, since it is here that the upper and lower halves of the radiation are supplied by two different and separate vessels.[35] However, the field defect could have been caused by a traumatic lesion of the inferior lip of the calcarine fissure.

Franceschetti and deMorisier,[30] in discussing their case and that of L'hermitte, deMassary, and Huguenin,[29] in which there was a lower quadrantanopia, theorized that the field defect was caused by contusion of the upper lip of the calcarine fissure. In pondering why the upper lip should be more exposed to injury than the lower lip, they expressed the belief that the superior lip is more vulnerable because it is in contact with the tentorium and so is much less resistant.

Conclusion

As previously indicated, the site of the lesion or lesions in the case herein reported cannot be determined by any aphasic symptom alone or by the field defect alone. However, taking them all together and in association, the most probable site is in the parieto-occipital region of the left hemisphere. Although the presence of multiple lesions cannot be ruled out, it is tempting to speculate whether a single lesion did not cause all of the symptoms. Involvement either of the parieto-occipital branch of the middle cerebral artery, or of the calcarine branch of the posterior cerebral artery, could produce the necessary pathologic changes. It is probable that the lesion consisted of contusion, hemorrhage, and edema.

Recovery from the aphasic symptoms indicates that the cerebral trauma was not severe. In spite of the evidence of a hemorrhagic lesion, it is probable that contusion and edema played an important part, for the relatively rapid subsidence of the symptoms is definite proof that the association tracts were not irrecoverably destroyed. If an anatomic area subserving a functional unit of language is destroyed, it never recovers.[34] In such cases, return of function depends on training of the homologous area of the other hemisphere, which in a man, aged 62 years, would not occur for a long time, if ever.

The persistence of the field defect is not unusual, for the supragenículate visual pathway appears to be more vulnerable to insult than do the association tracts.

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WIDENING OF THE ANGIOSCOTOMA IN THE ALARM REACTION*

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INTRODUCTION

The various symptoms of alarm are well known. These consist of pupillary dilatation, protrusion of the eyeballs, cutaneous vasoconstriction, contraction of the smooth muscles of the skin causing "gooseflesh," the erection of hairs in man, and increased sweating. Another effect, due to psychic influences, as noted by Evans[1] was a widening of the normal angioscotoma.

An opportunity to study alterations in the angioscotoma in three alarmed subjects was afforded, and the findings are herein reported.

METHOD AND MATERIAL

Gradle,[2] in 1916, believed that the blind areas resulting from the large vessels as they pass from the disc on to the perceiving retina were relative and could be traced several centimeters away from the disc. It is felt by Evans[1] that the angioscotoma is a defect in the visual field related in form to the pattern of distribution of the retinal vessel tree. Duke-Elder[3] defines angioscotometry as the tracing out of thin bands of physiologic blindness corresponding to the retinal blood vessels.

TECHNIQUE

Various investigators have mapped out these shadows using different methods. The technique followed in this study was that of Evans.[1, 4] The Evans stereocampimeter and charts were employed and the test object which was used in all cases was 0.4 mm. in size, spherical, and white. The illumination of the test chart was 15 foot-candles, and monocular fixation was employed.

The test object was moved from the seeing to the nonseeing area, and at all times at right angles to the border of the defect. The blindspot was first outlined and then the object was moved around the periphery of the blindspot until the superior arched angioscotoma was located and plotted. When the width of these bands, adjacent to the blindspot, was greater than 1.5 degrees, they were considered to be abnormally widened. This study was limited to the changes that occurred to this band, since the time element in these particular studies did not permit the mapping of the other bands which originate from the blindspot.

SUBJECTS

(a) Selection. Three individuals were studied while in a state of alarm, under the following circumstances, at the Long Island College Hospital.

Case A was one of a group being examined for the action of a certain drug on the angioscotoma. After the normal angioscotoma had been plotted, prior to the introduction of this drug, a nurse entered the examining room and notified the patient that a cablegram was being held for him in the superintendent's office. This subject immediately showed signs of alarm because, as he stated, his wife who lived abroad had recently become ill. It was requested that the cablegram be delivered to the examining room, and in the interim, while in the state of alarm, his angioscotoma was recharted.

Case B and *Case C* were seen simultaneously in the accident room of the hospital, markedly frightened although coherent and well oriented. They had been working on a chemical experiment at a technical school nearby, when a sudden explosion occurred,

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TABLE 1

APPEARANCE AND DURATION OF CHANGES IN SCOTOMA. (SUBJECT EXAMINED BEFORE FRIGHT; AFTER FRIGHT; AND AFTER REASSURANCE.)

	Subject A Time	Pupil	Scotoma Units
Physiologic Angioscotoma	8:45	4	42
Immediately after Saline	9:10	4	42
Immediately after Fright	9:32	7	128
Time Patient Reassured	9:33		
	9:35	6	119
	9:45	4	64
	9:53	4	42
	10:00	4	42
	10:15	4	42

shattering most of the glass equipment. Pieces of glass were found imbedded in the skin of the lower part of the face and chest in both subjects. The chief concern of these individuals was whether glass had entered their eyes. Ocular examinations were entirely negative. Without being notified of this fact, angioscotomas were plotted on these patients, while still in a state of fright, 10 to 15 minutes after the explosion had occurred.

(b) History and physical condition. All known causes for alteration of the angioscotoma were ruled out in the three subjects.

Case A, a British seaman, 24 years of age, a patient in the hospital with a diagnosis of fungus infection of the arms and chest, was otherwise in good physical condition. Past history essentially negative.

Case B, a woman school teacher, 26 years of age, in good physical condition. Last menstrual period, two weeks prior to examination.

Case C, a man, an accountant, 31 years of age, in good physical condition.

PROCEDURE

Case A had a normal angioscotoma plotted, and after the psychic disturbance, was immediately reëxamined. The news contained in the cablegram relieved his anxiety and his angioscotoma was again charted and repeated every 10 minutes until no further change was noted after three successive examinations.

The angioscotomas of *Case B* and *Case C* were plotted while they were still frightened. These patients were then reassured that no foreign body was present in their eyes and their angioscotomas were recharted every 10 minutes, until there was no further change in the width of their respective bands.

OBSERVATION

Widening of the angioscotoma was found in all these cases.

In *Case A,* the normal angioscotoma was first plotted and a control secured by instilling into the conjunctival sac several drops of saline. After being subjected to alarm, a marked widening of the angioscotoma was obtained. Immediately after fright had been dispelled the angioscotoma was found to be slightly less widened and gradually returned to normal with each successive reëxamina-

TABLE 2

APPEARANCE AND DURATION OF CHANGES IN SCOTOMA. (SUBJECTS FIRST EXAMINED WHILE IN FRIGHT AND THEN REËXAMINED AFTER REASSURANCE.)

Subject B (Frightened at 10:45) Time	Pupil	Scotoma Units
11:00	5	110
Time Patient Reassured: 11:08		
11:10	5	95
11:20	5	69
11:30	5	32
11:40	5	32
11:50	5	32

Subject C (Frightened at 10:45) Time	Pupil	Scotoma Units
10:55	5	120
11:05	5	105
Time Patient Reassured: 11:13		
11:15	5	70
11:25	4	44
11:35	4	44
11:45	4	44

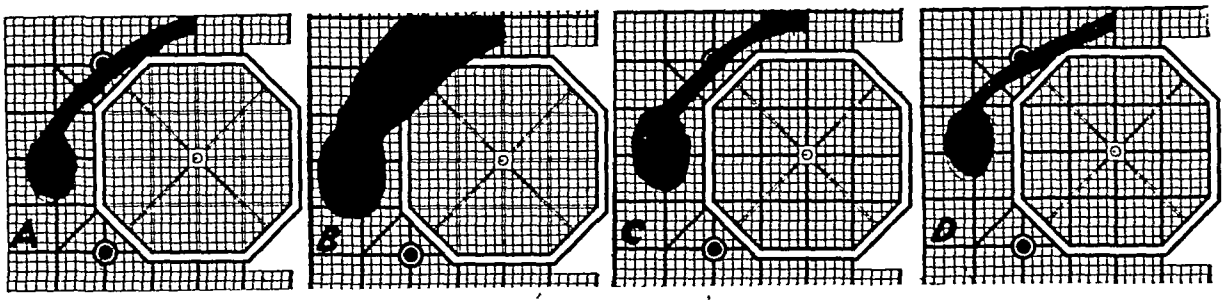


Fig. 1 (Cholst). Angioscotoma plotted to show the effects of fright on *Subject A*. (A) Normal angioscotoma. (B) Immediately after fright. (C) Twelve minutes after reassurance. (D) Twenty minutes after reassurance.

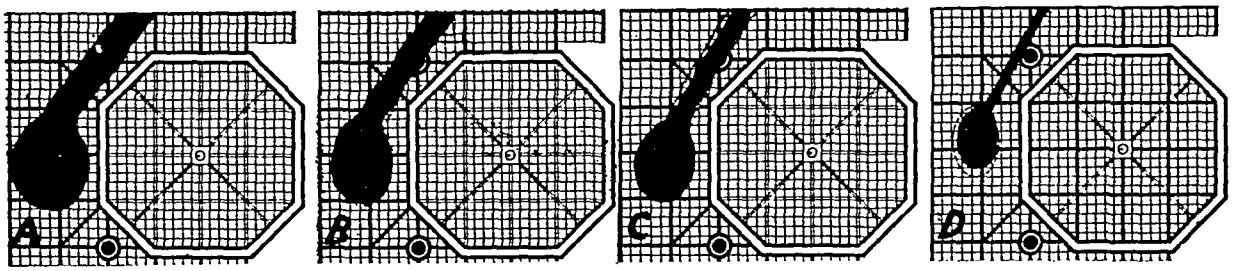


Fig. 2 (Cholst). Angioscotoma plotted to show the effects of fright on *Subject B*. (A) Fifteen minutes after fright. (B) Two minutes after reassurance. (C) Thirteen minutes after reassurance. (D) Twenty-two minutes after reassurance.

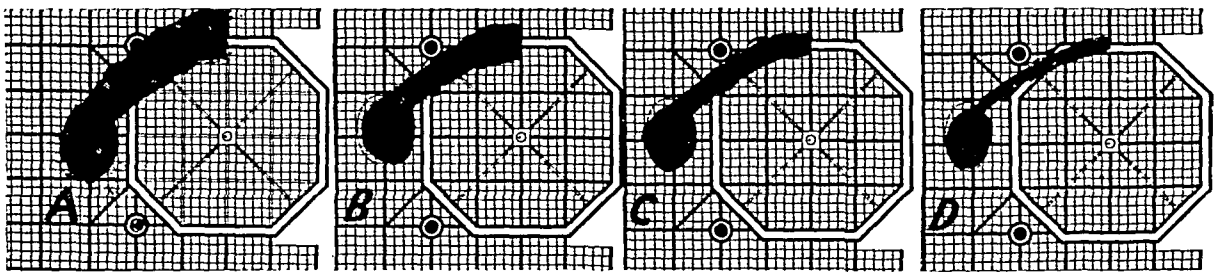


Fig. 3 (Cholst). Angioscotoma plotted to show the effects of fright on *Subject C*. (A) Ten minutes after fright. (B) Twenty minutes after fright. (C) Two minutes after reassurance. (D) Twelve minutes after reassurance.

tion. The normal angioscotoma was again plotted *20 minutes* after anxiety had been relieved.

In *Case B* and *Case C*, the subjects were in a state of fright when their respective angioscotomas were first plotted and an abnormally widened band was plotted in each case. After cause for alarm had been dispelled and the patients reassured, a progressive narrowing of the originally widened angioscotomas was obtained with each plotting. No further narrowing in Case B occurred 22 minutes after fright had been dispelled, and in Case C after 12 minutes. (When the same width occurred after three successive plottings, they were regarded as the normal bands for these individuals.)

Comment

In an attempt to explain the origin and characteristic changes of the angioscotoma, it is apparent that one cannot make the simple assumption that the areas mapped are direct projections of the Purkinje vessel shadows. Vascular dilation is probably not the explanation of the widening phenomenon because:

1. A corresponding change in the diame-

ter of the retinal vessel is not noted when studying the fundus with the ophthalmoscope. For example, when pressure is made upon the globe, the retinal vessels narrow, although the angioscotoma widens.

2. The degree of widening of the angioscotoma is often so great and so rapid that a retinal vessel would probably rupture were it dilated correspondingly (since the widening may be 5 or 6 times greater than the normal angioscotoma).

Alteration of the normal angioscotoma, according to many workers, may be influenced by numerous factors, physiologic as well as pathologic. One hypothesis has been presented[1] in an effort to explain the origin of the alteration of any angioscotoma and is known as the angiogenic hypothesis. This states that the synapse is the most easily interrupted point in the neuron chain. It is extremely sensitive to deleterious agents and in this way acts as a sort of fuse to protect the delicate rod and cone layer. Interference with the normal posterior drainage fluid from the eye, via the perineural and perivascular spaces, produces a temporary damming up of the fluid with a consequent edema of the synapse.[5] This results in a loss of response of the rod or cone of the corresponding chain and widening of the angioscotoma results.

Evidence was found in the literature which suggests a possible explanation for the alterations of the angioscotoma in this study.

Cannon,[6] in his classic experiments with the denervated heart, proved that fright, rage, pain, among other things, produced a reflex liberation of an adrenalinlike substance causing an acceleration in the heart rate of about 20 to 40 beats per minute. Removal of the adrenals or their denervation prevented this effect.

According to Burton-Opitz,[7] working with animals, injection of epinephrine into the circulation produced a rise in venous as well as arterial pressure. G. Rosenow[8] also observed this rise in venous pressure in normal men, using hypodermic injections of epinephrine. Clinically, dilation of the veins of the forehead and neck in individuals under psychic tension has been noted. Changes in venous pressures are accompanied by similar changes in the cerebrospinal fluid pressure, state Merritt and Fremont-Smith.[9]

They found that patients who have increased venous pressure, such as accompanies congestive heart failure, frequently show increased cerebrospinal-fluid pressures. In 32 patients with congestive heart failure the cerebrospinal-fluid pressure was found to be elevated. In studying the effect of the administration of drugs on the cerebrospinal-fluid pressure, they noted that adrenalin produces an increase in cerebrospinal-fluid pressure.

Evans believes that increased intracranial pressure produces a mechanical dilatation of the perivascular spaces by obstructing the posterior drainage system of the intraocular-tissue fluid. It is interesting to note that Spaeth[10] reported a patient with an intracranial vascular lesion who had early extensive widening of the angioscotoma.

There is thus ample evidence that an adrenalinlike substance is liberated in psychic disturbances. The explanation for the widening of the angioscotoma in fright could possibly be due to a transient increase in venous blood pressure which, in turn, produces an increased intracranial pressure. This interferes with the normal drainage of the intraocular-tissue fluids posteriorly, causing a dilatation of the perivascular spaces. The back pressure that ensues interrupts the synapse in the underlying retina due to the edema produced, resulting in a widening of the angioscotoma. Thus, the widening of the angioscotoma in acute apprehension could be explained by the angiogenic hypothesis.

The disappearance of the psychic stimulus is followed by a reversal to normal physiology, which can be clinically noted by the normal angioscotoma replotted.

Conclusion

1. This study presented the effect of alarm on the angioscotoma and also the possible physiologic mechanism involved.

2. A widening of the angioscotoma was demonstrated in the three cases studied, which gradually returned to normal shortly after the causes were removed.

3. This effect of fright could perhaps be a source of error in the mapping of the blindspot when routine central scotometry is performed on individuals in an apprehensive state.

694 Montgomery Street (13).

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THE CHARACTER OF THE NYSTAGMUS INDUCED BY AMYTAL IN CHRONIC ALCOHOLICS*

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Barbiturate drugs are known to influence ocular movements in man and in the experimental animal.[1,2] A common sign of barbiturate intoxication is a slow coarse nystagmus which appears when the eyes are deviated from the mid position.

While studying the effect of this drug on eye movements, it was noted that in chronic alcoholics intravenous injection of sodium amytal produced fine, shimmering nystagmus. This was a conspicuous and consistent finding. The coarse and slow nystagmoid movement which is often seen in barbiturate intoxication was not present. The difference in response to amytal between the alcoholic and normal individual was so prominent that we felt it warranted publication.

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Material and Method

The ocular statuses of 15 patients with a history of alcoholism were studied before and after intravenous administration of sodium amytal. Those who showed disorders in ocular movements on routine neurologic examination were excluded from the series. A group of 15 psychiatric patients, who manifested no physical or neurologic defects and had no history of alcoholism, served as the control group.

A 5-percent solution of sodium amytal was injected into the antecubital vein at a rate not exceeding 0.1 gm. or 2 cc. per minute. The total dose was never more than 0.5 gm. or 10 cc. During these tests the patients were instructed to fix their gaze on an object away from the central visual axis. Usually the patient was told to maintain his gaze either to the right or to the

left. With the eyes in a deviated position the onset of nystagmus may easily be detected.

Results

(A) Control series

In the control subjects injection of sodium amytal generally produced ocular responses of two types: (1) wide, slow irregular oscillations in which the eyes drifted slowly toward the midline from a point of fixation and returned to the original position with a flick; and (2) coarse, slow rhythmic nystagmus. This nystagmus varied considerably in rate and amplitude but, as a rule, it always remained sufficiently slow so that discreet oscillations of the eyes could be observed.

The following two cases were typical of the control series.

Case 1. D. P., a boy, aged 15½ years, was admitted to the hospital because of a conduct disorder. Physical and neurologic examinations were normal. The eye movements were intact and there was no nystagmus in any position of the eyes.

Sodium amytal, injected into the antecubital vein:

0.1 gm.—produced no nystagmus but as the injection continued coarse nystagmoid jerks were noted.

0.2 gm.—the nystagmoid movements became more prominent.

0.3 gm.—coarse nystagmoid jerks alternated with regular, rhythmic nystagmus of moderate amplitude. This was pronounced on horizontal or lateral deviations. Occasional nystagmoid jerks were also noted on upward gaze.

0.5 gm.—coarse nystagmus present in all directions. In time the coarse nystagmus became evident in all directions. The patient became drowsy five minutes after the injection of the drug and shortly thereafter fell asleep. Usually, when the patient did not fall asleep the nystagmus persisted for over two hours.

Case 2. T. N., a young woman, aged 19 years, was admitted to Bellevue Psychiatric Hospital with the symptoms of a psychic depression.

Sodium amytal was injected intravenously:

0.1 gm.—produced no nystagmus.

0.2 gm.—produced wide nystagmoid jerks on lateral gaze.

0.3 gm.—produced nystagmoid jerks alternating with sequences of coarse nystagmus on right and left lateral gaze. Later there was rhythmic nystagmus of moderate amplitude on right lateral gaze; coarse nystagmus with frequent jerky oscillations on left lateral gaze. In time the difference in the type of nystagmus between the right and left side deviations became reversed. This reversal was found to take place periodically, sometimes at 1- to 2-minute intervals.[1] The patient became drowsy and thick of speech. Her nystagmus lasted for over an hour. The duration of the nystagmus varied with the quantity of the drug injected.

(B) Alcohol group

All the patients in this series showed, on intravenous injection of sodium amytal, a nystagmus which was different from the type observed in the control series. In fact, one patient who denied addiction to alcohol showed fine shimmering nystagmus on injection of this drug. On further investigation it was learned that this patient had previous admissions to this hospital with diagnosis of acute and chronic alcoholism.

Case 3. G. O'C., a woman, aged 53 years, had been drinking for 20 to 25 years and had been admitted to Bellevue Hospital for alcoholism on several occasions. Neurologic examination was essentially negative. There was no spontaneous nystagmus. All eye movements were normal.

Sodium amytal produced, after the injection of:

0.1 gm.—no nystagmus.

0.2 gm.—no nystagmus.
0.3 gm.—rapid, fine "shimmering" nystagmus on lateral gaze.

Further injection, as much as 0.5 gm. of the drug, produced no change in character of the nystagmus. It continued to be fine and rapid. The duration of the nystagmus after injection of the drug was not nearly so long as that observed in the control series.

In most of the alcoholic patients, it was necessary to inject more than 0.3 gm. of sodium amytal before the nystagmus became manifest. It was also observed that the alcoholic suffered less from the narcotic action of the drug than the patient in the control series; the alcoholics were less drowsy than the controls.

Case 4. L. E., a man, aged 56 years, was admitted to Bellevue Psychiatric Hospital with a history that he had been drinking for over 40 years. At one time he was treated for delirium tremens and on two other occasions for alcoholic hallucinosis.

Sodium amytal injected intravenously produced:

0.1 gm.—no nystagmus.
0.2 gm.—inconstant, coarse nystagmoid jerks.
0.3 gm.—inconstant, coarse nystagmoid movements.
0.4 gm.—persistent, coarse, and rapid nystagmoid movements.
0.5 —"shimmering" nystagmus on lateral gaze alternating with coarse nystagmoid jerks.

It was noted that when the nystagmus became persistent it assumed the character of rapidity and shimmering. There were several such instances in the alcoholic series.

Case 5. W. S., a man, aged 32 years, was admitted to the hospital for symptoms of a depression. After a period of observation a diagnosis of "neurotic depression without psychosis" was made. The patient denied alcoholism and claimed that he drank only on occasions. In the course of a psychiatric interview, during which he was under the influence of sodium amytal, "shimmering" nystagmus was observed. This raised the suspicion of alcoholism. While the patient was under the influence of the drug it was learned from him that he had been addicted to alcohol for many years, that he was drunk at least twelve times, and that he was previously admitted to Bellevue Hospital.

Sodium amytal injected on a subsequent occasion disclosed:

0.1 gm.—produced no nystagmus.
0.2 gm.—produced inconstant, coarse nystagmoid jerks alternating with fine "shimmering" nystagmus on lateral gaze.
0.3 gm.—coarse nystagmoid jerks alternating with fine "shimmering" nystagmus on lateral gaze. Later the nystagmus became constantly fine, rapid, and shimmering.

Case 6. J. L., a man, aged 51 years, was not suspected of drinking alcohol. He was originally selected as a control. During the intravenous injection, it was observed that the nystagmus was of the type usually seen when amytal was injected in chronic alcoholics. Further questioning confirmed that he had excessive drinking habits of long standing.

Sodium amytal injected intravenously produced:

0.1 gm.—fine, inconstant nystagmoid jerks on right lateral gaze.
0.2 gm.—fine, inconstant nystagmoid jerks on right lateral gaze.
0.3 gm.—fine, nystagmoid jerks on left lateral gaze. Occasional fine nystagmus on right lateral gaze. The patient's mood changed. He became euphoric and facetious. He claimed he had been drinking for over a year and that he had consumed between 4 and 5 pints of "liquor" a week.
0.4 gm.—rapid almost "shimmering" nystagmus of right lateral gaze. Very fine rapid nystagmus, almost "shimmering," alternating with regular nystagmus of moderate amplitude on left lateral gaze. Very fine nystagmus was noted on up-

ward gaze. The nystagmus in all directions was persistent.

0.5 gm.—"shimmering" nystagmus on right lateral gaze. "Shimmering" nystagmus alternating with fine nystagmoid movements on left lateral gaze. Very fine, almost "shimmering" nystagmus on upward gaze.

Evidently the character of the induced nystagmus helped us to discover that the patient had been an alcoholic.

Discussion

In previous communications the effect of intravenous barbiturates on ocular movements and on various types of nystagmus were discussed. The pharmacologic mechanism for these alterations, however, have not been clearly understood. Spiegel, working with cats, found that amytal produced ocular effects by action on the brain stem as well as on other parts of the brain.

The present observations reveal that alcohol, when imbibed over a long period, alters the function of the nervous system in man. The latter alteration is apparent in reactions of the eyes to intravenous injection of sodium amytal. In the chronic alcoholic there is a shimmering nystagmus rather than the usual coarse rhythmic nystagmus found in the normal individual.* The fine rapid nystagmus is found even months after the patient has stopped drinking. This suggests that alcohol produces more or less of a permanent change in nervous-system function. Whether this change is basically morphologic or chemical is not known. In this connection, we have seen patients with acute and chronic alcoholism who have manifested unmistakable signs of central nervous-system involvement, such as ophthalmoplegias and marked tremors. Yet, on gross and microscopic examination of the nervous system, no definite evidence of a lesion in the brain, or brain-stem, was found. In such cases one was forced to assume that the neurologic signs observed during the period of alcoholic intoxication were due to a chemical (alcohol) which altered nervous-system function, without producing a change in structure, as could be shown by available histologic staining methods.

It would seem probable that the shimmering nystagmus which we find on intravenous sodium amytal in the chronic alcoholic may also be the result of a more or less permanent chemical change in the nervous-system function. This alteration is not necessarily accompanied by a demonstrable lesion in the nervous system. A method which discloses the presence of such an alteration in function is the study of ocular response (nystagmus) to intravenous injection of sodium amytal.

477 First Avenue (16).

* Shimmering nystagmus was also observed in patients with traumatic encephalopathy. However, we have little data to show that intravenous sodium amytal produces an abnormal type of nystagmus in patients with encephalopathies due to causes other than alcohol.

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DIATHERMY TREATMENT OF ANGIOMA OF THE RETINA*

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Angiomatosis retinae is a rather rare condition. Nevertheless, it is one of great interest from the standpoint of diagnosis and also of treatment. Diathermy coagulation has been extensively employed in recent years for the control of many ocular conditions. It seems to be particularly suitable for the destruction of retinal angiomas. In a paper on this subject,[1] presented before the American Academy of Ophthalmology and Otolaryngology in 1942, it was pointed out that only about 145 cases of retinal angioma had been reported in the literature. Since then, reports of the condition have been somewhat more common, leading one to conclude that perhaps the disease is not so rare as we have thought. No attempt is made in this paper to review the literature, as it has been adequately reviewed by Bedell,[2], Lloyd,[3] Cordes and Hogan,[4] and others. This paper is presented to promote the treatment of retinal angiomas by diathermy, to give the "follow-up" on a case operated upon in 1941, and to report another case operated upon in 1944.

A description of the usual fundus findings in angiomatosis retinae is unnecessary before this society as you are already familiar with the appearance of the disease. As Bedell[5] has pointed out, the presence in the retina of greatly dilated, parallel blood vessels usually denotes angiomatosis. However, atypical or far-advanced cases have been confused with Coats's disease, retinoblastoma, aneurysm, endophthalmitis, and several other conditions. Secondary glaucoma and hemorrhage may occur and render the diagnosis extremely difficult.

TREATMENT

Before any local treatment is begun, a thorough general and neurologic examination should be made to rule out involvement of the cerebellum or other organs. Radium applications and roentgen-ray therapy have been used with variable results. However, Cordes and Dickson,[6] in 1943, reported two cases treated successfully by X-ray irradiation. Weve,[7] in 1939, was the first to report the use of surface coagulation and punctures with diathermy. Kaye,[8] in 1941, reported two cases successfully treated in London by a combination of katholysis with surface and puncture diathermy. On April 29, 1941, Fralick[9] performed the first diathermy destruction of a retinal angioma in this country. Without knowledge of Fralick's operation, my first case was done on November 7, 1941, with the assistance of Dr. R. O. Rychener. Guyton[10] reported two cases on which he operated in 1942. One of these patients had a single angioma of one eye which was destroyed by diathermy punctures, with the preservation of normal vision. The other eye of the same patient had multiple angiomas with extensive retinal detachment. The angiomas were successfully destroyed, but no vision was restored.

The localization of the angioma may be done by the same methods as are used for the localization of retinal tears. The technique employed in the diathermy destruction of retinal angiomas is essentially the same as used for retinal detachments and was described in a previous paper.[1] Punctures with micropins into and immediately around the angioma are necessary. In addition to this, a moderate degree of surface coagulation of the sclera is advisable.

In view of the satisfactory results obtained by diathermy, it seems to be the method of choice in single and also in multiple angiomas of the retina. In early cases the prognosis is good for the preservation of useful vision. In advanced cases with ex-

* Presented at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947.

tensive exudation, degeneration, and detachment, the prognosis for restoration of vision is bad, but the operation is justifiable for preservation of the eyeball, although the latter is not always possible. X-ray treatment may, in certain hands, prove just as satisfactory. Reports of a larger number of cases treated by the two methods and observed over several years, with a final careful analysis of end results, will probably settle this question eventually.

Case reports

Case 1

History. The first case has already been reported and will be discussed here only in the following brief résumé to bring the history up to date. A white man, aged 25 years, was seen first in October, 1941, for refraction because of asthenopic symptoms. He had only recently noticed that the vision of his left eye was poor. He was found to have the typical enormously enlarged vessels and a single angioma far forward in the 3:30-o'clock meridian.

Operative procedure. Operation on November 7, 1941, using Walker micropins, as previously described, succeeded in destroying the angioma and the blood vessels. Vision in this case was only 8/200 before operation. This poor vision was due to the very extensive exudates, or deposits of lipoid material in the macula and surrounding retina. Following operation, vision did not improve. It remained the same for about one year, but had gradually become reduced to 2/200, due to extensive degenerative changes and scar tissue formation.

Course. The fundus picture had remained practically unchanged for the past several years. No trace remained of the large artery and vein, but along their former course, in the region of the equator, newly formed blood vessels and fibrous tissue extended forward into the vitreous to a height of about 6 diopters. When last examined (April, 1947), two small spots of hemorrhage were visible in that area, indicating that perhaps a very quiet form of proliferating retinitis was still going on. Dense scar tissue occupied the site of the former angioma. The general condition of the patient had remained excellent. The eye appeared a little smaller than the other and a scarcely noticeable exotropia was present.

Case 2

History. Mrs. M. P., a white woman, aged 34 years, was first seen in August, 1944, on one of the medical wards of the John Gaston Hospital. She had noticed for about two weeks that vision of her left eye was blurred, but she was confined to the Hospital to find the cause of severe headaches which had been present for three days before admission. The patient had been admitted to the Hospital for various ailments over a period of 12 years. Only one of these conditions was of particular interest. In June, 1944, an exploratory laparotomy had been performed. A small cyst of the pancreas was found and removed. It measured 20 by 8 by 2 mm. Microscopic section showed it to consist of a fibrous tissue wall with a low columnar cell lining. It was not an angioma. The family history was also interesting: her father died of a brain tumor (type unknown) at the age of 36 years. Her daughter died of a tumor (cerebellar cyst) at the age of 17 years, and one of her sisters died of a brain tumor. (None verified by autopsy.)

Physical examination. Complete general physical and laboratory examinations were negative and the consulting neurosurgeon found no evidence of cerebellar or other intracranial involvement. The right eye was normal and the vision, 20/20. The left eye was normal except for the fundus findings. The disc was slightly swollen with blurred borders. Below the disc, two very large blood vessels coursed tortuously downward and forward to a tumor mass in the 6-o'clock meridian, between the equator and the ora serrata. The tumor mass was about 1¾ times the size of the optic disc and of a light reddish brown color. There was no

separation of the retina, and none of the degenerative changes which had been so abundant in the first case. Vision was reduced to 20/100.

Operation. On September 6, 1944, operation was performed at the Memphis Eye and Ear Hospital. The procedure used was essentially the same as that used in Case 1. The conjunctiva, Tenon's capsule, and the inferior rectus muscle were separated from the sclera and retracted downward. One Walker micropin was placed on each side of the 6-o'clock meridian just anterior to the equator. Ophthalmoscopic examination showed these pins to be located just at the posterior border of the angioma. Micropins were then placed on either side of the tumor and the entire area between these 4 pins extending forward to the ora serrata was studded with punctures. A total of 15 Walker pins was used with 45 ma. of current. Surface diathermy was not applied in this case. No hemorrhage occurred during the operation.*

Postoperative Course. On the second postoperative day, there was a retinal detachment present. This gradually increased until on the 16th day it covered the entire lower half of the eye and obscured all but the upper border of the disc. In the meantime, numerous hemorrhages had occured into the retina and it was impossible to find any definite tears, but a disinsertion was thought to be present. On the 20th day after the first operation, a second diathermy procedure was performed. A barrage of micropins was inserted to surround the site of the angioma. Surface diathermy was also applied. Sclerotomy with a Graef knife released a considerable amount of clotted blood. Following this procedure, the vitreous was very hazy with blood so that for some time the fundus could not be seen. After another four weeks in bed, the patient was sent home with pinhole spectacles and with a

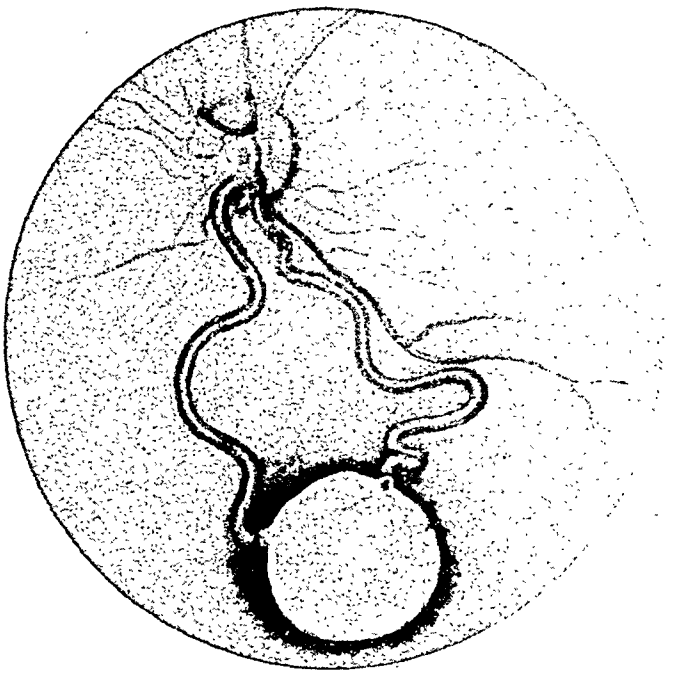


Fig. 1 (Lewis). *Case 2.* Preoperative appearance.

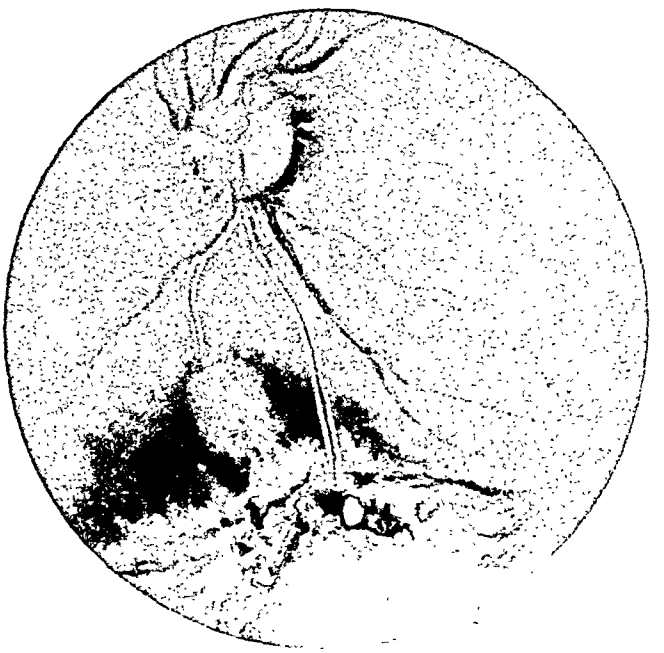


Fig. 2 (Lewis). *Case 2.* Appearance 32 months postoperatively.

* Dr. George Kambara, of Madison, Wisconsin, former resident in the Memphis Eye and Ear Hospital, assisted in the operation and management of Case 2.

rather gloomy prognosis. Iodides given internally, and the passage of time gradually cleared the vitreous. However, it was five months after operation before fundus photographs could be made. Even then they were indistinct. At that time the disc was fairly normal. The vessels were smaller. There was a rather diffuse pigmentation of the retina and the site of the angioma appeared quite red, but no details were visible. Vision was 20/100. The patient was not seen again until July, 1945. Vision was then 20/40 and the fundus could be seen fairly clearly. The angioma seemed to be completely destroyed. Its former site and the entire surrounding retina were pigmented and scarred. The vein appeared as a small column of blood which stopped just anterior to the equator. The artery was rather large and extended from the disc into the scar anteriorly. Both vessels were surrounded by fibrous sheaths. There was no evidence of tumor recurrence, but the patent artery made the final result seem somewhat doubtful.

Outcome. When next seen in February, 1946, vision had improved to 20/30 and J2. White atrophic spots, pigmentation, and very irregular scar tissue occupied the lower anterior one sixth of the fundus. The vessels were slightly smaller. Final examination on April 21, 1947, showed the vision to be 20/30, corrected with a +0.75D. cyl., ax. 90° to 20/20. Near vision was J1 with normal accommodation. The eyes functioned normally and the patient was unaware of a rather large defect present in the upper visual field. There was a definite flattening of the eyeball below, probably due to contraction of the sclera from coagulation. The vitreous was perfectly clear. The fundus was normal except for the extensive irregular scarring and the peculiar vessels. The blood columns were smaller, the fibrous walls thicker and whiter. The vein stopped at the equator, but the artery ran forward into the temporal side of the scar.

Almost three years have elapsed without recurrence of the growth and with great improvement of ocular functions. She still has occasional severe headache and recently (March, 1947) underwent pneumoencephalography, with negative results.

Comment. In retrospect it seems that failure to use surface coagulation in this case, at the time of the first operation, was a mistake. It might have prevented the necessity of the second operation. It is quite possible that 45 ma. of current is too much to use and that less scarring would result from a smaller amount. A smaller reaction without any hemorrhage would be ideal and may be possible with more experience.

Summary and Conclusions

Two patients with angiomatosis retinae were treated by diathermy coagulation and observed for 5½ years and 3 years respectively.

The first was an advanced case and while the angioma and large vessels were destroyed and the eyeball preserved, vision was not restored. The second case was early. The angioma was destroyed and normal vision was present after 34 months.

Due to the progressive nature of angiomatosis retinae it seems that all cases uncomplicated by intracranial or other serious involvement should be given the benefit of some type of treatment to destroy the tumors. Diathermy offers the best method for single angiomas, particularly when located far in the periphery. It is felt at present that the combination of surface diathermy along with multiple punctures into and around the angioma is, in the majority of cases, the procedure of choice.

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GLAUCOMA ASSOCIATED WITH SUBLUXATION OF THE LENS IN SEVERAL MEMBERS OF A FAMILY*

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Ectopia lentis, or familial displacement of the lens, is most frequently manifested as a bilateral, symmetric displacement of the lens due to defects in the zonular fibers. Partial or complete luxation of the lens occurs and is frequently complicated by a secondary glaucoma. Falls and Cotterman,[1] in 1943, reviewed a family of 157 members, 24 of whom had ectopia lentis. Thirteen of these 24 members developed glaucoma; no case of glaucoma was found in the non-affected group.

It has long been recognized that glaucoma may be associated with changes of the lens. Following the classification of Parker Health,[2] glaucoma may arise either (1) when the lens is in position or (2) when it is displaced.

Under the first heading, we can include microphakia, glaucoma capsulare, and increase in the lens bulk. In microphakia, the associated glaucoma has its onset in youth and takes the form of acute attacks. Glaucoma capsulare, or desquamation of the lens capsule, may cause glaucoma by toxic, irritative, and mechanical methods. An increase in lens bulk may press on the ciliary body and cause an irritative process leading to blocking of the filtration angle.

In the second group are found both partial and complete luxation of the lens, whether due to congenital weakness of the zonule or to trauma. In ectopia lentis, or luxation of the congenital type, the lens sometimes comes in contact with the ciliary process and gives rise to an irritative vasomotor reaction. Local edema causes a forward displacement of the lens and blocking of the angle of the anterior chamber by the root of the iris. Complete dislocations of the lens, either into the anterior chamber or the vitreous body, are frequently followed by glaucoma.

This paper presents the case reports of two brothers and an analysis of the histories of the other members of their family.

CASE REPORTS

Case 1. L. O., a white man, aged 55 years, was seen in September, 1941, complaining of pain in the right eye of three days' duration. His left eye had been enucleated in 1938 for absolute glaucoma. The tension of the right eye was hard to fingers, the cornea was steamy, the pupil was fixed. Treatment with ¼-percent eserine drops produced only partial relief from the pain. Twelve hours

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later an iridectomy was performed. The iridectomy relieved the severe pain, but the tension remained above normal and treatment with pilocarpine solution was necessary from 1941 to 1944. Refraction of the right eye was: −1.75D. sph. ⌒ −1.0D. cyl. ax. 100° = 20/50−1.

On February 8, 1944, the patient bumped his head against another worker. This caused the rays to proceed "up" when reflected from objects, rather than "down as previously." Objects appeared upright and normal to him. There was no pain, and he could see to get around. He realized that he had dislocated the lens of his right eye. Examination four days later showed an oily translucent mass in the anterior chamber of the right eye. The eye was not tender and the tension was normal to palpation. The lens was removed on February 15th by loop extraction, little vitreous being lost. Recovery was satisfactory and on April 11th the right eye was white and quiet with normal tactile tension. Glasses were prescribed: O.D., +10.5 D. sph. ⌒ +3.5D. cyl. ax. 30° = 20/30.

This patient with glaucoma and dislocation of the lens responded satisfactorily to treatment when the lens was removed, and the good visual result has since been maintained.

Case 2. C. O., aged 54 years, the brother of L. O., was first seen on May 5, 1947. About six weeks previously the vision of the left eye had become blurred and his optometrist had found the eye had become more myopic. For three weeks his left eye had pained and he had noticed rings about the lights.

Vision was: O.D., 20/20; O.S., 20/200 correctible to 20/60 with a −3.75D. sph. ⌒ −1.25D. cyl. ax. 110°. Tension was O.D., 19 mm. Hg; O.S., 65 mm. Hg (Schiøtz). The right eye was normal. On the left side, the conjunctiva was injected, the cornea was steamy, the anterior chamber was almost completely filled with the lens which projected through the pupil. The right pupil was round, 2 mm., reacted to light and accommodation, consensually and directly. The left pupil was oval, 7 mm., and did not react. The fundus was hazy and no gross pathologic condition was seen.

He was treated with neosynephrine (10 percent) drops to the left eye. On May 6th, the tension was 30 mm. Hg, but the next day it was 70 mm. On May 9th, an intracapsular extraction of the left lens was done, with a peripheral iridectomy. The tension at the time of operation was 70 mm. Hg. At the first postoperative dressing there was a prolapse of iris at the 1-o'clock position. This was excised and the wound healed well. A month later refraction was O.S., +10.5D. sph. ⌒ +2.D cyl. ax. 30° = 20/30. The field was normal for 5/330 white test object. The tension has stayed normal since the operation.

Family history

Grandmother A. The first member of the family of which we have any record became blind at the age of 43 years from bilateral glaucoma. She had eight children, of whom five were affected, as follows:

M. O. This was the mother of L. O. At the age of 52 years she had an operation for glaucoma on her left eye, and four years later a cataract was removed from that eye. When 65 years old, her right eye was operated on in St. Michael's Hospital, Toronto, for glaucoma with secondary cataract. It is recorded that prior to operation, the lens was dislocated into the anterior chamber.

M. W. This was an aunt of L. O. She suffered, at the age of 46 years, an acute attack of glaucoma in the right eye, for which an iridectomy was performed. At 50 years of age, a right cataract was removed, and it was noted that an incipient cataract was present in the left eye.

T. A. This is an uncle of L. O. When 37 years of age, his right eye was operated on for glaucoma. There is no further report on this eye until at the age of 60 years, it was said to be blind. Five years later, Dr. A. B. Ritchie, of Guelph, Ontario, noted long-

standing glaucoma in the left eye with vision reduced to light perception only. An iridectomy was performed and some vitreous was lost at operation. The vision is now light perception only.

C. A. This was an uncle of L. O. He was known to have glaucoma, but no further information is available.

glaucoma in the right eye. The eye did not respond to miotics, but on instillation of a 1:100 solution of adrenalin, the tension dropped and the pupil dilated to reveal a dislocated lens. A basal iridectomy with extraction of the lens was done. Subsequent vision was 20/20.

One year later, acute glaucoma, which did

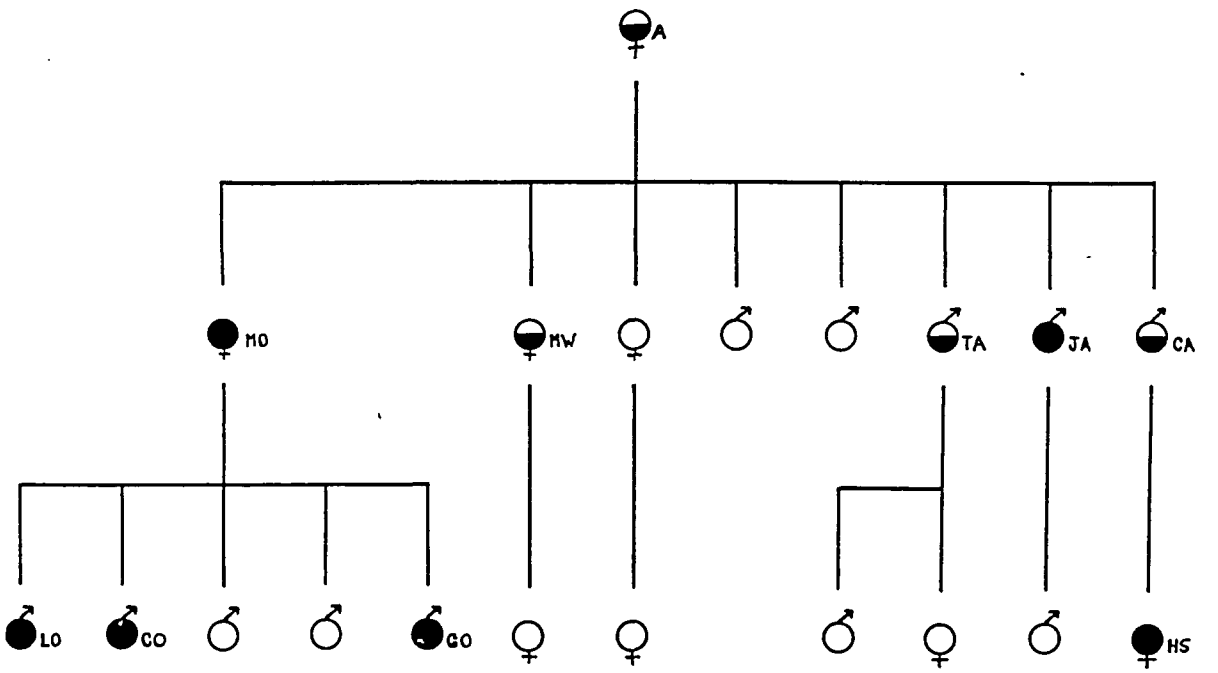


Fig. 1 (Harshman). Genealogic tree of a family in which several members suffered from glaucoma associated with subluxation of the lens. Half-blocked circles represent patients with glaucoma. Fully blocked circles represent patients with glaucoma and dislocated lenses.

J. A. This was an uncle of L. O. He has had eye trouble since the age of 40 years, and is known to have dislocated lenses. There is no medical report available.

Third generation

In the third generation, four members of the family are known to have dislocated lenses and glaucoma.

L. O. This case has been described above.

C. O. This case has been described above.

G. O. A brother of L. O. Dr. Gerald Spero, of Detroit, Michigan, states that the patient's first complaint was one of increasing myopia. At the age of 36 years, refraction was: −6.0D. sph. O.U. = 20/20; the tension and fields were normal. Six months later, the patient suffered an acute attack of

not respond to miotics or strong adrenalin, developed in the left eye. Dr. Kronfeld, of Chicago, did a basal iridectomy on the left eye. It was noted after operation that the left lens was dislocated. Nine months later, a loop extraction of the dislocated lens was done, and vision of 20/20, with correction, was obtained.

H. S. This is the daughter of C. A. and a cousin of L. O. When aged 42 years, she noticed a loss of vision for distant objects, and was told she was near-sighted. Glasses were prescribed. The glasses were changed a year later, and shortly after that Dr. Ruedemann, at the Cleveland Clinic, made a diagnosis of glaucoma. A few months later, the patient suffered an acute attack of glaucoma in the left eye, which was relieved by an

iridectomy and extraction of the dislocated lens. In the same year, she suffered an acute attack of glaucoma in the right eye. Iridectomy and extraction of the lens was again done. Dr. Ruedemann reports that the operation on the right eye was more successful than that on the left.

Comment

Stokes[3] has reported a family of five generations exhibiting glaucoma, and has reviewed the literature regarding hereditary glaucoma. He finds that the hereditary disease is usually chronic in form, and that permanently good results are obtained by a fistulizing operation, iris inclusion operation, or the Elliot trephining operation.

The family herein reported carries a hereditary tendency to glaucoma. Of the 10 members exhibiting the disease, 6 had dislocated lenses, and a 7th had an incipient cataract. Four patients showed a sudden increase in myopia prior to the appearance of the hypertension. Thus, the glaucoma is intimately associated with dislocation of the lens. The glaucoma exhibited its first clinical manifestations in the 4th to 6th decades, and its onset was acute in several of the cases.

Therefore, this series of cases does not belong in the usual group of hereditary glaucoma. They show a type of glaucoma secondary to a pathologic condition of the lens, whether it is faulty position causing a mechanical obstruction of the angle, or some irritative process of the ciliary body. For these reasons, the usual glaucoma operations fail to give complete relief.

Summary

A family, which contains many cases of glaucoma associated with subluxation of the lens, is presented and discussed. The disease, in this group, does not respond to the usual medical or surgical treatment for glaucoma, but is only permanently controlled by removal of the lens. Such cases should be remembered because they indicate that subluxation of the lens may be a factor in cases of glaucoma which do not respond to the ordinary operations.

I wish to thank Dr. R. J. P. McCulloch and Dr. Clement McCulloch for their kind permission to quote the case histories of patients L. O. and C. O.

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THE OCULAR EFFECT OF SEVERAL IRRITANT DRUGS APPLIED DIRECTLY TO THE CONJUNCTIVA*

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The aim of this work is to compare the immediate and delayed effects of a variety of irritants on the cornea—a tissue normally devoid of blood vessels—with their effects on the vascular tissues of the sclera and eyelids.‡

Method

The observations were made on white rabbits, unless otherwise stated. The substance, as powder or dissolved in 0.7-percent solution of sodium chloride, was placed in the lower conjunctival sac of one eye and held there usually for one-half minute. This was repeated at intervals of one or several days, if necessary. The other eye was treated with 0.7-percent solution of sodium chloride and used as a control. The eyes were examined for evidence of inflammation, and changes in the corneal structures were observed with the biomicroscope.

Results

The reactions observed after the application of several substances are the following:

1. Anthraquinone

This drug, applied to the eyes as a dry powder, daily for several times, produces only immediate sensory and inflammatory reaction (discomfort, blepharospasm, and conjunctival congestion) that disappears very soon. The eyes appear normal in a few hours, and the conclusion is that the anthraquinone produces these reactions by the mechanical contact of the powder, which is almost insoluble in the eye secretion.

2. Arsenic trioxide

The arsenic was applied as dry powder or saturated solution. The saturated solution, prepared with cold saline solution, is too dilute to produce either immediate sensory or acute or delayed inflammatory reaction. The dry powder, when applied once in very small quantity, produces only discomfort, blepharospasm, and lacrimation. The increase of the ocular secretion washes the drug from the eyes, and does not produce inflammatory reaction. When it is applied for several days (once daily during three days) or in moderate quantity, it produces immediate discomfort, lid spasm, miosis, acute inflammatory conjunctival reaction (distended vessels, large hemorrhage, and thrombosis), and marked edema of the lids. These conditions increase in 24 hours. The cornea soon turns opaque, and a purulent secretion appears. If the epithelial corneal alteration is not severe and the conjunctival vessels around the limbus are not necrosed, a vascular invasion of the cornea from all parts of the limbus begins in a few days (fig. 1B).

If the corneal lesion is slight, it is very soon repaired; if it is severe, a perforation may be produced in a week followed by recovery, or by phthisis bulbi in 20 days if the dose of the drug was high. When the dose is very great (almost filling the lower conjunctival sac with the dry powder), the acute inflammatory reaction is more violent, the edema of the lids increases in a short time and encloses the drug, which is almost totally absorbed so that the animals die from the systemic arsenic effects before

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‡ I am indebted to Dr. Torald Sollmann, professor emeritus of pharmacology, for the guidance and criticism, and to Dr. Lorand V. Johnson, assistant professor in ophthalmology, for checking the interpretation of the ocular lesions.

there is time to develop intense alterations in the ocular structures.

The events produced by moderate dose of arsenic trioxide appear similar to those described by Uhde[1] for B-chlorovinyl-dichlorarsine or Lewisite.

The damage to the nonvascular cornea as a dry powder and in saturated solution. With the dry powder, a single application is irritant and produces immediate sensory reaction, discomfort, blepharospasm, and conjunctival hyperemia. Edema appears with watery secretion on the day following the application, but the cornea is clear and in

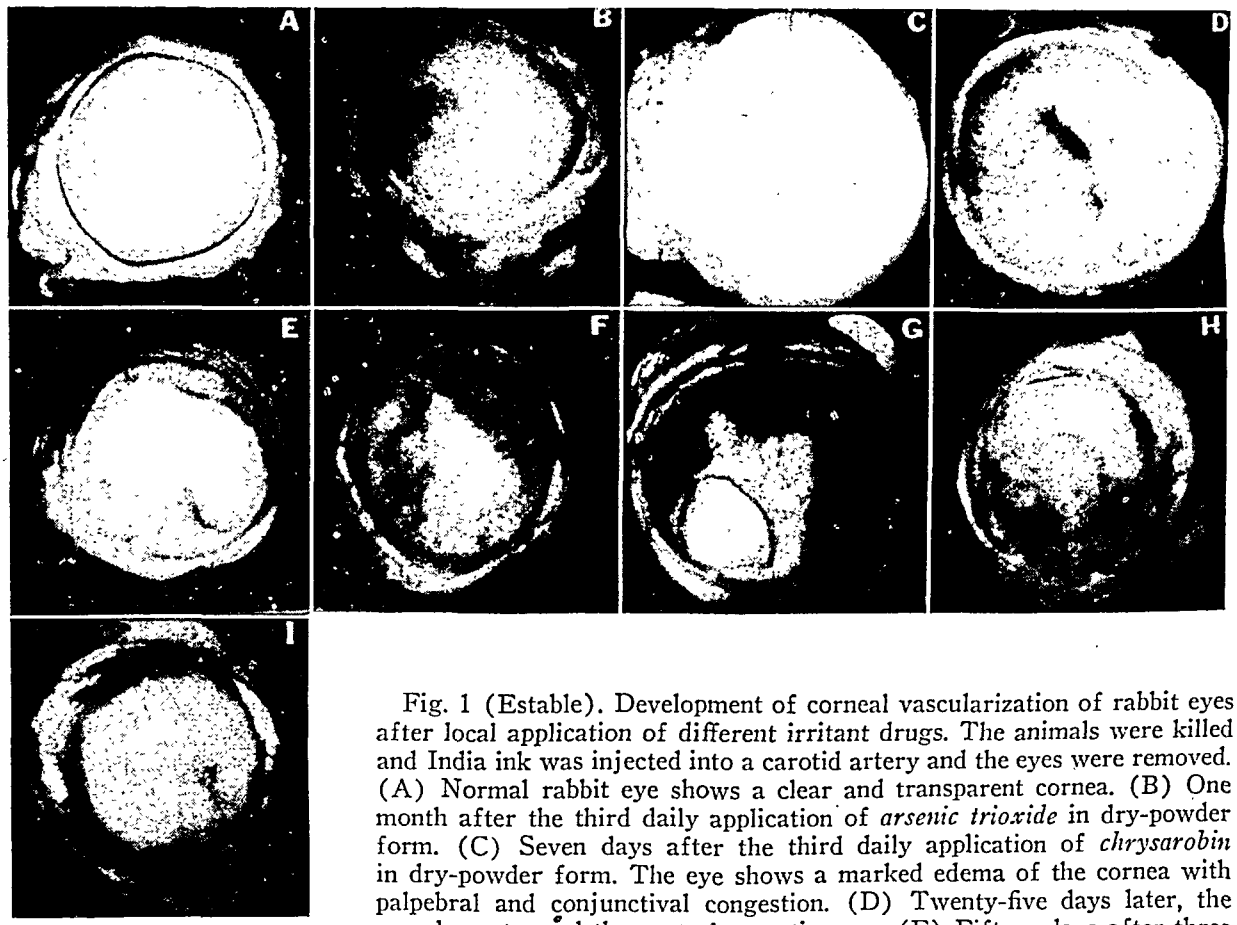


Fig. 1 (Estable). Development of corneal vascularization of rabbit eyes after local application of different irritant drugs. The animals were killed and India ink was injected into a carotid artery and the eyes were removed. (A) Normal rabbit eye shows a clear and transparent cornea. (B) One month after the third daily application of *arsenic trioxide* in dry-powder form. (C) Seven days after the third daily application of *chrysarobin* in dry-powder form. The eye shows a marked edema of the cornea with palpebral and conjunctival congestion. (D) Twenty-five days later, the vessels go toward the central necrotic zone. (E) Fifteen days after three applications of *emetine hydrochloride* (1:500). The cornea appears covered by superficial and deep blood vessels extending from sclerocorneal limbus to the central necrotic zone. (F) One month later, the blood vessels are well marked and the central zone of the cornea appears more clear. (G) Forty days after a single application of *quinone* in dry powder. The perforation was produced in 18 days. (H) Ten days after a single application of *quinone* in saturated solution. The eye shows a marked corneal necrosis with vascular proliferation on the conjunctiva as well as corneal invasion. (I) Forty days after a single application with *resorcinol* in dry-powder form.

shows that arsenic trioxide acts directly on the cells when it is applied topically in powdered form in moderate or great quantity, and not merely indirectly by the action of the drug on the capillaries.

3. Chrysarobin

This substance is very slightly soluble in water and in saline solution. It was applied four days the eyes appear to be normal.

A second application produces the same immediate and acute reaction, but the repetition of the applications, daily for several days, causes a severe inflammation. In the first few days, an ocular and palpebral conjunctival vascular reaction occurs, with increase of the ocular secretion. On the day after the third application, the cornea is

edematous and opaque, and the conjunctiva shows intense inflammation (conjunctivitis or keratitis), corresponding to the violent vascular conjunctival reaction described by Igersheimer.[2] Vascular invasion into the cornea begins in a few days, and depilation of the lids in a week. The saturated solution does not produce sensory, acute, or delayed reactions in the ocular structures, during or after several daily applications.

In conclusion, the chrysarobin in saturated solution does not produce any effect because of the slight solubility of the drug. A single application as dry powder causes immediate sensory and inflammatory reaction followed by acute conjunctivitis (hyperemia, edema, and watery secretion) that almost disappears in four days. Repeated daily applications result in marked irritant local reaction with intense edema of the cornea, conjunctiva, and lids, and vascular invasion of the avascular membrane (figs. 1C and 1D).

4. Colchicine

A dilute solution of colchicine (1:5,000) applied locally, daily for several days, does not produce immediate sensory or acute and delayed inflammatory reaction. Solution of 1:2,000 does not produce sensory reaction, but only a very slight hyperemia of the conjunctiva that disappears very soon. Daily applications produce the same effect. Solution of 1:1,000 produces only slight conjunctival congestion that disappears before 24 hours. Solution of 1:500 results in vascular conjunctival inflammation (hyperemia, vasodilatation) that is apparent 24 hours after the application and increases after the second and third application but without corneal modifications. The hyperemia has almost disappeared in 48 hours after the last application; and in four days the eyes are practically normal.

The same solution, applied every day for 10 days, also produces the same reaction, which does not progress and is very similar to the aspect of the first days. With strong solution (1:100), the vascular conjunctival reaction appears in a few hours and, after the third application, the cornea turns opaque and a vascular corneal invasion begins in a few days.

These alterations soon disappear and, in a few days only, the main vessels persist on a transparent cornea. For the increase and persistence of the corneal vascular reaction, more daily applications are necessary. When the dry powder is applied, immediate lacrimation, blepharospasm, and acute conjunctivitis appear; in 24 hours, the conjunctival congestion increases and extends to the iris, and slight edema of the palpebral conjunctiva develops. The eye is more closed than normally (photophobia?). The conjunctival congestion persists for 48 hours only, and in six days the eyes show corneal vascularization. The cornea remains almost clear throughout.

In conclusion, the eye symptoms shown by colchicine in dilute solution are slight and of short duration; a strong solution or dry powder produces an inflammatory reaction, with vascular invasion only if it is applied daily for several days.

5. Emetine hydrochloride

The irritant local action of the emetine on the conjunctiva was first pointed out by Lowin[3] and lately confirmed by Walters and others,[4] but their reports do not describe reactions in the nonvascular tissue (cornea). In two clinical cases, when a 4-percent emetine solution had accidentally splashed into the eyes, Blue[5] reports no immediate pain, but a few hours later "there is an uncomfortable scratchy feeling, intense photophobia, and lacrimation with conjunctival and circumcorneal injection."

The drug was placed into the conjunctival sac in various concentration, and one, two or more applications were made with intervals of one day. The immediate, acute, or delayed inflammatory reactions vary with the concentrations. Even a 1:50 solution does not produce an immediate sensory effect. The

application of a 1:10,000 solution, daily for several days, does not produce inflammatory effects. A 1:5,000 solution produces a slight conjunctivitis, 24 hours after the second application, that disappears very soon. With a more concentrated solution (1:2,000 and 1:1,000), the ocular and palpebral conjunctiva shows intense and prolonged congestion and a little edema but the cornea shows no changes, the local inflammatory reaction being confined to the vascular tissue.

The application of a 1:500 solution for three consecutive days is followed by intense conjunctivitis (hyperemia and vasodilatation), increase of the purulent ocular secretion, cloudiness of the cornea, and formation of new vessels in the conjunctiva, with coreal vascular invasion in a few days. With a 1:100 solution, conjunctivitis appears promptly and increases in 24 hours, with edema formation and purulent secretion. With a 1:50 solution, the immediate conjunctivitis increases rapidly, and edema and abundant purulent secretion are present in 24 hours. This picture remains unchanged for several days but, about the fifth day, cloudiness of the cornea appears and in seven days the cornea shows small vessels; in nine days, the skin of the lids is reddened and edematous and its depilation is evident.

The vascular invasion may become very great so that the vessels cover almost the entire surface of the cornea, leaving a small central necrotic zone free. The condition remains much the same for many days. Some 40 days after the last application, the corneal lesions begin to progress toward repair, and the vascular reaction disappears. In about two months the eyes usually recover without permanent damage and have normal aspect. A progressive development of corneal inflammatory reaction, after three applications of a solution 1:500, is shown in Figure 2.

The conclusion is that emetine hydrochloride produces a powerful and irritating local reaction on the eyes when relatively dilute solutions are applied for a few days. These begin in the vascular structures and progress to the nonvascular. The intensity and time of appearance of the irritating effect are related to the concentration of the solution and to the frequency of the application. These irritating actions are in contrast with the absence of immediate sensory effect.

6. Histamine biphosphate

A solution of histamine biphosphate (1:200) produces immediate sensory reaction, with slight acute conjunctival vasodilatation that disappears very soon. Dry powder produces discomfort, blepharospasm, lacrimation, and prompt vasodilatation, but these symptoms also disappear in a few minutes. Daily applications during several days produce the same effects. The slight conjunctival reaction with relatively concentrated solutions in rabbits is in contrast to the potent vasodilator effect produced in the human eye by 1:40,000 and 1:50,000 solutions as Gartner[6] shows in the photograph of blood vessels of the conjunctiva. Rabbits, therefore, appear relatively tolerant to action of histamine in this location.

7. Paraphenylenediamine (orsin)

The dry-powder form of this drug applied in the conjunctival sac produces immediate signs of discomfort or pain, lacrimation, blepharospasm, and a vascular conjunctival inflammatory reaction resembling allergic conjunctivitis, with promptly increasing palpebral edema. However, it does not produce any persistent alteration in the cornea and conjunctival membranes, even when the drug is applied several times. With a saturated solution, no immediate sensory reaction is observed, but the vascular conjunctival reaction appears immediately after the instillation of the drug, increases in a few minutes, and disappears very soon. This contrasts with the clinical reports of corneal ulceration, ophthalmia, and permanent blindness occurring in connection with its use as a brown dye for hair and fur.[7-12] However, these appear to involve individual allergic

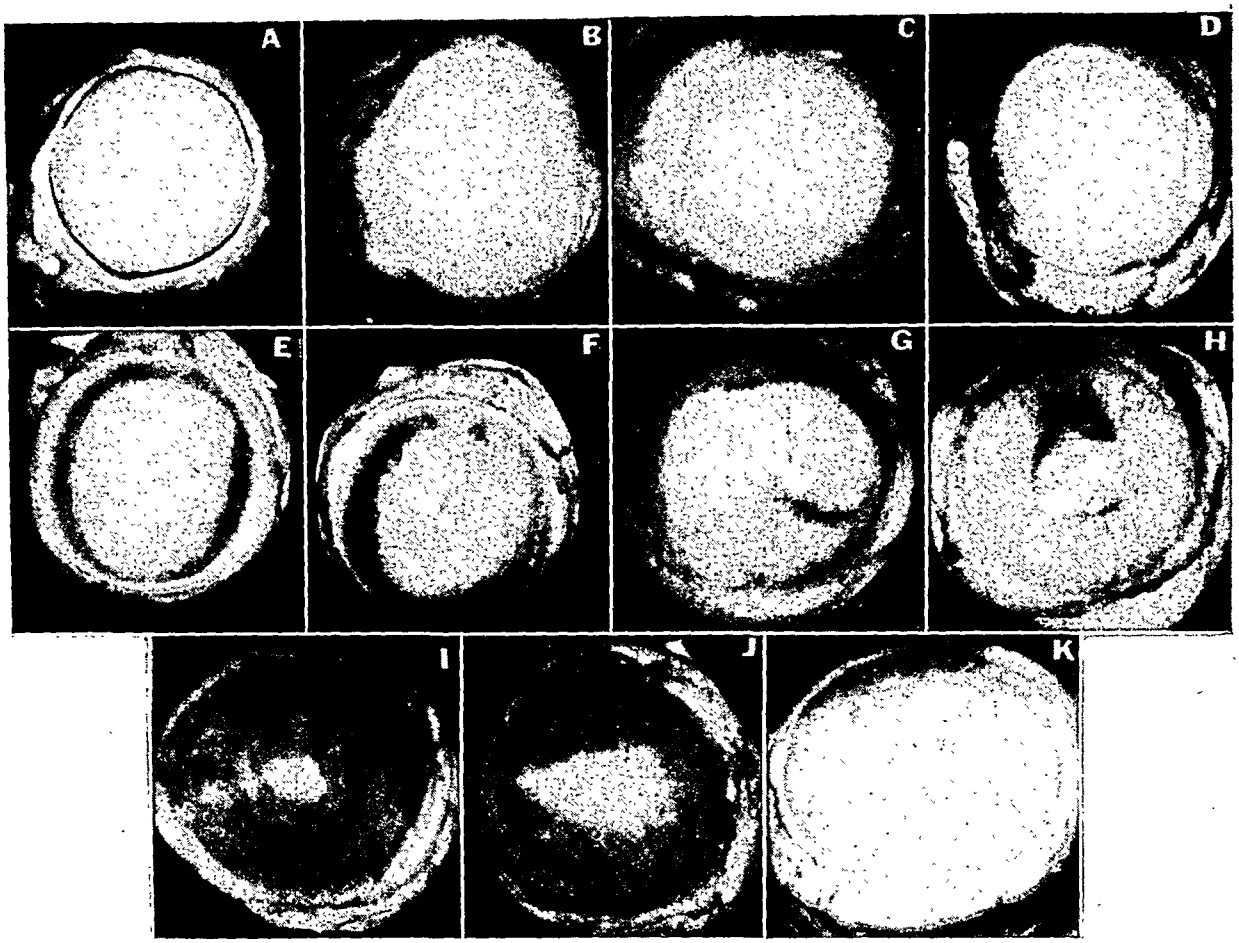


Fig. 2 (Estable). Progressive development of corneal inflammatory reaction of rabbit eyes after three applications of a solution (1:500) of *emetine hydrochloride*. The animals were killed and India ink was injected into a carotid artery and the eyes were removed. (A) Normal rabbit eye, the cornea is clear and transparent. (B) Twenty-four hours after the first local application. The sclera and palpebral conjunctiva are congested, but the cornea appears normal. (C) In 48 hours (24 after the second application) the conjunctivitis has increased. The cornea has lost its normal luster and appears slightly opaque. (D) In seven days, the superficial blood vessels around the limbus begin to extend into the edematous and rather opaque cornea. (E) In nine days, the aspect of the cornea is almost the same. (F) In 12 days, the corneal vascular invasion increases and a complete circular pannus appears. The corneal edema has spread, and superficial ulcerated zones are present. (G) In 15 days, the cornea shows the progressive advance of the vascular invasion. The superficial and deep blood vessels are extended on the opaque cornea toward the central necrotic zone. (H) In 20 days, the circular pannus is very regular. The large superficial vessels cover almost all the corneal membrane from the limbal plexus, leaving free only the central ulcerative zone. (I) In 25 days the cornea shows a similar aspect. (J) One month after the edema of the cornea has entirely disappeared, the opacity is relatively slight. (K) In 40 days, the cornea is much improved; the opacity has disappeared entirely, and the blood vessels are also rapidly disappearing.

susceptibility.

In conclusion, paraphenylenediamine, when applied to rabbit eyes, produces an inflammatory reaction resembling allergic conjunctivitis.

8. Podophyllin

This substance is very irritating to mucous membranes and eyes. Applied on the eyes as a dry powder, it produces immediate discomfort, blepharospasm, lacrimation, conjunctival vasodilatation, and edema that increase promptly. In 24 hours, the conjunctival congestion and the edema are very marked; in 48 hours, the cornea is slightly clouded and vascularization appears in five days. In 25 days, the cornea is normal. In conclusion, podophyllin in dry powder form

produces immediate sensory and inflammatory reactions that progress very rapidly.

9. Quinone

This has a very irritating action on the membrane of the eye when it is applied in powdered form and in solutions that are not too dilute. The 1:10,000 solution, applied daily for several days, only produces sensory reactions. These reactions are greater with 1:5,000, but without inflammatory effects. The 1:1,000 solution produces acute conjunctivitis (vasodilatation, edema, and purulent secretion) that disappears in some days. With daily applications it is more persistent, but always remains limited to the vascular membrane. With 1:500 solution, cloudiness of the cornea appears in 24 hours and its vascular invasion begins in four days. With a dry powder, the immediate sensory reactions are marked (discomfort, blepharospasm, lacrimation) and acute conjunctivitis appears in a few minutes. Marked edema and corneal opacity by necrosis is present before 24 hours, persists for a long time, and perforation of the cornea may result (figs. 1G and 1H).

In conclusion, quinone in different concentrations produces ocular reactions that grade from slight immediate sensory reaction with 1:10,000 solution, to violent conjunctivitis (vasodilatation, edema, purulent secretion), and marked necrosis of the cornea with the application of a dry powder.

The harmful ocular effects of quinone vapors were reported by Sterner, Oglesby, and Anderson.[13]

10. Menadione (2 methyl 1-4 naphtohoquinone)

Instillation of an aqueous solution of the bisulfite (1:1,000) produces immediate sensory reaction (discomfort and blepharospasm) with conjunctival congestion that disappears very soon without any evidence of injury. New applications produce the same effects.

11. Resorcinol

No immediate, acute, or delayed effects are produced by a 1:1,000 solution, even when applied daily during several days. With a solution of 1:100, slight blepharospasm and conjunctival congestion appear immediately but are of short duration and, in a few hours, the eyes present a normal appearance. Daily applications during several days produce the same effects. With a 1:10 solution, immediate sensory reaction is present, and clinical conjunctival inflammation with cloudiness of the cornea begins a few seconds after the instillation is started. A purulent secretion appears in 24 hours, and vascular invasion of the cornea begins in four days (fig. 1I). The application of the drug in dry powder form produces immediate discomfort and results in necrosis of the cornea, generally followed by perforation. If the necrosis is not very marked, a vascular invasion of the cornea develops.

General discussion

The irritant ocular reaction produced by the different substances herein reported may appear on the conjunctival structures alone, or on the conjunctival and ocular membranes, successively or simultaneously, but with different intensity and with a different type of reaction.

The clinical manifestations produced by the drugs studied are:

1. Immediate sensory irritant reactions—discomfort, blepharospasm, photophobia, and lacrimation.

2. Acute and subacute inflammatory reactions—hyperemia, vasodilatation, hemorrhage, edema, purulent secretion, and necrosis.

3. Delayed inflammatory reactions—corneal opacity, vascularization, necrosis, ulceration, and perforation of the cornea.

This clinical picture is not characteristic of any one drug. Several drugs may produce identical effects; and a given drug may produce them only in part, depending on (1) *Physical state* (all the drugs in powdered

form produce immediate sensory and acute reactions); (2) *Concentration* (very dilute solutions do not produce any apparent effect; for instance, arsenic trioxide and chrysarobin in saturated solutions; emetine (1:10,000); quinone (1:10,000); resorcinol (1:1,000); (3) *Time of contact* and *frequency of applications* (the clinical ocular picture with colchicine (1:100) is evident after the third application).

The actions of different drugs are influenced by their chemical affinity for the proteins of ocular membranes, by their physical adsorption,[14] and possibly by destruction or inhibition of enzyme systems in the cornea.

Some drugs produced delayed effect with sensory and inflammatory reactions, others acute inflammatory reactions without delayed effects; some produce only irritant sensory reactions but not lasting inflammatory changes and, finally, others show acute inflammation or acute followed by delayed effects without sensory reactions.

Some drugs produce only a vascular effect (anthraquinone, histamine, menadione, paraphenylenediamine); others cause both vascular and nonvascular changes, as illustrated by direct and indirect corneal alterations.

According to the intensity as well as qualitative effect produced by local application of different concentrations to the ocular structures, the different drugs that were studied may be classified in groups in order of potency:

1. Drugs without apparent effects in the following concentrations: arsenic and chrysarobin in saturated solution, colchicine (1:1,500), emetine (1:10,000), quinone (1:20,000), resorcinol (1:1,000).

2. Drugs that produce only immediate sensory reaction: anthraquinone and arsenic trioxide in powder and in small quantity; quinone solution (1:10,000 and 1:5,000).

3. Drugs that produce immediate sensory reactions followed by acute inflammatory effects: anthraquinone, chrysarobin, and paraphenylenediamine in dry powder, histamine (1:200), quinone (1:1,000), menadione (1:1,000), resorcinol (1:100).

4. Drugs that produce immediate sensory reactions followed by acute and delayed inflammatory effects: arsenic trioxide, chrysarobin (repeated daily applications), colchicine, and podophyllin in dry powder, quinone (1:500), resorcinol (1:10).

5. Drugs that produce only acute inflammatory reactions: colchicine (1:2,000, 1:1,000, and 1:500), emetine (1:5,000, 1:2,000, and 1:500), paraphenylenediamine in dilute solution.

6. Drugs that produce acute inflammatory reactions followed by delayed inflammatory effects: colchicine (1:100) (repeated daily applications), emetine (1:500, 1:100, 1:50).

Corneal turbidity as well as increase of the limbal capillaries appear to be necessary preliminaries to vascular invasion of the cornea. The destruction of the epithelium is followed by a secondary fibroblast formation, which facilitates the vascular progression. The turbidity of the cornea is related to the epithelium destruction or to the interstitial edema formation. Severe corneal necrosis does not produce vascular reaction, because the limbal blood vessels are necrosed. The opacity of the cornea and its vascularization are not specific of any drug. Every irritant substance that increases the capillary blood vessels of the ocular limbus and produces turbidity of the cornea may be followed by the vascular invasion.

The new formation of capillaries begins in the sclera and in the corneal limbus with the acute inflammatory conjunctival vascular reaction. When a slight corneal necrosis occurs, the vascular invasion progresses. The vessels appear on the cornea and invade almost all its surface from the limbus toward the center. The trunks pass from the limbus and there divide at right angles into numerous branches that form a loop plexus in the corneal margin, gradually extending toward the center.

The speed of return to the normal of the

ocular structures varies according to the intensity of the pathologic alterations. The corneal transparency is soon restored, but the blood vessels persist longer.

The eyes of several animals (rabbit, guinea pig, rat, mouse) show a similar picture, but pigeons show marked resistance to the ocular action of the several drugs. This apparent resistance may be related to the abundant watery conjunctival secretion which dilutes and washes out the drug.

It is not clear what relation the "exogenous" irritative vascularization of the cornea bears to the similar vascularization of the cornea which develops in animals with malnutrition from a diet deficient in vitamin A, riboflavin, or in aminoacids (histidine, phenylalanine, tryptophane, lysine, threonine, leucine, isoleucine methionine and so forth). The "endogenous" vascularization is an index of the nutritional conditions and regresses with return to normal diet and adequate respiratory enzymes.

Summary and Conclusions

The irritant local effects on the ocular membranes are studied by direct application of the drugs into the conjunctival sac of one eye of the rabbit; the other eye is treated with normal saline solution and used as a control.

The drugs tested, in several concentrations, were the following: Anthraquinone, arsenic trioxide, chrysarobin, colchicine, emetine, histamine, paraphenylenediamine, podophyllin, quinone, menadione, and resorcinol.

The clinical manifestations produced by different concentrations of these drugs are detailed and a classification in groups in order of potency and concentration is given.

The relation of solubility, physical state, concentration, time of contact, and frequency of application of the drugs and its irritant effect is discussed, as are the immediate, acute, and delayed inflammatory changes, and the opacity of the cornea and its vascularization.

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SOME ASPECTS OF STUDYING BINOCULAR VISION*

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It is the custom in modern medicine to classify disease processes on an etiologic basis and to direct treatment toward elimination of the causal condition. In disturbances of binocular vision a specific etiologic diagnosis is desirable, but it rarely suffices as a basis for therapy. History and physical examination must be directed toward determining the etiology, but in addition the status of the various complex components of binocular vision such as retinal correspondence and degree of simultaneous perception must be established before therapy can be outlined. These components may vary in diverse ways independently of the etiology.

The system of studying binocular vision in patients at The University of Oregon Medical School is based upon the concept that these anomalies are fundamentally deficiencies rather than positive phenomena. With few exceptions, patients with defective binocular coördination are lacking in one or more of the physiologic components of normal single binocular vision. Therefore, a systematic investigation of each of these physiologic components to determine if it is deficient or adequate provides a practical approach to the clinical study of binocular anomalies. A rigid routine of tests is not followed; rather, the physiologic components are investigated by the technique most applicable to the case.

The components of comfortable single binocular vision are interrelated, but, as a basis for examination, they may be divided into four sensory and four motor groups (fig. 1).

*From the Department of Ophthalmology, The University of Oregon Medical School. Aided by a grant given by Dr. and Mrs. John E. Weeks in memory of Dr. Frank R. Mount. Read before the sixth annual meeting of the American Association of Orthoptic Technicians, Chicago, Illinois, October 12, 1947.

SENSORY COMPONENTS

As a first step in examination of a given case, monocular tests are made to determine if vision in each eye is useful for binocular coördination. A full field of vision and normal visual acuity are not necessary, but, for orthoptic training, a patient must usually have at least 25 or 30 degrees of overlapping visual field in each eye and one eye must be capable of central fixation. Since the development in recent years of methods of peripheral fusion training,[1] acuity of 20/50 or better in each eye has not been essential for

PHYSIOLOGIC COMPONENTS OF BINOCULAR VISION

I - SENSORY

1. Useful vision and similar images in each eye.
2. Simultaneous binocular perception.
3. Normal retinal correspondence.
4. Cerebral integration of binocular perception (Fusion).

II - MOTOR

5. Full rotations and concomitant versions
6. Approximate parallelism of lines of distant fixation in fusion free position.
7. Ample fusional movements.
8. Accomodation - vergence balance.

Fig. 1 (Swan). Physiologic components of binocular vision.

binocular training. Every effort is made to restore vision in an amblyopic eye, but children with a persistent amblyopia of 20/100 or 20/200 in a squinting eye are no longer denied the benefits of orthoptics.

SIMILAR IMAGES IN EACH EYE

For maintenance of comfortable single binocular vision, the retinal images in the two eyes must be similar. It has not been possible to make routine studies for aniseikonia in patients with defective binocular vision, but otherwise every effort is made to detect inequality in vision of the two eyes. Accurate refraction is an essential part of every examination. Great care is taken to detect and correct oblique astigma-

tism and anisometropia, as well as hypermetropia and myopia. Textbooks emphasize the relationship of hypermetropia to esotropia and myopia to exotropia, because uncorrected, these refractive errors disturb the accommodation—vergence balance. This emphasis is justified but the high incidence of anisometropia, oblique astigmatism, and unilateral astigmatism in the common tropias of childhood is indicative that dissimi-

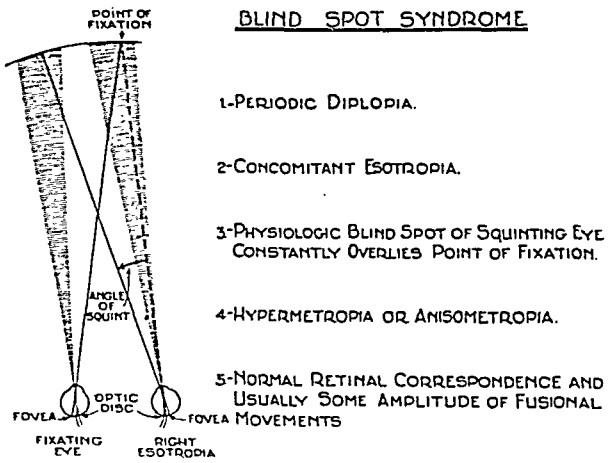


Fig. 2 (Swan). Blindspot syndrome.

lar retinal images are also of etiologic importance in binocular incoördination. A review of 1,000 cases of esotropia in children revealed this type of refractive error to be approximately four times as frequent as in children with normal binocular vision. The converse is also true. Disturbances of binocular vision seem almost invariable in the presence of uncorrected anisometropia of any appreciable degree. In addition to refraction, patients are carefully studied for any organic pathologic conditions which might produce an inequality in vision in the two eyes.

Simultaneous binocular perception

Simultaneous binocular perception is a second physiologic component of single binocular vision. Study of this faculty is of the greatest importance in all anomalies of binocular vision, but it seems commonly neglected or considered as a qualitative faculty. The degree of simultaneous perception varies greatly with the circumstances under which the eyes are used, that is with the type of the retinal stimulus and the particular retinal areas which are stimulated. For example, there are few patients with useful vision in each eye in whom some degree of binocular perception cannot be demonstrated under ideal circumstances, namely, by use of vertical prisms, a red glass, a totally dark room, and a bright point of light for fixation. Many patients may also demonstrate binocular perception on haploscopic devices, but otherwise may have some degree of suppression. It is essential, therefore, to study simultaneous perception as a quantitative phenomenon.

Establishment of good binocular coördination by training is futile if the patient has a useful degree of binocular perception only on haploscopic devices; therefore, it is particularly important to determine the degree of binocular perception which exists under ordinary visual conditions. A satisfactory method is to study the field of binocular vision on a large screen in a fully illuminated room with a filter-twin projection system. Either red and green color filters of the type described by Lancaster,[2] or of polaroid may be used with two projectors to separate the objects perceived by the two eyes. Normally it should be possible to demonstrate retinal rivalry and the absence of suppression scotomas in the central field of vision. If a suppression scotoma is found, it is important not only to plot its size, but also to determine its intensity by variations in the size and brilliance of the targets.

In esotropia, it is particularly important to determine the position of the physiologic blindspot because the normal blindspot is frequently a part of suppression scotomas. In some instances the blindspot may be utilized as a central scotoma by the squinting eye.[3] Recognition of this "blindspot syndrome" is important because it is common (fig. 2). If treatment is properly directed, the prognosis is favorable.

Bifoveal fixation under ordinary visual circumstances represents the highest degree of simultaneous binocular perception. It is not essential for comfortable single binocular vision, but its presence or absence is of clinical importance. For example, the demonstration of bifoveal fixation in a corrected case of unilateral esotropia has seemed the best indication that good visual acuity will persist in a formerly amblyopic eye. For studying bifoveal fixation, polaroid filters and twin projectors are used in a lighted room with the aluminized screen at least three meters from the patient. While the patient maintains perifoveal fusion, the central one degree of binocular field of vision is studied for scotomas with targets subtending small visual angles.

Normal retinal correspondence

Correspondence between the functions and the anatomy of the retinas and visual pathways of the two eyes is one of the essential components for normal single binocular vision, but is often lacking in the common tropias developing early in childhood. Study of retinal correspondence is, therefore, an essential part of the routine of examination in disturbances of binocular vision. Varied techniques must be used because the state of retinal correspondence may change with the circumstances of testing, particularly in cases receiving treatment. One test may indicate normal, while another test demonstrates anomalous correspondence, or the same test may yield inconsistencies. This is not an indication that one or the other test is erroneous; rather it provides the examiner with an indication of the stability of the correspondence and the circumstances under which it varies.

It is our custom to study the state of retinal correspondence at the same time that the field of binocular vision is plotted with a filter-twin projection system because anomalous retinal correspondence invariably is associated with some degree of suppression.[4] Haploscopic tests of retinal correspondence are made with a major amblyoscope. The after-image test is also used in most cases. Demonstration that the two foveal regions have the same visual direction is considered evidence of normal correspondence.

Cerebral integration

The term fusion is often used synonymously with single binocular vision. In a strict sense, fusion is the subconscious

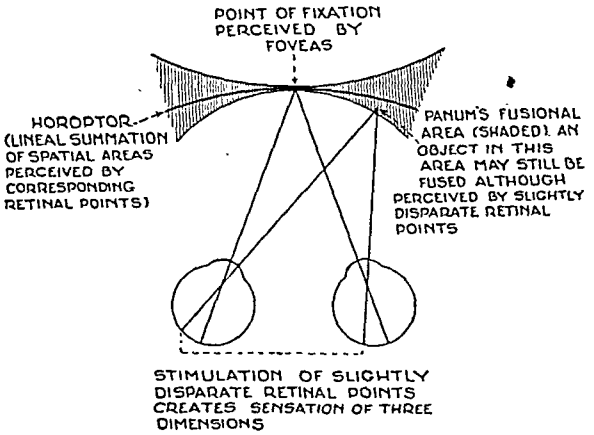


Fig. 3 (Swan). Horopter.

cerebral integration of simultaneous perceptions of the two eyes into a single conscious impression. It is commonly assumed that patients either have or do not have this faculty, but our experience indicates that it is quantitative. Normally it is possible mentally to integrate into a single impression retinal images of three dimensional objects, despite the fact that some parts of these objects must necessarily be visualized by slightly disparate retinal areas. Normal stereoscopic vision is dependent upon this ability to fuse images slightly dissimilar in the horizontal meridians, as is the normal ability to overcome the aniseikonia induced by asymmetric convergence.

Some of our patients have demonstrated a lower grade of fusional ability. Tested on haploscopic devices the only targets that these patients seem able to fuse are those identical in size and shape, such as two simple discs; that is, corresponding parts of

the two targets have to be visualized by exactly corresponding retinal points. It seems evident that in these patients the horopter lacks the depth which is called Panum's fusional area (fig. 3). Depth of this fusional area may be determined by studying the patient's ability to fuse objects of different dimensions in the various meridians.

Patients who lack the normal ability to overcome an artificially induced aniseikonia may be divided into two clinical groups. These cases will be described and discussed in detail in a subsequent report,[5] but may be summarized here. In the first group the disparate parts of the target seem selectively suppressed when aniseikonia is induced, but fusion of nondisparate areas is maintained. These patients are able to fuse stereoscopic targets but the sensation of depth is lacking. Three patients with this apparent selective suppression of disparate images have been observed over a period of five years. These individuals had comfortable single binocular vision, but failed tests for stereopsis. These patients must not be confused with the many corrected cases of esotropia who lack stereopsis because only peripheral fusion exists. In the latter the defect is associated with a nonselective suppression of the central field of vision of the nondominant eye.

In the second group of four cases, suppression of slightly disparate retinal images did not occur and annoying diplopia resulted. Initially these patients had had an alternating type of esotropia with anomalous retinal correspondence. In each case the deviation was corrected surgically. Also, intensive and prolonged orthoptic training was required before normal correspondence was established and an appreciable amplitude of fusional movements obtained. Then true fusion could be demonstrated only with simple two dimensional targets. These patients were unable to fuse targets with any degree of disparity, such as the standard targets for testing stereopsis. They could superimpose the images, but would describe either retinal rivalry or a constant sliding of the targets over each other. In an ordinary room they would describe three dimensional objects as not completely separating into two images but shimmering constantly.

When they were placed in a dark room and allowed to perceive a single, simple, two dimensional object, such as a flat illuminated picture on the wall, the shimmering would disappear and the picture would appear single and sharply defined. In 2 of the 4 patients suppression developed within six months after termination of orthoptic training. It was not possible to follow one case for more than three months, but in the fourth case the patient was still diplopic after two years. Experiences with the above cases have led us to study the fusional faculty as a quantitative phenomena. An ability to overcome induced aniseikonia is investigated in every case of long-standing alternating esotropia. Lack of this ability and the absence of suppression seem a possible explanation for one type of so called "horrors fusionis."

Motor components

Full rotations

The motor phase of the investigation is usually initiated with studies of the ocular rotations. Good rotations are essential components of comfortable, single binocular vision. In our examination, duction (monocular rotation) tests are not neglected, but in detection of spastic and paralytic phenomena greater emphasis is placed on the concomitance of binocular rotations in the cardinal fields of gaze. These tests are conducted in the usual manner, but in the search for those slight degrees of nonconcomitance which may occur with a muscle paresis, the Lancaster red-green test used at a distance of 5 or 6 meters seems more accurate, as well as simpler, than the commonly used diplopia fields plotted with red glass and point light. Ophthalmographic studies provide a highly objective and sensitive means of studying concomitance for near fixation. Twin tele-

scopes are used to pick up and focus the corneal reflexes on a calibrated ground-glass plate for direct study or on moving film for permanent recording.

Parallelism of lines

For comfortable, single binocular vision, deviation of the eyes in the fusion-free position must not be greater than that which can be readily overcome by a reasonable amplitude of fusional movements; that is, approximate parallelism of the line of distant fixation of the two eyes is another component of normal binocular vision. To study this component the deviations are measured in the cardinal fields and in the primary position by the usual techniques, but under varying circumstances. Where possible, objective tests such as the cover and corneal reflex are supplemented by the usually more precise subjective procedures such as measuring the separation of the images by a filter-projection system or devices such as the Maddox rod.

Amplitude of fusional movements

Another component of comfortable binocular vision is amplitude of fusional movements adequate to overcome easily any deviation of the eyes in the fusion-free position and to permit the maintenance of binocular vision when fixation is shifted from a near to a distant object and vice versa. Both associating and dissociating types of fusional movements are studied under varying circumstances and by diverse techniques. The amplitude of fusional movements is affected by fatigue and other circumstances; therefore, conclusions as to the amplitude of fusional movements are never made from a single examination. Normally, complex and detailed stereoscopic targets may stimulate fusional movements, but in a patient with defective binocular vision they are apt to be confusing and lead to suppression or retinal rivalry. In our experience simple two dimensional targets are most suitable for indicating a patient's potentialities in regard to fusional movements. In all cases it is important to measure the range of convergence and divergence from the fusion-free position of the eyes as well as in relation to orthophoria; that is, to measure the absolute convergence and divergence.

Vergences are coördinated fusional movements which must not be confused with the uncontrolled ductions of the nonfixating eye that may occur when fusion is disrupted. Comparison of fusion-free deviations for near and distant fixation is of value but does not indicate the state of the accommodation vergence relationship. To diagnose an insufficiency or excess of divergence or convergence on this basis alone is not physiologically sound. For example, uncontrolled adduction of the nonfixating eye occurs with accommodation in the so-called accommodative types of squint. Before hypermetropia is corrected and binocular vision is established, such patients are often mistakenly diagnosed as having a convergence excess because the inward deviation of the eyes is much greater for near than for distant fixation. A true convergence excess does not exist, as is demonstrated when the refractive error is corrected and single binocular vision is reëstablished. Then a marked deficiency of convergence almost invariably exists.

Accommodation-vergence balance

A final physiologic component of single binocular vision is a good balance between accommodation and the horizontal vergences. Accurate study of balance between accommodation and vergences is not possible until after the patient is able to maintain fusion and has acquired some amplitude of fusional movements. Then the amplitudes of divergence and convergence are determined in relation to a fixed amount of accommodation and the amplitude of accommodation is measured in relation to a fixed degree of convergence. Fine fixation targets are used over measured periods to detect accommodative spasm or fatigue.

Management of individual cases

Knowledge of phenomena other than those described above is vital to the management of individual cases. For this reason the ophthalmologist must not restrict himself by adhering to a fixed routine of tests or techniques. The system of studying binocular vision described above is a comparison of the individual patient's binocular status with the normal by the technique most applicable to his case. The system of investigation frequently elicits phenomena which necessitate special study. For example, if paresis or paralysis of an extraocular muscle is demonstrated, an examination must be made for secondary phenomena such as contracture of the direct antagonist or overaction of the yoke muscle in certain fields of gaze. Also in such cases determination of the usually fixating eye has great importance. Finally, it should be stressed that the study of binocular vision is only one part of a complete ophthalmic history and examination. Disturbances of binocular vision frequently result from organic disease of the eyes. This is particularly true in young children because any disturbance of vision is almost certain to alter binocular development.

Interpretation of data

In interpretation of data obtained from any type of examination, it must be kept in mind that the status of the various components of binocular vision varies with the circumstances under which the eyes are tested. This is particularly true if binocular vision is defective; therefore, the study of the same binocular phenomena should be made by the ophthalmologist and the orthoptic technician using different techniques and working under varying circumstances. In this respect we commonly observe two extremes. At one extreme is the ophthalmologist who thinks of orthoptics only in terms of therapy and therefore neglects to use orthoptic facilities in his diagnoses. He is prone to send patients to the orthoptic technician without a specific diagnosis or purpose. The results are certain to be poor. At the other extreme is the busy ophthalmologist who, when orthoptic facilities and a skilled technician are available, neglects his own simple tests such as are made with prisms. He may feel that the phenomena of binocular vision can be more accurately and extensively investigated by the technician utilizing equipment such as the major amblyoscope.

Determine usual status of functions

The major amblyoscope is excellent for determination of the patient's binocular potentialities because circumstances can be created which are nearly ideal for single binocular vision. Considerable deviation can be overcome without distortion of the targets, the patient's field of vision can be limited to a few degrees, and the technician may stimulate retinal areas of her choice. The intensity and the character of the stimulus can be altered by changing the color, illumination, size, shape, and background of the target. Even the duration of the stimulus can be accurately controlled. Nevertheless, the conditions of this type of examination are artificial and strikingly different from those in which we ordinarily use our eyes. Therefore, it seems best to rely more upon other types of tests to determine the usual status of the patient's binocular functions.

Study of binocular function in an illuminated room containing three dimensional objects and maintaining the patient's full field of vision is essential if normal conditions are to be simulated. In this respect filter-twin projection devices fill an important place, as a supplement to prisms, the screen test and similar office procedures. With two projectors which can be directed in accordance with the deviation of the patient's eyes, and with the use of polaroid or color filters to separate the objects perceived by the two eyes, it is possible to duplicate many of the binocular visual tests which

must otherwise be performed on haploscopic devices. It is possible to stimulate retinal areas of the operator's choice and at the same time to maintain a full peripheral field of vision. In determining the status of binocular vision for near fixation, emphasis is placed upon bar-reading tests and ophthalmographic studies made while the patient is actually reading or writing.

After data obtained by examination is interpreted, the deficiencies of the case are summarized and binocular potentialities are discussed by the ophthalmologist and orthoptic technician before treatment is planned. It seems essential that responsibilities for treatment be delegated specifically. Orthoptic training is not given unless its purpose is agreed upon by the ophthalmologist and orthoptic technician. It is important that, during the course of treatment, the patient's condition be reviewed by both at frequent intervals.

Criteria for functional cure

No system of studying anomalies of binocular vision is complete unless the criteria for a functional cure are established. Dependence must not be solely upon tests made under the artificial circumstances which haploscopic devices provide. Most disappointing are those patients, who, after intensive treatment, demonstrate parallelism and a high degree of binocular vision upon the stereoscope, but who, under the ordinary circumstances of using their eyes, lack even simultaneous binocular perception. We designate these patients as "stereoscopic cures" because they have good single binocular vision only under ideal circumstances which such haploscopic devices provide. Anomalies of binocular vision cannot be considered fully corrected until the presence of comfortable single binocular vision is demonstrated under circumstances in which the patient normally uses his eyes.

Summary

In cases with defective binocular vision, it is desirable to make an etiologic diagnosis; but to plan treatment and evaluate therapy the status of the various components of binocular vision must be determined. Anomalies of binocular vision seem fundamentally deficiencies in which the patient is lacking in one or more of the physiologic components of single binocular vision. These are interrelated, but for purposes of examination they can be divided into four motor and four sensory groups. Systematic investigation of these physiologic components provides a convenient and flexible routine for clinical study of patients with anomalies of binocular vision. Components such as simultaneous binocular perception and the faculty of fusion are quantitative phenomena, and must be studied accordingly.

It is important to study the field of binocular vision, and to determine the size and intensity of suppression scotomas. In esotropia, the normal blindspot is frequently utilized as a central scotoma. Localization of the normal blindspot of the squinting eye is, therefore, essential to recognize the "blindspot" syndrome. Absence of Panum's fusional area is discussed as a possible explanation of one type of horrors fusionis.

When binocular vision is defective, the status of such phenomena as simultaneous binocular perception and retinal correspondence varies with the circumstances under which the tests are conducted; consequently, it is important for the ophthalmologist and the orthoptic technician working coöperatively to study the various binocular phenomena separately and by varied techniques. In general, haploscopic devices on which it is possible to create nearly ideal circumstances for binocular vision are most suitable to determine the potentialities of a given case, but study under ordinary visual conditions is essential to determine the usual status of binocular function. In this respect filter-twin projection systems seem of particular value.

In diagnosis and treatment of binocular anomalies there is no need for complex

classifications. A summary of a patient's deficiencies and analysis of his binocular potentialities serve as a basis for therapy. In evaluation of treatment, it is stressed that a patient may have parallelism of his eyes and demonstrate a high degree of single binocular vision under the ideal circumstances which haploscopic devices provide, but cannot be considered normal until the presence of comfortable single binocular vision is demonstrated under the conditions in which the patient customarily uses his eyes.

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Discussion of Dr. Swan's paper

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I think that everyone who has just heard Dr. Swan's paper must now be looking forward to its publication and the opportunity of reading and studying it. It covers so much that is vital to orthoptics that once over is not enough.

In analyzing the sensory and motor components necessary to maintain single binocular vision, Dr. Swan has worked out a logical and concise classification. Nevertheless, it forms the basis for a more thorough examination of squinters than is customarily made, with emphasis on quantitative determinations whenever specific data can be obtained. This is, perhaps, best exemplified in his studies of simultaneous binocular perception in which he makes accurate plottings of the fields of binocular vision and of suppression scotomas.

In this connection, I would like to ask Dr. Swan on how young a patient he can obtain these data. I have felt quite triumphant when, once or twice, I have been able to map the blindspots of a five-year-old child. On the other hand, it is possible to determine the status of retinal correspondence and to start fusion training with most four-year-old children and some who are three years of age. If Dr. Swan can plot the binocular fields and suppression scotomas of these little patients, then I think that he must be "Superman!"

Although techniques have not been worked out, as Dr. Swan indicates, for making quantitative routine studies of aniseikonia in patients with defective binocular vision, one occasionally gets an indication of its presence in squinters during the course of carrying on orthoptic treatments with a major amblyoscope. In such cases, the spontaneous report is given that the target before one eye is larger than that before the other; specifically, "the lion is too big for the cage," or with the second-grade targets "the bunny with the flower is bigger than the bunny with the tail."

There are no more important tests for binocular function than those for retinal correspondence, as evidenced by the fact that at least 50 percent of all squinters develop an abnormal retinal correspondence, and that any unsupervised orthoptic training in its presence will serve to confirm rather than correct the squint. It is sometimes dif-

ncult for those who have not made the various tests to appreciate how variable retinal correspondence can be. However, the orthoptic technician is inclined to rely primarily on the results obtained with a major amblyoscope, since the training directed toward correcting an abnormal correspondence is carried on under the same conditions as those under which the test is made.

The two grades of fusion observed by Dr. Swan are comparable, it seems to me, to the second and third grades of binocular vision described by Worth, namely simple fusion and stereopsis.

In my experience, some simple fusion can be elicited in most squinters under ideal instrument conditions during the course of orthoptic treatments, but a fairly large percentage of these patients never learn to interpret the disparity of stereopsis targets in terms of depth, even though they may have attained binocular vision for casual seeing. I do not know whether, in daily life, these patients have better binocular than monocular perception of depth. Is this not another example where the instrument situation should be compared with that of ordinary function?

During tests made this past year, I found only one individual who was acutely aware of a diplopia of the disparate elements of stereopsis targets. She was a young adult, having had surgery some years ago, and was complaining of a diplopia of recent development. At the time, I considered the orthoptic prognosis good, but Dr. Swan's results with similar cases seem to indicate otherwise.

In the manuscript which Dr. Swan sent me, he called attention only to the fact that many cases of so-called convergence excess reveal a marked deficiency of convergence "when their hyperopia is corrected and single binocular vision is established." I am pleased to learn from his remarks tonight that he has noted, as I have, that this deficiency of convergence is demonstrable even earlier, during the course of routine examinations with a major amblyoscope.

It is not necessary to discuss in detail the battery of tests for ocular motility, muscle balance, and fusion amplitudes which complete Dr. Swan's exhaustive study of binocular functions. The advantages of a variety of tests and of repeated tests need no further elucidation. His warning against relying wholly on results of preliminary tests and final evaluations obtained with instruments cannot be too strongly underscored. A divergence excess may simulate an esophoria on the major amblyoscope and an apparent cure simulate a functional one.

The transfer of training from the instrument situation to that of daily life presents one of the major problems of orthoptics. Many patients develop a pattern or set for the particular exercise situation and any binocular ability which they attain is active only during training periods. How to effect the conversion of these specialized visual skills to the routine binocular habits of daily seeing presents a constant challenge to the orthoptic technician. Those patients, designated by Dr. Swan as "stereoscopic cures," who do not achieve this final step are in reality orthoptic failures.

Dr. Swan emphasizes that the final goal of orthoptics is "comfortable binocular vision under circumstances of normal seeing." In spite of the admitted orthoptic failures, he implies throughout his paper that this final goal can be achieved by a sufficient number of patients with binocular disturbances to make orthoptic training worthwhile. Were this not so, then such comprehensive studies of binocular functions as he carries on would have little practical value and they would belong in the field of academic research.

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FURTHER EXPERIENCES WITH INTEGRATED EYES AND VITALLIUM IMPLANTS*

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Since Ruedemann's[1] epoch-making report on his work on artificial-eye implants for use in enucleation, much has been done by him and others to improve on technical details. Most of the work has been done with the idea of developing a permanent implant with which can be integrated a removable eye.

The idea behind the development of Vitallium implants was to provide: (1) An implant to which the muscles and fascia of the eye may be permanently attached at the time of enucleation. (2) A similar implant that may be used in evisceration. (3) A similar implant which may be used for the late replacement of buried implants.

A series of implants were made of Vitallium in which cracks and crevices could not develop, and each was provided with an exposed, standard, flat anterior face in which there was a uniform oval depression for the reception of an integrating peg on the posterior surface of the artificial eye.

Vitallium was selected because of its extensive use in surgery and dentistry for many years and its ability to be cast in permanent form in the shape of a hollow sphere. Each implant is made in permanent form so there can be no shrinking of plastic parts away from metal parts or cracks developing due to the aging process, as in the case of plastic. There can be no question of allergy or other reaction to a plastic, and the removable eye is later fitted to the implant.

The advantage of replaceability is obvious when one considers that scratches may develop and changes in color (no permanent dyes have yet been found) may take place over a period of years. The position of the eye can be changed at will by simply relocating the peg on the back of the eye without any surgical procedure. Also, any enophthalmos or exophthalmos can easily be corrected by altering the thickness of the artificial eye.

Vitallium is a metal of low electropotential in the body and has, therefore, very little tissue reaction, as shown by the studies of Venable and Stock.[2, 3]

A preliminary report on the use of these implants in enucleation and evisceration has already been given.[4] This paper will primarily be concerned with changes in technique and shape that have been made from the original form.

A. CHANGES IN FORM OF IMPLANTS

1. ENUCLEATION

The entire implant is now polished and the depression on the anterior surface is made with steeper sides so that the integrating peg can be more accurately fitted and the eye and the implant more completely integrated (fig. 1B).

Changes in technique. It is found that when silk sutures are used, much less discharge is present than when cotton or linen is used.† The discharge lessens gradually over a period of 1 to 4 months and is reduced to a minimum by the occasional use (once or twice weekly) of sulfacetimide (15-percent drops) and sulfathiazole ointment placed in the depression on the face of the implant.

2. EVISCERATION IMPLANT

This implant is inserted through the usual corneal opening enlarged by two radial incisions. Two additional incisions are made posteriorly in the sclera from within, one above and one below to receive the anchor bars.

* Presented at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947.

† Absorbable plain gut sutures (3-0) are now used.

The bars are then easily pulled through the openings by four double-armed 3-0 plain gut sutures. They are first threaded around the bars and then passed through each end of the scleral openings and brought out through the conjunctiva in each fornix, and tied in the conjunctival fornices. When these sutures are tied, the bars are forcibly held through the sclera. A small transparent plastic cup 12 mm. in diameter, with two slits corresponding to the position of the bars, aids in locating these scleral openings properly.

The sclera is then wrapped around the peg can be used on the back of the eye as on the other implants.

The ring for the muscle and fascial attachments is necessarily smaller than the ring on the standard enucleation implant and only four supports are used to provide more space for the tissues to pass around the bar.

Change in surgical technique

Operative procedure

The conjunctiva of the back of the socket is separated from the underlying tissues by

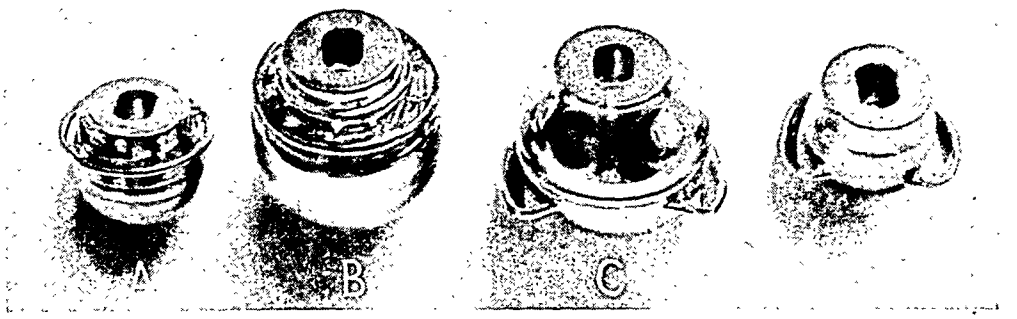


Fig. 1 (Hughes). New design of metal implants all with the same depression on the anterior face for the reception of the integrating peg on the artificial eye. (A) Smaller sized implant for use in replacing buried implants. (B) The depression on the anterior surface of this enucleation implant is made with steeper sides so that the integrating peg can be more accurately fitted. (C) Regular 18-mm. evisceration implant. (D) Smaller sized evisceration implant with a 12-mm. body.

neck of the implant and covered over with conjunctiva. The sclera contracts around the body of the implant and the anchor bars remain outside of the sclera. This gives a firmly anchored implant of perfect motility. It is made in two sizes, regular 18-mm. (fig. 1C) and a smaller size with a 12-mm. body to be used in case of a shrunken eye (fig. 1D).

3. Replacement implant

This is a smaller sized implant for use in replacing buried implants, somewhat similar in design to the enucleation implant and has been used since the preliminary report was given (fig. 1A).

This implant is made 12 mm. in diameter at its equator but the anterior face and depression are kept standard so that the same

ballooning it up with a very superficial injection of procaine hydrochloride or saline (fig. 2A). A strip of tissue about 4-mm. wide is dissected up anterior to and in line with each of the recti tendons to increase the effective length of the tendon (fig. 2B) so there will be enough tissue to pass around the attachment bar without tension.

A suture is placed in one side of the end of each tendon and tied in place. The tendons are individually passed forward between the bar and the body of the implant, and then folded over the bar and attached back to themselves (fig. 2C). Another suture is placed in the other side of each of the tendon strips to spread them out. Tenon's capsule is brought up on each side of each muscle tendon and folded back over the bar in a manner similar to the muscle tendon

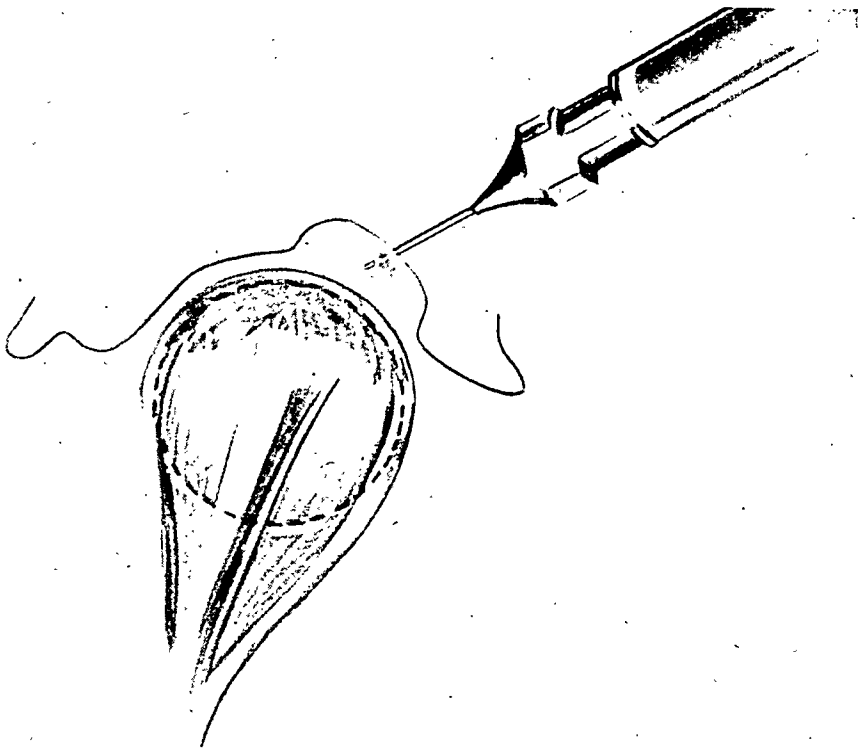


Fig. 2A (Hughes). Ballooning up conjunctiva overlying muscles and sclera.

strips (fig. 2D). Each portion is then sewed back to itself.

The conjunctiva is then anchored around the face of the implant (fig. 2E), and the surgical form is fitted to retain the fornices and to steady the implant in proper position during the early healing process (fig. 2F).

This surgical form is made of clear plastic in order to be able to see that the peg on its posterior surface is actually fitted into the depression on the anterior surface of the implant. It also has two holes drilled obliquely in the anterior convex face for the reception of a Lester forceps to aid in its manipulation or removal and replacement. It is oval and can be obtained in various sizes. The standard one is 22 mm. by 29 mm.

A moderate pressure dressing is applied,

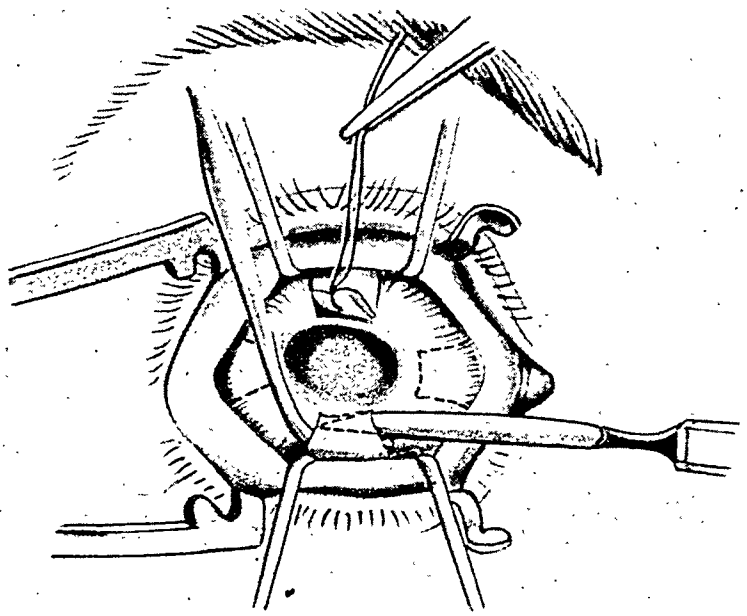


Fig. 2B (Hughes). Dissection of muscles, each with a scleral tip (same as for enucleation).

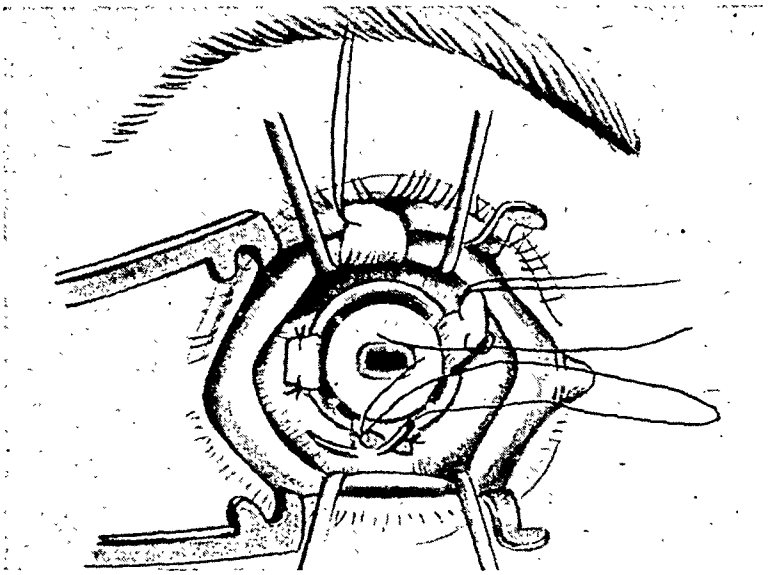


Fig. 2C (Hughes). Each muscle strip is passed forward around bar and attached back onto itself passing around the bar.

and a mask with a hole, 2-cm. across, in front of the good eye is used to limit its rotation for the first two weeks. In this way there is less strain put on the muscles during the early healing process.

The tissues may be inspected through this form at the dressings and, if the condition appears satisfactory, it may not need to be removed for 2 or 3 weeks. At the end of three weeks, an artificial eye may be fitted.

Integrating of the Eye with the Implant

An ordinary stock plastic eye is selected first for color, size, and general fit. Then the position of the peg in relation to the corneal position is determined. A trial eye with a peg located centrally can be placed in position to see if the eye is properly located in relation to the other one. If it is divergent, the peg must be placed more temporally than on the final eye. If it is slightly

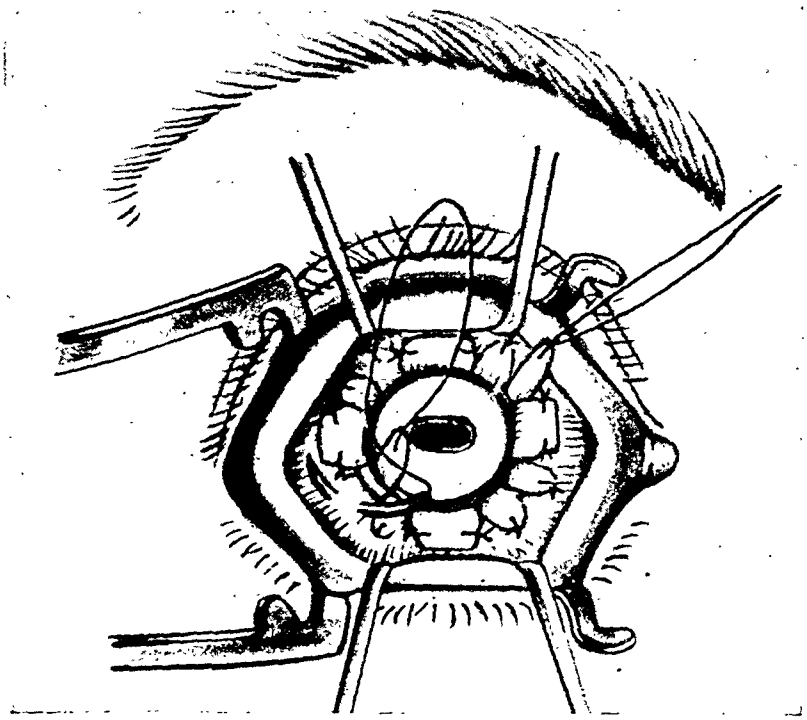


Fig. 2D (Hughes). A scleral strip on each side of each muscle is likewise passed around the bar and attached back to itself.

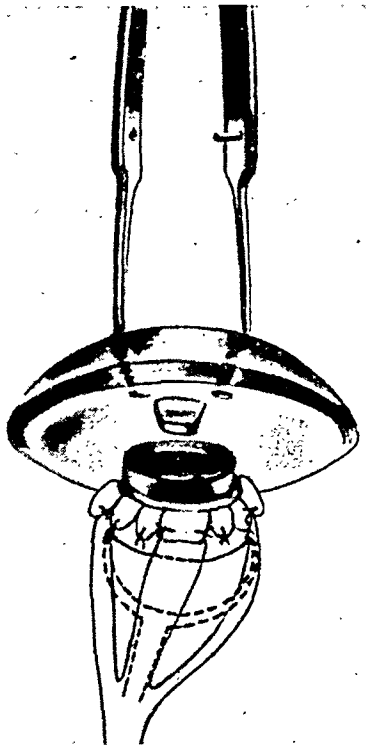


Fig. 2E (Hughes). Body of implant fits into scleral cup formed by posterior half of sclera.

convergent, the peg must be moved nasally to bring the cornea into line with that of the other eye. If it is too high or too low, a similar adjustment can be made to give the eye the correct position.

Another method would be to use the Hirschberg reflex from the normal cornea and compare its position with the similar reflex from the front of the transparent surgical form to locate the position of the reflex in relation to the peg on the posterior surface.

Case Reports

Case 1

History. Mr. A. W., aged 67 years, presented a case of evisceration in which a Vitallium implant had been inserted four months previously. He was operated on the day following its extrusion for the insertion of a Vitallium replacement implant (12-mm. body).

Technique. The conjunctiva was ballooned up and dissected free from the underlying muscles and fascial tissues. The muscle tendons were isolated and a strip of tissue, 3-mm. wide, anterior to the tendon, was dissected up with each tendon. A suture was put in one side of the end of this strip and the first part of a surgeon's knot was tied. Each of the muscle tendons was isolated from the globe and the anterior portion of the sclera removed. The posterior one half

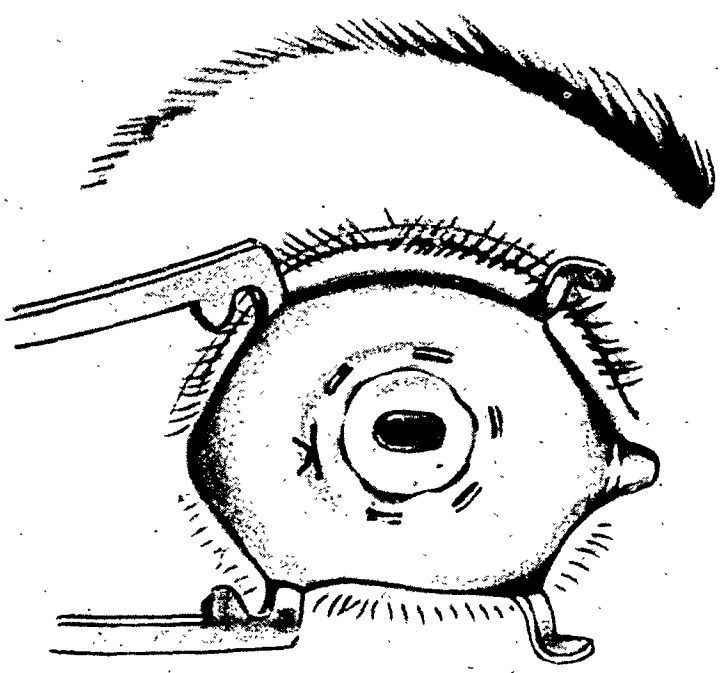


Fig. 2F (Hughes). Conjunctiva is anchored around the open face of the implant.

of the sclera was not disturbed and was retained and served as a cup for the reception of the body of the implant. The muscle tendons were attached to the ring as illustrated and the fascial strips brought forward on each side of the muscle strips and sewed back on themselves as has been described.

The regular sized enucleation implant (17 mm.) was tried first to see if it would fit. It was found that there was not sufficient room to admit the body of the implant.

The integrated eye has now been fitted, with excellent movement and a normal upper lid.

CASE 2

Evisceration with insertion of a new model Vitallium implant with anchor bars. Mr. W. B. complained of pain in an eye that had been blind for several years. A band keratitis was present with calcareous degeneration and breaks in the epithelial covering. There was considerable staining of the cornea with fluorescein. A corneal curettage was done and, due to chronic irritation, it was decided to do an evisceration two months after the patient was originally seen. The eye was widely divergent (about a 30-degree arc).

Technique. The procedure already described under evisceration was used except that the incisions were made under the lateral and medial recti for the purpose of doing the evisceration and placing the implant. Also a resection of about 6 mm. was done on the medial rectus to help straighten the eye.

Healing was uneventful but there was still a divergence of about 20 degrees. The surgical form was exchanged for an artificial integrated eye at the end of three weeks, with excellent motility except for slight limitation in the nasal field. The condition of the upper lid was normal.

In this case the implant was made with the anchor bars opposite the long axis of the oval depression on the anterior surface of the implant for comparison with the result when the bars were placed in the vertical meridian. No conclusion on this problem can be reached until a larger series of cases has been done.

CASE 3

History. A boy, aged 16 years, had his left eye injured by an explosion of a .22 bullet. Enucleation with insertion of 18-mm. implant was done. This boy insisted on playing baseball one week after his operation and would not coöperate. Two weeks after his operation, he tripped and fell and suddenly felt something "give way." The attachment bar was found to be exposed temporally and he was returned to the operating room where the lateral rectus and adjoining fascia were dissected up and reattached to the bar, and the conjunctiva was closed again.

He has now been fitted with an artificial eye but there must still be some question about the final outcome even though the present condition is satisfactory.

CASE 4

History. Miss V. Y. has worn an artificial eye for many years following an enucleation for a severe injury to the eye. There was very limited motility in all directions and some sinking in of the upper lid.

The muscle cone was dissected down its center by sharp, followed by blunt, dissection, with surprising ease. The tissue strips in the region of the recti muscles were dissected and looped around the attachment ring and sewed in position. The conjunctiva was anchored around the open face of the implant and the surgical form inserted (fig. 3).

The integrated eye was fitted in three weeks with excellent cosmetic results both static and dynamic.

CASE 5

History. Mr. D. F. aged 40 years, had an enucleation without implant 28 years ago. The patient had been kicked by a horse and

the left eye was removed one year later. No ball was put in at the time. There was poor motility of the artificial eye. A procedure similar to that in Case 4 was done. Three weeks later the integrated artificial eye was fitted with excellent appearance and motility.

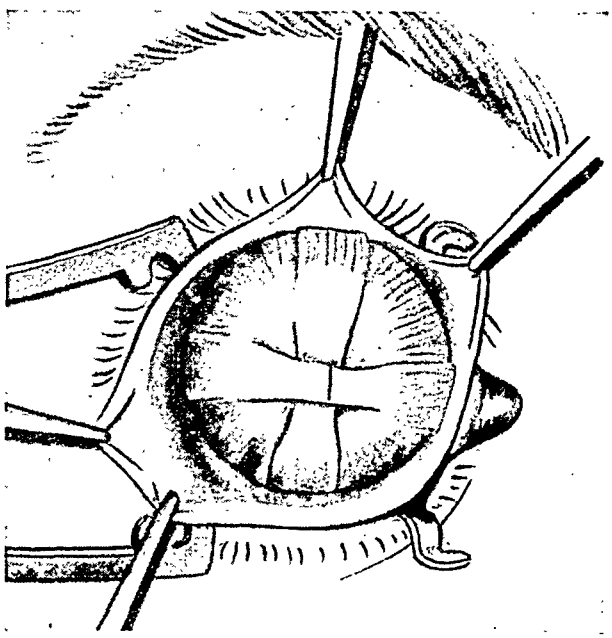


Fig. 3 (Hughes). Plan of operation in cases where enucleation was done previously with or without a buried implant.

Conclusion

It is too early to draw definite conclusions, and it will be 10 years or more before final results can be truly evaluated, but from preliminary results, it is evident that a definite improvement in the appearance, especially of the upper lid, and of the motility of an artificial eye is possible.

These implants, made in a hollow-sphere construction of Vitallium, noncorrosive, nonelectrolytic metal in which cracks and crevices cannot develop, are thought to be superior to implants made solely of plastic or a combination of plastic and metal.

No amalgam reaction is present with mercury compounds given internally or applied externally as may occur with gold or other compounds. This is important when one considers the fact that, if mercurials are given internally, sufficient mercury is secreted through the skin to cause amalgam formation in gold spectacle frames worn over long periods. This consideration would also be of importance to persons who work with mercury, such as reported by Dr. W. S. Atkinson.[5]

The integration of the eye with the implant by means of an oval peg is designed to prevent rotation of the prosthesis. The shape of the depression is standard for all sizes and shapes of implant.

These implants provide a series of shapes and sizes for various types of procedure; namely, enucleation, evisceration (2 sizes) or replacement.

A replaceable eye is obviously an advantage over a permanently placed eye, since it can be changed if the color is not correct or if color or position change in the course of years. Its position, horizontal, vertical, and anteroposteriorly, for the correction of an enophthalmos or exophthalmos, can be easily altered without any further surgical procedure.

131 Fulton Avenue.

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A NOTE ON PLASTIC TEST OBJECTS FOR PERIMETRY*

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It is generally recognized that the early detection of scotomas and other localized defects in the visual field may require the use of test objects of very low visibility. Low visibility may be obtained either by means of white test objects subtending very small visual angles, or by the substitution of colored for white test objects.

Several arguments in favor of the second of these procedures may be advanced. (1) Examination of the visual field with both red and blue test objects frequently provides information of diagnostic importance that is not given by the use of white test objects. (2) In order to obtain low visibility it may be necessary to employ 1/1000 or 1/2000 white targets; whereas, approximately the same level of visibility is provided by 1/330 or 3/1000 red and blue test objects.† Because of their greater visual angle the colored test objects of equivalent visibility are less influenced by an uncorrected error of refraction.

White test objects, on the other hand, possess many practical advantages in comparison with the colored paper discs commonly employed. Any ordinary white paper or paint may be used; whereas, in the case of the colors, standardization, not only of the reflectance, but also of the hue and the saturation of the color is necessary if tests made at different times and by different examiners are to be comparable. Frequent replacement of the colored paper discs when they become soiled or faded is essential. It is difficult to obtain a satisfactory adhesive for mounting the discs that will not change their color.

White, red, and blue test objects cut from plastic material in sheet form have been used for the past nine years at the Wilmer Institute and have proven far more satisfactory than paper test objects. The flat discs are secured to the wands by means of a special plastic cement. If the test target becomes soiled it is easily and quickly restored to its original color by wiping its surface with a damp cloth. Samples of the plastic materials, after exposure to direct sunlight for a period of several weeks, showed no perceptible change when compared with unexposed samples.

Colorimetric specifications of the white, red, and blue plastics in artificial daylight illumination (Illuminant C) are given in Table 1. The reflectances of the red and blue samples, 0.1026 and 0.1053 respectively, are practically identical and are a close match to the reflectance of the gray arc of the Ferree-Rand perimeter. It has been

TABLE 1

COLORIMETRIC SPECIFICATION OF PLASTIC MATERIALS IN ILLUMINANT C

	Munsell Notation			Reflectance	Trichromatic Co-ordinates	
	Hue	Value	Chroma		x	y
White	4.7 PB	8.78	2.1	0.7400	0.298	0.305
Red	5.1 R	3.72	11.0	0.1026	0.534	0.312
Blue	6.2 PB	3.77	9.8	0.1053	0.202	0.179

* From the Wilmer Ophthalmological Institute of The Johns Hopkins University and Hospital.

† A 1/1000 test object subtends a visual angle of 3.4 minutes; 1/2000, 1.7 minutes; 1/330, 10.4 minutes; 3/1000, 10.3 minutes.

shown that best results are obtained in color perimetry when the color is viewed against a background of approximately the same brightness.* The colors are more nearly equal in chroma than are the Heidelberg red and blue papers. Normal subjects, therefore, have fields of about the same extent for red and blue test objects of the same size. With Heidelberg colors, on the other hand, the normal field for blue is significantly wider than the field for red. Approximately equal visibility of red and blue test objects in the case of the normal eye is desirable, in order to detect a differential impairment of sensitivity to the two colors.

In summary, it is believed that the special features of these plastic test objects eliminate the major difficulties which have led to the virtual abandonment of colored test objects by many perimetrists.

Johns Hopkins Hospital (5).

B. PYOCYANEUS CORNEAL ULCER TREATED WITH PENICILLIN†

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New York

Corneal ulcer caused by B. pyocyaneus is a rather uncommon condition, somewhat less than a hundred cases having been described in the literature. It is also one of the most destructive corneal lesions. Before the advent of the sulfonamides, the usual end result was a total loss of vision. In 1942 and 1943, however, successful treatment of this type of ulcer with sulfapyridine and sulfadiazine was reported by several authors.[1]

Penicillin treatment of pyocyaneus ulcer has apparently been reported only once. In 1945, Juler and Young[2] had such a case in a series of ulcers treated with penicillin locally. This case, described as severe but without hypopyon, spread rapidly and showed no response to penicillin; further details of the outcome were not given.

Case report

D. C., a 9-year-old white girl, was admitted to the Manhattan Eye, Ear, and Throat Hospital on June 17, 1947. Four days prior to admission she had had a foreign body and rust ring of the left cornea removed at another hospital. During these four days, the left eye became increasingly red and painful.

Examination. When the patient was first seen at this Hospital, there was marked blepharospasm and tearing of the left eye. Conjunctival injection was severe, and in the central cornea there was a horseshoe-shaped ulcer involving perhaps a third of the cornea; the edges of the ulcer were elevated but not undermined. A small hypopyon (3 to 4-mm. wide) was present, and the iris was moderately dilated (previous mydriatic). Examination of the deeper structures was impossible; vision was light perception.

The right eye was normal. Vision was: O.D., 20/20. There was no history of previous eye disease or injury.

Treatment. On admission, a culture of the ulcer was taken. Treatment consisted of local instillations of 1-percent atropine three times daily; penicillin drops (5,000 units per cc.) every four hours, and later every two hours during the daytime; intramuscular penicillin G, 50,000 units every four hours day and night.

Culture. The admission culture, as well as a second one taken four days later, grew a gram-negative, green pigment-producing rod considered to be B. pyocyaneus.

Course. Within 48 hours after admission, considerable improvement was apparent, the hypopyon having disappeared. Because of this it was felt that continued treatment with penicillin alone was justified. By the 10th

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* Ferree, C. E., Rand, G. and Sloan, L. L.: Sensitive methods for the detection of Bjerrum and other scotomas. Arch. Ophth., 5:224-260, 1931. (See p. 229.)

† From the Manhattan Eye, Ear, and Throat Hospital.

day, there was no staining of the cornea, and on the 14th day the patient was discharged from the Hospital. At this time, there was only slight injection; a central macula was present, involving the anterior layers of the cornea and preventing a clear view of the fundus; and vision was limited to counting fingers at one foot.

After discharge, local treatment with penicillin and atropine was continued for 10 days. Three months after the onset of the present illness, the corneal macula is still present, but has shown some clearing. Vision is now 20/200, O.S.

Conclusion

A case of B. pyocyaneus corneal ulcer is presented which apparently responded to local and parenteral penicillin therapy.

210 East 64th Street (21).

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MALIGNANT MELANOMA OF THE IRIS

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Case report

T/4 R. E. H., a white man, aged 30 years, was admitted to Fletcher General Hospital, Cambridge, Ohio, on September 4, 1944. He had been evacuated from the E.T.O. where he had been examined by several ophthalmologists, including the Consultant in the E.T.O., all of whom had diagnosed malignant melanoma of the iris of the right eye.

History. The patient related that, while stationed in Iceland, his right eye became red and painful and a tiny black pinpoint spot was noticed on the globe. He had had about six attacks of pain in the right eye, each lasting 7 to 10 days. The black spot on the globe had increased gradually to its then present size over the course of 13 months. The vision of the right eye had become slightly blurred during the same period of time. He also complained of headaches behind the right eyeball at night. There was no history of any trauma to the eye.

Examination disclosed vision to be: O.D., 20/40, J1 corrected with a −0.75D. cyl. ax. 90° to 20/20; O.S., 20/20−3, J1, corrected with a −0.25D. cyl. ax. 180° to 20/20. There was no muscle imbalance.

The right globe was white; there was a fleshy pterygium nasally encroaching 2 mm. on the cornea; a pear-shaped pupil pointing up at the 1-o'clock position and reacting actively to light except above; a blue-black crescent-shaped lesion, measuring 4 by 2 mm. and elevated about 1 mm. above the surface of the cornea, situated at the periphery of the cornea and overriding the limbus corneae extending from the 12- to the 1-o'clock positions and occupying the anterior-chamber angle.

Slitlamp examination showed numerous blood vessels coursing over the surface of the lesion. The temporal part of the lesion was translucent; the nasal periphery was faintly translucent. The iris presented numerous "freckles," rust-colored conglomerations of pigment. The media were entirely clear. The optic disc color was good. There was a small central cupping of the disc. There was an irregular whitish area with fine pigmentary changes located at

the first bifurcation of the superior temporal vein about one disc diameter from the nasal border of the disc. Tension was 18 mm. Hg (Schiøtz).

The left eye, externally, was negative in



Fig. 1 (Levitt). Lesion simulating malignant melanoma of the iris.

every respect. The iris presented numerous nevi of a character similar to that noted in the right eye. The media were clear. The optic disc and fundus generally were normal. The disc was not cupped. Tension was 18 mm. Hg (Schiøtz).

X-ray films of the right globe were negative.

General physical examination yielded negative results. Blood Wassermann was negative.

Diagnosis. My diagnoses were (1) malignant melanoma of the iris of the right eye; (2) benign melanoma of iris, multiple, bilateral; (3) pterygium, right eye.

The right eye was enucleated under intravenous pentothal anesthesia on September 15, 1944. Healing was uneventful.

Microscopic report

The following is the microscopic report of Col. J. E. Ash:

Gross. The specimen consists of a firm eye measuring 24 by 24 by 23 mm. A small elevated pigmented lesion (3.5 by 2 mm.) is situated at the limbus between the 12- and 2-o'clock positions. There is hemorrhagic thickening of the limbus at the 4-o'clock position (in paraffin). The pupil is eccentric. The eye is opened between the vertical and horizontal planes. There are multiple retinal folds posteriorly. The iris adheres to the posterior surface of the cornea on one side. The optic nerve is too short for cross section.

Microscopic. Descemet's membrane is interrupted at the site of a bulging keratoiritic scar which is covered by conjunctiva and surface epithelium and is lined by atrophic iris and its pigment epithelium. On this side the filtration angle is occluded by anterior synechia. Redistributed pigment is present in the atrophic iris and the spaces of Fontana and around the canal of Schlemm. Chronic inflammatory cells are very sparsely scattered throughout the iris and there is ectropion uveae. The choroid is thin. There is cystic degeneration of the retina at the ora serrata. The lamina cribrosa appears somewhat depressed but this may be due to operative trauma. One separate paraffin section shows hemorrhagic detachment of the ciliary epithelium and another elastosis and hyalinization of the stroma of the limbal conjunctiva.

Diagnosis. Pterygium; perforation of cornea near limbus; prolapse of iris; cystoid cicatrix; low-grade iritis, with atrophy and redistribution of pigment.

991 Ocean Avenue (26).

CORNEAL SCISSORS

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The present trend in cataract surgery indicates the employment of a small corneal section made with a keratome or Graefe knife. This incision is enlarged for free passage of the lens, a procedure easily ac-

complished by using scissors especially designed* for the purpose.

When these scissors are visualized as lying on a flat surface, the blades are seen to curve in two planes: (1) upward from the plane of the shanks, and (2) laterally away from the line of the shanks. Both pairs are identical except that the lateral curve is to the right or to the left for use on corresponding sides of the corneal incision.

The lateral curve naturally follows the corneal rim as the tip of the lower blade, which is blunt to avoid engaging the iris stroma, enters the chamber along the plane of the iris. The curve away from the horizontal plane facilitates the handling of the scissors, especially in deep-set eyes.

The blades are the same length, being 14- to 15-mm. long. On either side of the pivot hinge, the scissors are 4- to 5-mm. wide. It is believed that this width, together with the double curve, permits strength and firmness in the blade which eliminates slippage or springing apart of the blades sometime encountered in scissors of a lighter construction. I have used these scissors for more than six years and have found them to be most satisfactory.

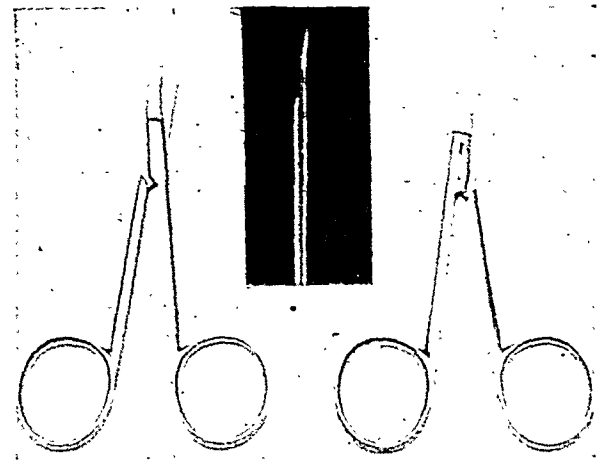


Fig. 1 (Moehle). Specially designed corneal scissors for cataract surgery.

*Manufacturer, William Langbein & Bros., Brooklyn, New York.

15 Schermerhorn Street (2).

Historical Miniature

The history of the ophthalmoscope illustrates how the solution of a problem must await the mind of genius and how easy it is to make a modification, once the master has showed the way. Kussmaul clearly understood all details of the problem, but succeeded only in building an ophthalmoscope that had a serious defect: it did not reveal the fundus. On the other hand Donders easily substituted a perforated silvered mirror for the multiple cover glasses that Helmholz had described, because he could not curb his impatience while waiting for an instrument of Helmholz's design to be delivered to him.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

September 9, 1947

ATOPIC CATARACTS

DR. J. WESLEY MCKINNEY reported the case of W. M. S., aged 31 years, who was seen in February, 1947. His history was that the vision had become progressively worse for the past three months. He had had chronic eczema over the face and body for many years and also was asthmatic. He had received a number of small doses of X ray. Vision was corrected to 20/40 mostly, right eye; 20/50 mostly, left eye. The eyes were entirely normal except for central anterior and posterior subcapsular lens opacities in each lens. The skin of the face, parts of the body, and extremities was leathery, scaly, and slightly reddened. This is the stage of lichenification of chronic eczema. The association of cataract with chronic eczema in a young person is rare, only 40 cases having been reported in the literature up until 1940. It is supposed that the lens, being an ectodermal structure, may take part in this allergic disease of the skin with the formation of cataract. Linear cataract extraction was performed on the left eye in April, 1947. The resulting vision was 20/20, J1.

PAPILLEDEMA OF UNKNOWN ETIOLOGY

DR. J. WESLEY MCKINNEY reported the case of Miss A. McC., aged 17 years, who was first seen December 31, 1940. For most of her life she had been subject to attacks of semicoma which was considered to be petit-mal epilepsy. The attacks lasted for only a few moments as a rule and she was otherwise a normal healthy girl. Because of the finding of choked discs she had been subjected to a complete neurologic study including the spinal fluid and air injection. All examinations were negative. The ocular examination revealed vision to be 6/6, J1 in each eye. There was a quarter diopter of hyperopic astigmatism in each eye. The pupils were equal and active. The ocular movements were normal. The ophthalmoscopic examination revealed two diopters of papilledema of both discs. The vessels on the discs showed sheathing. The retinal veins were slightly dilated. Fields showed general contraction and enlargement of the blind-spots. The patient, now 23 years of age, was last seen in March, 1946. She had been checked at intervals for six years without change in the fundus picture. The fields have varied from full to marked general contraction. No other symptoms have developed.

LOCALIZED EDEMA OF THE RETINA

DR. J. WESLEY MCKINNEY reported the case of Mrs. R. G., aged 43 years, who was first seen for this affection on September 7, 1945. She complained of a central area of dim vision which had been present for seven days. Vision was: O.D. 6/6; O.S., 6/24, improved to 6/9 partly with +1.5D. sph. There was edema of the retina of about 1½ disc diameters in the area immediately below and involving the macula. There were no hemorrhages or exudates, and the blood vessels of the region of the lesion seemed normal. There was a paracentral scotoma, the lower margin of which just missed the macula. The peripheral field was normal. Physical examination was completely negative. It was thought that this might be a case of Gifford's central angiospastic retinopathy. However, no evidence of vasospastic disease could be made out. The edema and paracentral scotoma persisted for a month and gradually subsided. Five months later the retinal edema was entirely gone leaving behind a few fine yellow spots. A small rela-

tive paracentral scotoma persisted. The refraction which had been +1.5D. sph. was now +0.25D. sph.

Recurrent retrobulbar neuritis, chiasmal arachnoiditis

Dr. R. O. Rychener reported a case of recurrent retrobulbar neuritis apparently due to multiple sclerosis. E. C., aged 18 years, was admitted to the Memphis Eye, Ear, Nose, and Throat Hospital on February 26, 1942, because of acute failure of vision of the right eye during the previous week. There was no light perception in his right eye, the pupil measured 4 mm. and reacted to light, consensual reflex being present. The visual acuity of the left eye was normal. No intraocular pathologic condition was apparent, and the diagnosis of retrobulbar neuritis was made. Treatment with foreign protein and vasodilators over a period of two weeks caused improvement of vision to counting fingers at two feet and, in the course of the next three months, the visual acuity of 6/7.5, J4 was obtained. The right nerve was definitely pale.

On June 11, 1943, the patient awoke with blurring vision in the left eye and reported after three days with vision diminished to moving objects. Hospitalization and the same treatment were given with visual improvement of the left eye to 6/18 after six months. At this time there was definite pallor of both optic discs.

On November 3, 1944, visual acuity was 6/7.5, J1 and 6/9, J1, as recorded. Ten days later visual diminution in the right eye was again noticed, vision being recorded at 6/24, foreign-protien therapy was again instituted with visual recovery in two weeks to 6/10, J3.

On October 30, 1946, acute visual failure was again evidenced in the left eye, visual acuity being 1/40 which, under treatment, improved only to 2/60, J12.

During these episodes complete general and neurologic examinations were made with entirely negative results.

In April, 1947, he was seen in consultation by Dr. W. L. Benedict at the Mayo Clinic where the findings above were confirmed but all examinations proved to be negative with regard to etiology. At this time the visual fields were concentrically reduced two thirds in the right eye and one half in the left eye.

On August 12, 1947, he submitted to chiasmal exploration by Dr. J. C. Love at the Mayo Clinic who reported the visual apparatus at the chiasm completely surrounded by dense proliferative arachnoiditis with a collection of fluid causing distinct pressure on the nerves and chiasm. The fluid was evacuated, the proliferating arachnoid was resected, thus thoroughly decompressing the nerves, chiasm, and tracts. On August 28, Dr. Henry Wagener thought there was some slight improvement in visual acuity and visual fields.

The patient apparently made a satisfactory convalescence from this intracranial surgery but on October 26, 1947, suddenly developed paraplegia and retention of urine and was brought to the Baptist Hospital for care by Dr. Semmes and Dr. Murphey. The patient suddenly died on the 10th day following the development of these symptoms, and the diagnosis was not established since no postmortem examination was allowed. In the light of the previous history of recurrent attacks of retrobulbar neuritis and the concluding syndrome it was thought that this patient had multiple sclerosis.

Pseudotumor of orbit

Dr. Charles M. King reported a case of inflammatory pseudotumor of the orbit in a white man, aged 27 years.

Mr. K. R. was first seen on July 31, 1947, with history that for the past six weeks the right eye had been uncomfortable, red at times, and the vision was blurred. Discomfort was not severe enough to prevent his teaching school. No history of recent injury could be obtained. There was a history of sinusitis several years ago while

he was in the armed forces in Europe, but only supportive treatment was necessary.

Examination showed the right eye to be slightly red, but no secretion was present. The palpebral conjunctiva was normal. There was a manifest hypertropia of 10$^{\Delta}$ to 15$^{\Delta}$ but the patient was not aware of diplopia until tests elicited it. The pupil was round and reacted well to light. Movement of the eye was limited down and out and diplopia was greatest in this field, although it was present on looking directly out, and up and out. There was slight exophthalmos, measuring O.D., 18 mm., O.S., 16 mm. (Hertel).

Fundus examination revealed the media to be clear. Above the macula, and also below, and including the temporal aspect of the disc margin, the retina appeared wrinkled and somewhat elevated. Marked tortuosity of the vessels was present. The A-V ratio was about normal. There was a small indistinct grayish area temporal to and below the macula. The left fundus was normal.

Vision was: O.D., 20/40, corrected to 20/20; O.S., 20/20.

The patient was not seen again until August 30, 1947. There had been less pain in the eye although there was constant diplopia. Medial rotation of the eye was possible but movements in all other directions were markedly reduced or absent. The fundus picture was about the same. Corrected vision was still 20/20. Visual fields showed approximately normal perimetric form for a one-degree white target. X-ray examination on this date failed to reveal any definite mass or change in the orbit.

On September 15, 1947, the patient was next seen. Meanwhile he had been seen by a local ophthalmologist as well as by an ophthalmologist and an otolarygologist in another city. A diagnostic irrigation of the right antrum was done elsewhere and no evidence of infection in the antrum was found. At this time the patient was not able to move the eye out or downward. Hypertropia 15$^{\Delta}$ to 20$^{\Delta}$ was still present. A firm mass could be palpated over the outer half of the lower orbital rim extending from the region of the external canthus to the midline and backward along the floor of the orbit. The lower lid was firmly bound to this mass; the lower fornix being almost obliterated. Only slight tenderness was elicited on forceful palpation of the mass.

On September 25, 1947, an orbitotomy was done by transconjunctival approach over the tumor itself. Densely matted fibrous and vascular tissue filled the lower half of the orbit binding the external rectus and the inferior rectus within its substance. These muscles were dissected with much difficulty and isolated. The inferior oblique was exposed from its origin to its insertion and resembled a piece of firm, resistant spaghetti. On severing this from its attachment to the globe a clear fluid was seen to flow out spontaneously. The entire muscle was excised. Biopsy of other regions in the mass was done, it being impossible to remove the whole thing from the orbital floor.

The pathologic report was chronic inflammatory tissue, fibrosis, focal necrosis, and degeneration of striated muscle. No evidence of malignancy was found. Blood Kahn was negative on two separate tests. A mild leukocytosis was the only other positive laboratory finding.

Convalescence was uneventful and the patient left the hospital on the third day. On October 21, 1947, the right eye was almost straight, there being about 5$^{\Delta}$ hypertropia. Good levator action was present and there was no exophthalmos. There was no diplopia, because visual acuity had decreased to 10/200, correctible to 20/70. Tortuosity of the retinal vessels was still marked, but the posterior pole area had no apparent edematous areas. The patient was comfortable and has continued his work.

Orbital tumor

Dr. Charles M. King reported a case of orbital tumor in a white girl, aged three years, which proved to be a lymphocytic

nodule in an acute state of lymphatic leukemia.

C. A. W., an apparently healthy child, was first seen on September 4, 1947. The mother stated there had been a puffiness of the lower lid for two months and recently she had felt a hard lump in the lid. No history of serious illness of any nature could be obtained.

Examination revealed a definite, hard, smooth mass, palpable through the left lower eyelid along the lower orbital rim and extending from the midline to the outer canthus. No displacement of the globe was present. No limitation of motion of the globe was found. There was no evidence of external inflammatory changes. The mass was movable from below upward and slightly movable from side to side. Transillumination of the mass was clear. Over the left mastoid region were three distinct nodular masses about the size of a pea, none of which was tender to palpation. There was one similar nodule over the right mastoid region, and palpable nodes along the posterior cervical chain on either side were present.

On September 8, 1947, a skin incision was made along the temporal two thirds of the lower orbital rim and a well-encapsulated smooth, fibrous tumor, measuring approximately 3½ by 2½ by 1 cm. was removed from within the lower aspect of the orbit. None of the extraocular muscles was involved. There was little difficulty in removing the entire mass intact by blunt dissection. The fascia was closed with interrupted catgut sutures and the skin closed with a subcuticular suture of black silk.

Laboratory findings:

Date	RBC	WBC	Hb
9-5-47	4,130,000	5,580	12.4 mg.%
9-13-47	3,550,000	4,300	10.5 mg.%

Concentrated smear showed 100% lymphocytes.

Preoperative X-ray examination showed a destructive process involving the floor of the orbit and roof of the left antrum. However, at operation these bony changes were not evident by palpation of the lower orbital rim or floor of the orbit.

Pathologic diagnosis was lymphatic leukemia and the lesion in the orbit was interpreted as a leukemic infiltration of the subcutaneous tissue.

The immediate postoperative course, in so far as the orbit was concerned, was uneventful. However, the typical symptoms of acute leukemia became more marked clinically. The daily temperature showed spiking and fluctuated from 100°F. to 104°F. (rectal reading). On the 12th hospital day the parents wished to take the child home. At last reports the patient was still alive but was incoherent part of the time and unable to be out of bed.

This case of acute lymphatic leukemia is of interest to us in that the first clinical evidence of the disease was manifest in the orbit and serves to impress upon us the many possibilities in diagnosing tumors of the orbit.

Optic neuritis treated with histamine

Dr. Philip Meriwether Lewis reported a severe bilateral optic neuritis, which responded rapidly to treatment with histamine.

C. M., a white man, aged 27 years, was first seen on February 2, 1947, because of marked visual failure. Two weeks previously he began to have severe headaches and lost the vision of his right eye. Ten days later the vision began to fail in the left eye. He was told that his trouble was due to sinus disease and, without benefit of X-ray studies or consultation with a rhinologist, was treated daily for the supposed infection of his sinuses. When first seen, vision was reduced to light perception in the right eye and 20/50 in the left. This had fallen by the next morning to counting fingers at four feet. The pupil of the right eye did not react to light and that of the left eye only sluggishly. The discs were both moderately swollen and red to almost the same degree. The retinal vessels were engorged but there

were no hemorrhages. The visual field of the left eye was mostly lost below and temporally. General physical examination and blood studies were negative. Dr. Sam Sanders found the sinuses normal and suggested using histamine intravenously after the method of Horton. This was done—2.75 mg. in 300 cc. of normal saline, intravenously, daily for a total of six times. In addition typhoid-H antigen was administered. Improvement was rapid and he was dismissed from the hospital on the 12th day with vision of O.D., 20/50; O.S., 20/40. The edema had subsided.

Two weeks later vision had improved to O.D., 20/40; O.S., 20/30. Both nerves appeared normal, but the right blindspot was still twice the normal size. He had resumed work and noticed only a very slight headache occasionally. Observation every 6 or 8 weeks was advised.

Comment. It was felt that this was a case of early multiple sclerosis and that while the neuritis would probably have subsided eventually without treatment, the use of histamine intravenously was beneficial in hastening recovery.

Monocular hysterical blindness

Dr. Philip Meriwether Lewis reported two cases of hysterical blindness of one eye.

Case 1. A white man, aged 38 years, who was in charge of the public schools of a nearby community, was first seen in March, 1944, because of nervousness which he attributed to his eyes. Examination showed his eyes to be normal except for a slight hyperopic astigmatism (+0.50D. cyl. ax. 90°, O.U.). His vision was 20/20, J1 in each eye. His accommodation was rather low, being only four diopters. Glasses were prescribed for reading.

The patient was next seen in August, 1946. He stated that his right eye had become sore and red the previous day and that it had lost its vision. He had been having some recent headaches and said he was quite nervous. Examination showed some congestion of the conjunctiva with slight chemosis. The pupil was normal in size and reaction. The fundus was normal. Vision was no light perception. In the left eye, it was 20/20. The right eye was tender to pressure and painful on motion. The visual field and blindspot of the left eye were normal. A diagnosis of an acute retrobulbar neuritis was made and he was hospitalized for study and treatment.

Complete physical, neurologic, laboratory, and X-ray examinations were made and found negative. Treatment consisted of dionine and hot compresses, locally; nitroscleran, intravenously; foreign-protein injections, and even penicillin. After two weeks, the patient was sent home. The only improvement was that the eye had lost its redness, edema, and soreness. He still could not perceive even a bright light.

His vision was unimproved when seen a week later. When seen again about three weeks after leaving the hospital, he still claimed inability to see light with his right eye. More than five weeks had elapsed since the blindness began, but the fundus was still normal. For the first time hysteria or malingering was suspected. With a strong fogging lens over his left eye, he read 20/50 with his right eye; and with a stereoscope, he could see the right image as well as the left. He was then told that he would positively recover his vision and probably normal vision. From that time on improvement was steady and by late October (10 weeks after onset) his vision was 20/20, J1 in both eyes with correcting glasses.

Case 2. A healthy white girl, aged 18 years, was seen in November, 1946. She claimed that four days previously she had lost the sight of her right eye. Since then she had been totally blind in that eye and had had a severe headache constantly.

Examination was completely negative. The central vision, visual field, and blindspot of the left eye were normal. By retinoscopy both eyes were found to have

practically no refractive error (+0.50D. sph.). She professed inability to see any light with her right eye. With a strong plus lens over her left eye she read 20/40 with her alleged blind eye. Careful questioning failed to elicit the cause of this hysteria or malingering, whichever it really was. Her family was told that her trouble was of nervous origin and she was referred to her family physician. After several weeks of pseudoblindness, which eventually proved to be due to dislike for her work, she recovered completely.

Comment. The first patient was a well educated and intelligent man. He had been studying very hard for an M.A. degree in addition to being overworked with his occupation. He was not satisfied unless he made the highest marks in his studies. It was felt that the probable cause of his hysterical amaurosis was that he was afraid that he would be unable to maintain the high standard which was expected of him. He therefore subconsciously used the blindness of one eye as an escape mechanism. His recovery was more rapid than usual. Most hysterical blindness is bilateral and may last for years. The second case may have been more malingering than hysteria. It is often difficult to differentiate hysterical from simulated blindness.

Daniel F. Fisher,
Recorder for Eye Section.

CHICAGO OPHTHALMOLOGICAL SOCIETY

DR. BEULAH CUSHMAN, *president*
October 6, 1947

The clinical meeting was conducted by the Department of Ophthalmology, Northwestern University Medical School.

Scientific Program

SURGERY FOR CORRECTION OF MUSCLE ANOMALY

DR. WATSON GAILEY (Bloomington, Illinois), presented this subject. An abstract of his paper follows.

Great advances have been made in recent years in muscle surgery, a branch of surgery not too difficult for the average ophthalmic surgeon. However, it is not corrective surgery we should worry about. Rather it is the proper evaluation of a given case and the thorough study of the under- or overaction of the various muscles involved which should be carefully considered before any definite surgical campaign is adopted.

These preoperative studies should engage our full attention. Following this the surgical treatment should be comparatively simple. Every case is a case in itself and some require repeated examinations. Particular study should be given to fixation and the findings in screen cover tests in all fields.

I am sure that we all know that the correction or near correction of squints of all types would be simple if we could determine *accurately* in millimeters the amount of resection or recession necessary to effect the cure of a given amount of deviation measured in diopters.

For some years in our clinic we have attempted to establish a standard of surgical procedure on which we can rely—based on our cover-test findings and translated into millimeters of recession and resection—with only a reasonable degree of success. By the cover test we painstakingly work out the lateral and vertical deviations in diopters. We estimate the degree of paresis as best we can in certain muscles, the degree of secondary contraction in the paretic muscle's antagonist, and how much the vertical component might increase the lateral deviation and record these findings on our chart. After this, we decide which muscles are to be exposed and how much recession and how much shortening these muscles must undergo. But we reserve the right to change our minds and either decrease or increase the amount of shortening or recession.

To put it simply, outline a definite procedure but do not hew to the line. Reserve

for yourself the right to change your mind and your method of attack and become more conservative or more radical as your good judgment directs.

There are certain rules which we have found to be useful in our clinic:

1. In monocular squints with amblyopia of the squinting eye we confine our surgery to the amblyopic eye if possible.

2. If the power of convergence is unlimited, there should be no fear in doing a reasonable amount of recession. If the P.C.B. is 100 or more, for instance, it is much safer to strengthen the laterals only.

3. Vertical deviations should always be searched for diligently.

4. We have concluded that: it is smart to expose the opposing muscles involved in convergent or divergent squint of any type before deciding definitely how much strengthening or weakening to do on either.

5. It is a great problem to decide how much to correct in convergent squints—partially or wholly accommodative—for great danger lies in obtaining orthophoria for distance and near without correction of the refractive error only to find that this beautiful result is converted into a very unwelcome divergence when the correcting lenses are worn.

6. A slight overcorrection is worse than 10 to 15 degrees of undercorrection and these cases must be approached with great caution. We always attempt to under correct partially accommodative squints.

7. When the P.C.B. is 90 mm. or over in convergent squints, external rectus resection is indicated. Operate verticals first if the hyper defect is greater than the laterals.

8. Visual acuity should be made equal if possible before surgery, not necessarily normal.

9. With equal paresis of superior recti of moderate degree and equal upshoot of contralateral inferior obliques, recede both obliques. But, watch your step if both superior recti are markedly paretic for you may, by recession of both inferior obliques, destroy elevation and find your patient tilting his head backward.

10. If there is a moderate paresis of both superior recti and there is 10 or 15 degrees' difference in the hypertropia, recess the oblique showing the greater secondary deviation and later you may resect or shorten the superior rectus of the same eye.

11. If there is an under correction of hypertropia after recession of an overshooting inferior oblique after three months and some increase in the hypertropia in the field of the contralateral inferior rectus muscle, this muscle must be receded.

12. When we find marked bilateral superior rectus paresis unequal, strengthen one or both superior recti, proportionately. In marked bilateral superior rectus paresis associated with esotropia or exotropia, we find these cases are liable to over correction if laterals are operated first.

13. In moderate bilateral superior rectus paresis: if fixing left in eyes right and fixing right in eyes left, correction of convergent or divergent may be all that is necessary, but, look out for P.C.B.

14. If we have an amblyopic eye with either a convergent or divergent squint accompanied by a big upshoot of the squinting eye we do a complete tenotomy or myomectomy on inferior oblique of the upshooting eye while operating the lateral.

15. In marked superior oblique paresis, a liberal recession of the secondarily contracted inferior oblique is sometimes gratifying.

16. When one superior rectus is almost completely paralyzed, resect this paretic muscle. When both superior recti are very paretic, with marked overshooting of inferior obliques, leave inferior obliques alone and resect both superior recti.

17. Inferior rectus recession. In recession of a secondarily deviated inferior oblique, as evidenced in a contralateral paretic superior rectus and a secondarily contracted inferior rectus, it is well to be cautious. We are quite satisfied to wait several months

before recessing this inferior rectus muscle as one finds frequently that the recession of the overshooting inferior oblique will tend to ease this secondary contraction in whole or part. Tensity in this muscle is greatly reduced in amount after recession of the contralateral inferior oblique and strengthening of the ipsilateral superior rectus.

18. First, strengthen the too weak muscles and weaken the too strong muscles by any effective method with which you are familiar. Although one goal of these measures is cosmetic parallelism, the most important aim for which one strives is a parallelism that permits of single binocular vision and stereopsis; in other words—a satisfactory functional result.

19. A complete chart of our findings in an individual case is on the wall of the surgery showing the full information we have gleaned concerning each case. This chart is as important as X-ray films in reduction of fractures. This bit of prophylaxis was made a must in our clinic some years ago after a muscle was recessed instead of resected. It might have been disastrous had we resected instead of recessed.

Never promise that a single operation will cure any squint. We feel safer in promising them three, when we feel that we could accomplish a cosmetic result in one. If you feel sure of your findings and confident of your conclusions and there are no contraindications to any procedure you propose to employ, there seems to be no limit to the number of muscles you may operate at one sitting providing of course you are a respector of tissue.

Discussion. Dr. Walter Stevenson approved of Dr. Gailey's treatment preliminary to operation. While muscle surgery is certainly not exact and many times does not give the desired result, any time spent in careful effort to make a proper diagnosis is well spent. It is just as important to have in the operating room a chart showing the essential findings as determined in the office, as it is to have X-ray films in certain types of surgery. One should have an open mind, as Dr. Gailey said, and at times should change the preconceived idea of what is to be done in muscle surgery.

There should be a definite understanding with the parents, before surgery is undertaken, that it may be necessary to do two, three, or even four operations. While as physicians we should be interested in the functional rather than the cosmetic result, it must be remembered that parents bring children for correction of a squint and adults come for correction of a squint because of the cosmetic defect in almost all cases. Dr. Gailey is correct in saying that if the vertical defect is greater than the lateral, the vertical should be operated on first, although he himself does not always do so. If the vertical deviation is greater than the lateral, the decision as to procedure should depend upon the amount of deviation in various fields. For example, if there were 14 degrees of right hypertropia in the primary position, which increases to the left and up, this would indicate a left superior rectus paresis and surgery should be directed to the right inferior oblique, provided there was no false ptosis of the left upper lid. In such a case, with only a small esotropia one would expect an increase after surgery, because the abducting power of the right inferior oblique would be decreased. On the other hand, an exotropia, if present, would be decreased if the right inferior oblique were weakened. Likewise, if the left superior rectus were resected, the esotropia would increase; the reverse would be true in exotropia.

As stated in the paper, everything possible should be done before surgery to correct the imbalance; a patch on the good eye is helpful. Many cases can undoubtedly be helped by orthoptic training. It should also be stated that with the use of a rotoscope, in certain instances, a vertical deviation can be markedly increased.

Dr. Stevenson was in agreement with practically all the points brought out, al-

though he felt that through a tenotomy of the inferior oblique at its insertion, one obtained more correction there than elsewhere, in addition to its being more easy to do. One should be extremely careful in operating on internal squints that are partly corrected by plus lenses, particularly if the lenses improve vision. It is very easy to convert such a squint into an external squint.

He agreed definitely with Dr. Gailey's methods of anesthesia, but did not consider shaving the eyebrow unnecessary; he also agreed that age should not be considered in correction of squint if one is sure that surgery is necessary. Plain catgut, he felt, was quite satisfactory for buried sutures.

Dr. Stevenson does not incise Tenon's capsule widely above and below the muscles, feeling too wide an incision might cause release of tension, although there must be sufficient exposure for complete observation. He emphasized the importance of dissecting the conjunctiva over the caruncle, following recession operations; if this is not done the caruncle is apt to disappear, leaving a starey eye. To remove every part of the muscle stump from the sclera may leave a depression, with sometimes discoloration.

With reference to the O'Connor cinch operation, he felt it was a clumsy looking operation and had not performed it, although all surgeons who use it are pleased with it. There has been opposition to the transplantation of a part of the superior and inferior rectus to the external rectus in abducens paralysis, but it has been satisfactory in his hands. One should be extremely careful with a hook in strabismus fixus. It is understandable that one could pull out a piece of the sclera in an effort to pull forward a muscle that under no circumstances will so pull. His results with the retraction syndrome were just as disappointing as those of Dr. Gailey.

From what has been said, one inexperienced in squint surgery might feel that convalescence in these cases is uncomplicated but a frightening experience may occur as the slides shown illustrate.

Dr. Paul V. Carelli agreed that definite diagnosis must be made before surgery is attempted. This can be done only after repeated examinations and with the screen cover test in all the cardinal fields. The amount of resection or recession to be done is learned only through experience. The late Dr. White would not commit himself by saying that so many millimeters of recession or resection would correct a certain number of diopters, merely replying to the question by saying "Do enough." Results vary with the individual surgeon; one may get a certain correction by a 3-mm. recession of the medials, while another may obtain a different correction by the same means.

In the squinting amblyopic eye, the good eye is totally occluded for about three weeks prior to surgery, and macular stimulation of the amblyopic eye is instituted. Thus it is possible to improve fixation, vision, and bring out the total deviation so that an accurate diagnosis may be made prior to surgery.

Dr. Gailey's statement that he attempts to undercorrect partly accommodative squints is probably in reference to those cases in which glasses are to be worn. In cases in which an attempt is made to remove the glasses, is an overcorrection sought?

In recession operations, he agreed that the overshooting inferior oblique must be recessed if the patient prefers the paretic eye or alternates freely. In the past six years, in a series of 250 squints, Dr. Carelli had found overacting inferior obliques in 112 patients; in 29 operated cases, recessions have been done ranging from 5 to 10 or 12 mm. with satisfactory results. He was glad to hear that Dr. Gailey has abandoned the tucking and advancement. He felt that in lateral rectus surgery more can be obtained with a bold resection than with a small resection and advancement. In recession of the medial rectus, Dr. Gailey's method of

placing sutures at upper and lower borders, 1.5 mm. from the tendon attachment to the globe instead of using the Prince forceps, is excellent. More accurate results are obtained.

In the technique of inferior oblique recession surgery, Dr. Carelli was in accord with Dr. Gailey except in one step. Recently, for fear that the scleral bite might not be placed in the proper line for proper action of the inferior oblique, he had switched to the following: After proper isolation of the muscle, a small hemostat or Kelly forceps is placed on the tendon at its insertion; sutures are then inserted at the desired point. Thus, while the muscle is still attached to the globe, it is possible to place the scleral sutures properly. The tendon is then severed from the globe and the sutures placed through the muscle. Also, Dr. Carelli agreed as to tenotomy of the inferior oblique at its insertion, because when this muscle retracts one cannot tell where it will reattach and how it will function thereafter.

Surgery in the retraction syndrome must be carefully guarded, because resection of the fibrotic exterior rectus may cause exophthalmus. Surgery in such cases should be directed toward increasing the binocular field.

Very little improvement has been reported in the procedure of joining the outer third of the superior and inferior rectus to the external rectus in paretic cases. It should be considered poor surgery if it limits depression and elevation, especially when the abduction resulting is questionable in most cases.

Dr. Gailey (closing) said that he was pleased to hear that Dr. Stevenson and Dr. Carelli agreed with him on so many points in surgical management of squints. Dr. Stevenson's report of the unfortunate complication which he so beautifuly illustrated should make us realize that postoperative complications arise even in the most skilled surgical hands. The O'Connor cinch operation might be stressed particularly in the phorias and mild tropias uncomplicated by vertical anomalies; it is not difficult, but does require practice.

What Dr. Carelli said regarding learning by experience in the amount of resection or recession in a given case is certainly true. One is bound to under- or overcorrect early in one's practice, but it is through these errors that proper judgment is acquired. Careful records of the types of muscles encountered, together with postoperative studies of the amount of correction accomplished, will be valuable.

Dr. Carelli apparently misunderstood the remarks concerning surgery employed for lateral rectus paralysis. The inner halves of the superior and inferior recti rather than the lateral halves have been used, and the results have been good.

Partially accommodative squints are always undercorrected if the hypertropia is greater than two diopters, because of the possibility that when this correction must be worn by the patient, the orthoptic state is convered into a divergence.

Dacryocystitis of Infancy

Dr. J. V. Cassady (South Bend, Indiana) presented a paper on this subject which is published in full on page 773 of this Journal.

Discussion. Dr. Roy O. Riser felt that Dr. Cassady had done the society a favor tonight in provoking the question of earlier probings in congenital dacryostenosis. His results are perfect, and the lack of complications in so large a series is evidence of his skill. In performing the procedure without general anesthesia he has avoided the pulmonary complications that cause many to hesitate to do probing. Since other branches of medicine and surgery have accelerated many procedures, we also should have an open mind. The main reasons for delay have been that the patient is inarticulate; symptoms are not too alarming; and most parents

shrink from subjecting an infant to the surgical procedure.

He wished to correct the statistics quoted from his paper. Seventy-seven percent of the eyes in his own series that were treated conservatively cleared without probing. If Dr. Cassady's series of babies had been watched until six months of age, using Dr. Riser's percentages, more than 60 of the 100 cases should have cleared without probing at all. However, Dr. Cassady's procedure had prevented 3 or 4 months of blockage and stagnation of tears. One must judge for himself as to the more desirable situation, early and safe cure by probing, or a two thirds possibility of no probing by waiting. The statistical results from probing at the age of six months are equal to those done at an earlier age. His preference was for the term "dacryostenosis" for, as brought out in his thesis, a true dacryocystitis in a child is another and far more stubborn problem.

Dr. R. C. Gamble also felt indebted to Dr. Cassady for this report, to no part of which one could take exception. He has explained clearly the embryology and pathology, his series is large, his technique is very clever, and is his own. The results are perfect.

In choosing between immediate probing and massage, antiseptics and later probing if necessary, one is right either way. The situation should be explained to the parents for their decision; usually the conservative procedure is chosen. This is not meant to imply that immediate probing is radical; it is safe, simple, and effective.

A few facts should be considered in deciding the situation. The most important is that congenital obstruction of the lower end of the nasolacrimal duct very rarely, if ever, causes an acute phlegmon of the sac or the intractable infection seen in later life. These are different conditions and have a different origin. A second, less important point, is that while spontaneous recovery takes place in the majority of cases of congenital dacryostenosis, there is often moderate tearing for a few years after the pus discharge has disappeared, and there is less tearing after probing than after spontaneous recovery. A third point is that probably no ophthalmologist really knows the true percentage of spontaneous recovery; it is probably much higher than we think. Most pediatricians understand this condition quite well, and refer only the most stubborn cases to the ophthalmologist and in this they are right.

He asked Dr. Cassady whether this series of 100 cases was consecutive, or if all cases which had bony obstruction of the duct, phlegmon of the sac, fistulas, or other evidence of acquired obstruction, were eliminated. These, in his experience do not respond well to probing.

Dr. Elias Selinger agreed that early probing is indicated in most cases seen by the oculist, since these patients have already been under so-called conservative treatment by the pediatrician or general practitioner.

It is advisable to stress a few points of the technique of conservative treatment and of probing of the tear sac. The term "massage" of the tear sac is a misnomer. What one actually attempts is to employ hydrostatic pressure, that is, use the accumulated fluid in the sac and exert pressure through it in such a way that it will be forced toward the lower orifice of the tear sac and cause a rupture of the occluding membrane. For that reason, pressure should not be exerted in the upward and nasalward direction. Instead, the mother or nurse should be instructed to exert pressure nasalward and downward, beginning just below the medial canthus, as if she were trying to force the contents of the tear sac into the nose.

The need for repeated probing indicates faulty technique in most instances. Once is usually all that is necessary to establish patency. In small infants it is preferable to probe through the upper canaliculus, as in that way strictures of the more important lower canaliculus are avoided. Also, the tear sac is more easily entered if the probe has been passed through the upper canaliculus.

Introduction of the probe is greatly simplified if the upper lid is held in an inverted position. The probe must be carried along the canaliculus nasalward and slightly posteriorward, to pass behind the caruncle. When the nasal wall of the sac has been reached, the tip of the probe must maintain contact with it while the probe is being rotated into a vertical position. Withdrawal of the probe predisposes to faulty direction. Dr. Selinger has employed a No. 0 (No. ½) Bowman probe in seven premature infants with purulent tear-sac infection; the smallest of these weighed only 2 pounds 10 ounces. In this case there was a phlegmonous inflammation around the sac that failed to respond to systemic penicillin and sulfonamide therapy. Purulent secretion broke through the skin on three different occasions under this form of therapy. One probing resulted in permanent cure. In one infant the probe was passed through a fistulous tract into the tear sac and down through the nasolacrimal duct.

Dr. J. V. Cassady (closing) said, in reply to Dr. Gamble's question, that these were consecutive cases. Some of them had acute dacryocystitis with external drainage of the phlegmon and more than 50 percent had had mucopurulent secretion. No complications occurred from probing the ducts through these infected sacs.

He apologized if he had misquoted Dr. Riser. It was the total number of patients, in some of whom both sacs were infected, which gave the apparent discrepancy.

Sac massage such as described by Dr. Selinger would be of advantage were sac distension and infection to persist after the duct has been probed open and is patent, and he thanked him for his description of the procedure.

Richard C. Gamble,
Secretary.

Historical Miniature

Neither Hippocrates nor Galen used "nystagmus" to designate rapid oscillation of the eyeball. Indeed the word did not suggest rapid motion to a Greek, but on the contrary the dropping off to sleep. They called the phenomenon "hippus," little horse. The introuction of the error in the modern use of the word nystagmus to designate restless pupils may be ascribed to Mauchart who used it in a dissertation in 1742.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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THE AMERICAN OPHTHALMOLOGICAL SOCIETY MEETING

The 84th annual meeting of the American Ophthalmological Society, presided over by Dr. Henry C. Haden, was held at Hot Springs, Virginia, May 17 to 19, 1948. In attendance were 121 members and 21 guests. Twenty-three papers on various ophthalmic subjects were presented and the program was well balanced in content.

Because of the usual high quality of its program, it is always difficult to single out, at any meeting of this society, papers that are particularly outstanding.

Lyle discussed "Cataract and Tetany Produced by Parathyroid Deficiency during Pregnancy, Lactation, and Menstruation," a combination of the work reported before the last meeting.

Reese described "Herniation of the Anterior Hyaloid Membrane Following Uncomplicated Intracapsular Cataract Extraction," and pointed out that the treatment of this condition consists in the use of strong miotics (D.F.P.) alternating, if indicated, with dilatation of the pupil with neosyn-

ephrin and recumbent position of the patient.

W. P. McGuire's paper on "The Effect of Dicumarol on the Visual Fields in Glaucoma" provoked much thought and discussion. The extraordinary improvement in the fields of vision of controlled glaucomatous subjects under dicumarol treatment reported by McGuire was most startling. If supported by experience, this is indeed a noteworthy contribution to ophthalmology.

Castroviejo summarized his vast experience in transplantation of the cornea in keratoconus, and showed many beautiful colored slides of his cases. He indicated the necessity of including the entire conical area of the cornea in excision. Thus, a large graft is frequently necessary and in his capable hands the results were excellent.

Haessler and Heise's subject "Therapy for Some Ocular Inflammations Based on Immunologic Principles," was illustrated by a clever, instructive, and amusing animated motion picture. It will be useful in teaching.

Cordes presented a case of primary malignant melanoma of the optic disc and emphasized the great rarity of this finding. It occurred in a 52-year-old Negress. Calhoun in discussing Cordes's paper brought out the fact that ocular melanoma in the pure Negro has not been observed, and ventured the guess that Cordes's patient may have been of mixed blood. This was verified by Cordes.

Harrington described his studies on "The Mechanics of Intracapsular Cataract Extraction" and demonstrated the role of the vitreous as an important factor in the dislocation of the lens. Col. Henry Smith's pioneer work in this field was thus reemphasized.

Rychener reported a case of retinoblastoma occurring in a woman, aged 33 years, the fifth such case on record. Thygeson reported his recent studies on the epidemiology of epidemic keratoconjunctivitis. He and the discussors of his paper disclosed that a large number of ophthalmologists had suffered this infection during the recent widespread epidemic.

Heath's paper on "Ocular Lymphomas" summarized and classified in a lucid manner, our knowledge of this condition.

H. Gifford pointed out that retrobulbar injection of novocaine alone is efficient in reducing temporarily the intraocular pressure, and suggested among other things that this procedure would be useful in determining the base pressure in glaucomatous individuals. Scheie's studies showed that the mydriasis produced by retrobulbar injection of novocaine could only be overcome by pilocarpine until the effect of the injection had worn off.

Since many of these papers, as well as others not mentioned, will appear in forthcoming issues of the JOURNAL, it is unnecessary to go into further details. They are mentioned here only as samples of the ophthalmologic feast spread out before the members and guests of the society. As usual the discussions of the papers were often the most valuable part of the program itself.

The reception given to the new members was made particularly gracious by honoring Dr. Walter B. Lancaster who had just celebrated his 85th birthday. He was, therefore, one year old when the society was organized. This vigorous leader of American ophthalmology enchanted his audience during the scientific meeting with a discussion of some secondary subjective effects produced by prisms, delivered in his customary logical and meticulous style.

The Howe Medal was awarded to Dr. William Zentmayer of Philadelphia for his many years of faithful and distinguished service to ophthalmology. The choice of the recipient was a happy and popular one. The influence of Dr. Zentmayer as teacher, friend, counsellor, and physician has been and is of great strength.

Although the weather was unkind, it did not prevent to any appreciable extent popular indulgence in the outdoor diversions of

tennis, riding, and golf. To those less venturesome, the verandas and lobbies invited groups to sit and enjoy shop talk, a favorite and important sport of the occasion.

Bernard Samuels of New York was elected president; Parker Heath of Boston, vice-president, and Maynard C. Wheeler of New York succeeded Walter Atkinson as secretary. The latter was appointed member of the council in recognition of his many years of efficient service as secretary to the society. It was voted to hold the next annual meeting in Hot Springs, Virginia, June 2 to 4, 1949. Derrick Vail.

CORRESPONDENCE

New drainage operation for glaucoma

Editor,
American Journal of Ophthalmology:

The operation of iridencleisis is discussed in a paper by Dr. Oscar Lavine and Dr. Karl Langenstrass, "A New Drainage Operation for the Relief of Glaucoma" (American Journal of Ophthalmology, 31: 78-80 [Jan.] 1948), in a way which is much at variance with the experiences of many other ophthalmologists.

The authors write:

"The scleral incision tends to close immediately and tightly due to the inherent elasticity of the scleral tissue. The incision heals quickly and firmly because large areas of mesodermal surfaces are in intimate contact. The included iris tends to undergo pressure atrophy as the result of sharp compression by the scleral lips. This event renders the operation practically valueless."

With reference to this quotation, I would like to point out that the object of Holth's iridencleisis subconjunctivalis is to create an epithelium-clad drainage canal from the anterior chamber to the subconjunctival space. Holth succeeded in proving that this objective had been attained; witness his microscopic examinations of eyes which had been enucleated directly after the death of patients who had successfully undergone iridencleisis up to six years earlier. His observations were presented as early as 1913 at the Ophthalmological Congress in Heidelberg XXXIX. His later investigations were published in December, 1930, in the *Archives of Ophthalmology* and elsewhere. Here Holth showed that pigmented epithelium lined the walls of a fistula through the sclera to the subconjunctival space. He emphasized, as an important factor in the operation, that as little subconjunctival scar tissue as possible is provoked so that drainage of the aqueous humor is facilitated. For the same reason no conjunctival flap is made, but only a subconjunctival "tunnel" at the same time that the scleral incision is made. Further, as much as possible of the fistula-forming iris tissue should be retained. On this account iri*dec*tomy is not undertaken, only a meridional irido*to*my with both iris flaps lying in the scleral wound.

Very many ophthalmologists must surely disagree with the authors' comments on the value of iridencleisis and the other fistula-forming glaucoma operations. With reference to iridencleisis, I would like to refer to my own work: "The Results of Iridencleisis," published in Acta ophthalmologica, 25:3, 1947. Permit me to quote the summary of this article:

"The results of iridencleisis subconjunctivalis cum iridotomia meridionali for glaucoma simplex in 455 eyes at least one year after this operation are presented. Vision was the same or better in 83.4 percent, the field of vision in 96.8 percent. Tension was normal without myotics in 79.8 percent, and in a further 12.5 percent it was normal under pilocarpine with which normal tension could not be maintained before the operation. Thus, as far as tension was concerned, good results were achieved altogether in 92.3 percent.

"A classification of the material in various stages according to the degree of development of the disease shows that the chances of maintaining the functions of the eye un-

changed are best when the operation is carried out in an early stage of the disease.

"An observation period of one year after iridencleisis is presumed to be long enough to give a correct picture of the state of tension."

(Signed) J. C. Holst,
Oslo, Norway.

RELIEF OF EPISCLERITIS

Editor,
American Journal of Ophthalmology:

I am able to confirm the statement of Dr. Edwin M. Shepherd who obtained immediate relief of symptoms in episcleritis with instillation of histamine diphosphate (1:1,000) described in the American Journal of Ophthalmology, 30:907-909 (July) 1947.

Personally, I advise the use of ionization, which prevents side reactions. The principal indication is represented by rheumatic, focal episcleritis. My technique is: A histamine solution (1:10,000) is applied using 1 ma. for 1 minute, anode, positive pole. The advantage of this procedure consists in applying the drug on the focus of infection alone; it may also be repeated. Chemosis is eliminated by preliminary anesthesia.

This was studied by P. Payot (Ophthalmologica, 112:1 (July) 1946). My method was described in 1935 (Szemészet) and in my monograph on physical therapy published in 1941. (Both of these papers are published in Hungarian.)

(Signed) Stephen de Grósz,
Budapest, Hungary.

BOOK REVIEWS

LA CONCEPTION DES COUCHES-LENTILLES CORNÉENNES, ALTERNANTES MÉCANIQUEMENT ET OPTIQUEMENT. By M. Carapancea. Standard Graphica-Marvan, Bucarest.

The corneal stroma, which occupies nine-tenths of the cornea, is of even thickness as is also the endothelium, but the other corneal components are lentiform structures. The concave meniscus of the epithelium is balanced by the convex meniscus of Bowman's membrane, while Descemet's membrane is again a concave meniscus. This architecture has the physiologic function of providing resistance both to the atmospheric pressure from without and to the intraocular pressure from within. Optically however the cornea acts as a unit, the refractive surfaces being simply its anterior and posterior surfaces.

James E. Lebensohn.

THE PHYSIOPATHOLOGY OF THE EYE IN THE AVIATOR. By A. Mercier and J. Duguet. A report presented before the meeting of the Société d'Ophthalmologie de Paris, November, 1947, pp. 1-230.

This monograph on the ocular physiopathology of the aviator is a report of the authors' thorough investigation and a review of the present status of knowledge on this subject. It is not a discussion of the physical requirements of pilots nor of the ophthalmic tests routinely used by flight surgeons but is limited to a description of the effect of flying on the organs of vision and visual functions.

The first chapter is devoted to the influence of altitude on the visual organs and describes the effect of anoxemia and atmospheric depression on the retina, choroid, pupils, visual acuity, fields, stereoscopic vision, and adaptation. It also includes a discussion on the application of oxygen and on airtight cabins in airplanes.

The second chapter deals with the influence of increasing speed on the visual organs, the brutal effect of centrifugal and rectilinear forces on the human body, and the dangers of sudden changes in the direction of flight. All these facts should limit the acceleration of the airplanes below a certain standard, at least for the time being.

The actions of physical factors are the

topics of the third chapter. The intensity of the sunlight in high altitudes, the relation of the direction of the light waves to the direction of the flight, the effect of the reflected lights and their phototraumatic and photochemical action on the retina are discussed in detail. The dangers of extreme cold are described with special emphasis on corneal changes. The deformations of the soft part of the face and of the lids through the action of the wind are demonstrated in a series of pictures. The effect of vibration on the sympathetic nervous system and visual efficiency are discussed and the hazards, which originate when all those unfavorable factors act in summation, are outlined.

The fourth chapter covers the problem of vision and orientation in the air, visual illusions in flying and flight without visibility. It explains the meaning of aerial orientation and aerial equilibration and discusses the possible impairment in the function of the labyrinth and the resulting abnormal reactions and impressions. It refers to and explains the artificial horizon as a help which provides the pilot with the knowledge of the horizontal plane and the changes in direction.

The origin, clinical appearance, and treatment of injuries and burns are the subjects of chapter 5. In the next two chapters are discussed the psychoneuroses in pilots and the intoxications which might be caused in the air by such toxic agents as gas, carbon oxide, and nitrogen tetraethyl.

The protective measures are described in the eighth chapter. The effect of ultraviolet rays on the eye, the mechanical value of protective glasses, and the importance of Noviol glasses are discussed at length.

Visual problems in connection with the construction of airplanes are reported in the ninth chapter. Among many details the placement of the cockpit to allow the largest possible field, transparent surfaces and good illumination are especially important. There are 45 illustrations and a valuable bibliography of 357 references.

Alice R. Deutsch.

CAUSES OF BLINDNESS AMONG RECIPIENTS OF AID TO THE BLIND. By Ralph G. Hurlin, Sadie Saffian, and Carl E. Rice, M.D. Washington, D.C., Federal Security Agency, Social Security Administration, Bureau of Public Assistance, 1947.

The Federal Security Agency, Washington, D.C., has issued a report which presents information on more than 20,000 recipients reported on a voluntary basis by 20 state agencies. This is the first information that has been collected on the eye conditions of recipients of aid to the blind and the underlying causes of their blindness.

The volume of information included in the report is larger than that of any previous study of causes of blindness in this country in which the cause data have been taken from medical records.

The publication will have considerable interest for those concerned with the statistics of causes of blindness.

F. H. Haessler.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea; sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

7

CONJUNCTIVA, CORNEA, SCLERA

Palm, Erik. **A case of crystal deposits in the cornea.** Acta ophth. 25:165-174, 1947.

A woman 46 years of age had chronic arthritis followed by ocular discomfort, lacrimation and photophobia, which increased in intensity with the joint involvement. The objective examination revealed small, irregularly shaped, opaque, uniformly scattered spots over the corneal surface, with a clear area 1 mm. in width adjacent to the limbus. On retro-illumination each spot was found to consist of a small cubic crystalline structure, situated immediately beneath the corneal epithelium, and raising it slightly. The crystals are probably identical with the globulin crystallizing from the blood plasma. The crystallization from the blood appeared to be initiated by a change in pH following the loss of carbon dioxide from the blood. The author suggests that the loss of carbon dioxide from the superficial corneal layers may have caused a shifting of the pH toward the alkaline side, which resulted in the precipitation of these crystals. Brief reference is made to the literature on corneal opacities caused by various precipitates. The author found two cases similar to his. Meesman's patient had small amorphous desposits formed by Bence-Jones protein scattered through the entire depth of the cornea and Blobner's patient had lustrous crystals in the cornea and conjunctiva, the exact nature of which was not identified. (2 illustrations.)

Ray K. Daily.

Panzardi, D., and Pasca, G. **Bacteriologic and clinical investigations concerning the action of streptomycin on conjunctivitis due to gonococci, Koch-Weeks bacilli, diplobacilli, and on epidemic keratoconjunctivitis.** Boll. d'ocul. 26:581-589, Sept. 1947.

Four patients with gonorrheal conjunctivitis, 15 with Koch-Weeks conjunctivitis, 29 with Morax-Axenfeld conjunctivitis, and three with epidemic keratoconjunctivitis were given four to six instillations of a streptomycin solution containing 10,000 US units per cc. for one to five days. In all cases of conjunctivitis, a complete cure was achieved within one to three days; no effect was seen in the cases of epidemic keratoconjunctivitis. In the conjunctival diseases, however, the

drug proved definitely superior to all the known ocular antiseptic solutions.

K. W. Ascher.

Ry Andersen, S. **Malignant melanoma of the conjunctiva with metastasis to the choroid.** Acta ophth. 25:311-319, 1947.

The left eye of a woman, 35 years of age, was enucleated with the diagnosis of limbal naevus in a state of malignant proliferation. Histologic examination showed a small flat tumor in the choroid, extending backward from the equator. The limbus growth had existed for five years and the choroidal nodule was considered metastatic. The author suggests that the nomenclature of melanocarcinoma or melanosarcoma be abandoned in favor of the term malignant melanoma, which is used in the Anglo-American literature.

Louis Daily, Jr.

Verrey F. **Acute keratoglobus.** Ophthalmologica 114:284-288, Oct.-Nov., 1947.

"If the term keratoglobus did not exist, it would have to be invented to describe the corneal malformation" which existed in both eyes of a girl, 21 years of age. Her corneas measured from 13 to 13.5 mm. at their base, were perfectly clear, about one-third as thick as normal, of conical shape in the periphery and strongly and astigmatically curved in the center. With spherocylindrical lenses the vision of the right eye was improved to 20/200, that of the left eye to 20/40. The condition was probably related to keratoconus, since in the left eye several acute phases of inbibition of aqueous (the equivalent of acute keratoconus) could be observed.

P. C. Kronfeld.

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UVEA, SYMPATHETIC DISEASE, AQUEOUS

Bardram, M. T. **A case of iridocyclitis leprosa.** Acta ophth. 25:265-269, 1947.

A man, 41 years of age, had lived for 15 years in the East. Eight years after the initial skin lesion on the left upper arm he developed a bilateral iridocyclitis with increased tension and lepromata on the left iris. After eight months of unsuccessful therapy his visual acuity was 3/26 in the right eye, and 2/60 in the left.

Louis Daily, Jr.

Björk, Ake. **Antistreptolysintitration in acute iritides.** Acta ophth. 25:127-138, 1947.

Björk applied the method of titer determination to study the relation between acute iritis and rheumatic disease. The material of his study consisted of 52 cases of acute iritis of undetermined etiology, in adults, of which 22 had had previous attacks. The tabulated data of their antistreptolysin titer show an increased titer in 10 percent, which corresponds to the findings reported in a normal population. He concludes that hemolytic streptococci do not have a significant part in the etiology of acute iritis, and doubts that there is a close relation between iritis and rheumatic disease. (1 table, references.)

Ray K. Daily.

Dubois-Poulsen, and Dubois-Verlière. **Cutaneous tuberculous allergy in iridocyclitis.** Ann. d'ocul. 181:65-81, Feb., 1948.

Following the technique of Canetti, the authors employ four intracutaneous injections in the arm at one sitting. These contain 1/10 cc. of tuberculin (obtained from the Pasteur Institute) which is diluted to 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}. The allergic reaction is considered strong, medium, weak, or absent depending on the minimal reaction beginning with the highest number. Thirty-five women and 20 men with iridocyclitis of different etiology were thus examined. Of the entire group, 71 percent showed a strongly positive reaction. In 15 patients with definitely non-tuberculous lesions the reaction was strongly positive in 45 percent and in

13 cases presumably tuberculous, the percentage was 85. In 10 cases of unknown origin, the reaction was strongly positive in 60 percent. In patients with uveal, dermal, ganglionic and osseous tuberculosis the reaction is usually strongly positive. Patients with pulmonary tuberculosis react less strongly, and the intensity of the reaction decreases with age. A strongly positive reaction alone is not sufficient to establish the tuberculous origin of a uveitis. Chas. A. Bahn.

Loewenstein, A., Foster, J., and Sledge, S. K. **A further case of iridoschisis.** Brit. J. Ophth. 32:129-134, March, 1948.

The ninth case of iridoschisis to be reported occurred in a 46-year-old man, who had received a severe blow which broke his nose. Aside from a "black eye" on the right side, there was no apparent eye injury. Ten weeks later he noted that the color of the right iris was changing from its normal hazel to a dark blue. The vision in each eye was correctible to 6/6. The affected iris presented large brown patches of atrophy. Many of the fibers of the anterior layer had separated at the pupillary end and were hanging suspended in the aqueous or were attached to the posterior corneal surface near the limbus. The lens, vitreous, and fundus were normal but the tension was 35 mm. Schiøtz. The diagnosis was iridoschisis with secondary glaucoma. A broad basal iridectomy led to uneventful recovery. The authors explained the phenomenon as a result of the blow whereby the aqueous was forced into the spongy iris tissue where proteolytic enzymes destroyed the stroma. The pigment thus liberated blocked the drainage channels and caused the secondary glaucoma. (4 figures.)

Morris Kaplan.

Sichel, A. W., and Louw, J. G. **A case of sympathetic ophthalmitis of unusual onset responding satisfactorily to treatment.** Brit. J. Ophth. 32:180-184, March, 1948.

A 54-year-old farmer with a severe laceration of the right eye refused to have the eye enucleated. It remained moderately painful and three months later was removed when the patient was annoyed by epiphora of the good eye. This irritability and tearing continued for almost a month. Then a mild papillitis and cloudiness of vitreous were noted and one week later typical signs of sympathetic ophthalmia appeared in the anterior segment. The patient was given large doses of penicillin and salicylates and two injections of neoarsphenamine. Large doses of sulphadiazine and sodium iodide and dionin were added. After two months improvement was satisfactory and the corrected vision was normal. The patient has remained well for several months.

Morris Kaplan.

9

GLAUCOMA AND OCULAR TENSION

Allen, T. D. **To prevent cycloplegic glaucoma.** Ophth. Ibero am. 9:217-220, 1948.

Precautions listed by the author include (1) awareness of the fact that cycloplegic glaucoma may follow the use of cycloplegia; (2) a careful precycloplegic examination; (3) careful records of corneal size and transparency, pericorneal vascular condition, depth of anterior chamber, and other details; (4) tonometry before and after the use of mydriatic or cycloplegic drugs; (5) postcycloplegic test as to possible need for miotics.

W. H. Crisp.

Diaz Domínguez, Diego. **A new technique for cyclodiathermy.** Arch. Soc. oftal. hispano-am. 8:117-129, Feb. 1948.

The literature on the techniques of cyclodiathermy is reviewed. The corneal complications following the Vogt tech-

nique led many investigators to modify the procedure. The author prefers Thiel's technique of subscleral diathermy-coagulation of the ciliary body, which diminishes the function of the ciliary processes, and provides for aqueous drainage through the suprachoroidal space. The technique is that of cyclodialysis, with the spatula as a diathermy electrode; the spatula is introduced between the sclera and ciliary body until its end appears in the anterior chamber, the current is then turned on, and the spatula moved up and down, coagulating one-third or one-fourth of the ciliary body. The current is disconnected, and the spatula removed. The limited number of cases in which this technique was used does not permit of definite conclusions. The results, however, are not inferior to those of the Vogt cyclodiathermy, at least in simple glaucoma in adults. The addition of diathermy-coagulation to cyclodialysis does not increase the risk of the operation, and the author believes that is it indicated wherever fistulating operations are not suitable.

Ray K. Daily.

Holst, J. C. **The results of subconjunctival iridencleisis with meridional iridotomy in the period 1928-1939.** Acta ophth. 25:271-278, 1947.

The author discusses 1019 patients with simple glaucoma, on whom 1318 operations had been performed. A period of one year of observation was possible in 455 eyes. Vision was the same or better in 83.4 percent of eyes, and the field of vision was improved in 96.8 percent. Tension was normal without miotics in 79.8 percent, and in a further 12.5 percent it was normal under pilocarpine, which had been ineffective before operation. The chances of maintaining the functions of the eye unchanged are best if the operation is performed early. (3 tables.)

Louis Daily, Jr.

Márquez, M. **Old and new ideas about ocular hypertension and glaucoma.** Ophth. Ibero am. 9:123-147 (in Spanish), 148-169 (in English), 1948.

The author speaks of these two conditions as more or less distinct entities although they frequently coincide: which one develops sometimes depends chiefly upon susceptibility of the optic nerve to what is ordinarily thought of as normal or relatively normal tension. (Bibliography.)

W. H. Crisp.

Moreu, Angel. **Gonioscopy in glaucoma.** Arch. Soc. oftal. hispano-am. 8:80-89, Jan., 1948.

Moreu enthusiastically advocate gonioscopy, which he has been doing since 1933. He began with the Troncoso gonioscope and the Koeppe contact lens, and now uses the Goldman contact lens with the slit lamp. For experimental purposes he uses dogs, which are easy to gonioscope. He points out that most of the investigations on gonioscopy were done in the Americas, the Europeans having manifested but little interest in the subject. Supporting his opinions by extensive gonioscopic investigations, he argues against the acceptance of the anatomic structure of the anterior chamber angle as a factor in the pathogenesis of glaucoma. The size of the angle varies, and is subject to changes in the same eye. He has seen acute glaucoma in eyes with wide open angles free of synechia, and chronic glaucoma with a narrow angle and peripheral synechia. Moreau regards the changes in the angle of the anterior chamber as a consequence of glaucoma and not its cause. The early glaucomatous change is an edematous ciliary band, with foci of fine exudate. Gonioscopy makes possible the study of the ocular physiology, and combined with intravenous or intramuscular fluorescin injections it reveals much of the physiology of the aqueous veins and Schlemm's canal. Gonios-

copy is valuable in the study of postoperative results, and the anatomic effects of surgical procedures. The site for cyclodialysis should be selected by gonioscopy. If the cyclodialysis spatula hits where there is a synechia no dialysis results; there is merely a perforation which closes on the following day. Ordinarily after a cyclodialysis a small hematoma fills the dialyzed area, and as the hematoma absorbs, a synechia, which was not there before the operation, is left in its place; the surgical result may nevertheless be good. Following fistulating operations gonioscopy sometimes reveals that there is no fistulization; but the ciliary edema in the ciliary body and processes is gone, and the intraocular tension is reduced. The favorable results are due to the effect of the operation on the uveal circulation. Moreu is a firm believer in the vascular basis of glaucoma. Ray K. Daily.

Moreu, Angel. **Reflections on some points relative to the pathogenesis of true glaucoma.** Arch. Soc. oftal. hispano-am. 8:64-79, Jan., 1948.

Moreu stresses the importance of differentiating between secondary hypertension, caused by obstruction in the angle of the anterior chamber, and true glaucoma caused by a disturbance in the ocular circulation on the basis of a neurovegetative dystonia. Reference is made to the recent investigations of Duke-Elder, Kinsey and Grant, and Barany on the production of aqueous humor, and the investigations on the function of Schlemm's canal are critically analyzed. The author's own experiments with the reaction of Schlemm's canal to puncture of the anterior chamber and the analysis of the aqueous humor withdrawn in the various types of glaucoma are described in detail. As a result of these investigations he sounds a warning on the use of vasodilators, recently advocated in glaucoma; they augment the volume of blood which enters the eye, and in case of inability of this blood to leave the eye through obstructed drainage pathways may precipitate an acute attack. In an eye with good drainage passages vasodilators may be used even in an acute stage. Vitamin P, which diminishes vascular permeability affects favorably the ocular tension and the composition of the aqueous. Ray K. Daily.

Owens, W. C. **Glaucoma following cataract extraction.** South. M. J. 41:357, April, 1948.

A series of 2,086 cases seen at the Wilmer Ophthalmological Institute from 1925 to 1943 was studied. The percentage of all glaucoma cases was 4.2. In the group with intracapsular extraction with round pupil it was 1.6. Most of the prevention of glaucoma is technical, at the time of operation, such as removing all or as much as possible of the lens to minimize postoperative iridocyclitis, the most common cause. Loss of vitreous is reduced by adequate anesthesia, a speculum which does not press on the eye, and detention when possible of a round pupil. Corneoscleral sutures were used to close the wound well and to prevent delayed reformation of the anterior chamber. If it had not reformed at the end of six days, air was injected. To prevent mechanical block by vitreous an adequate peripheral iridotomy or iridectomy should be done at the time of operation.

In treatment of glaucoma that was associated with an acute iridocyclitis, foreign protein and mydriatics were used. When lens material is retained, desensitization with lens protein may help. A trephine operation is advised if these measures fail. In cases without iridocyclitis, miotics were used, and the tension carefully recorded. If operation was necessary, the choice was cyclodialysis, in the upper quadrant if possible, with miotics for at least several weeks afterwards. This operation may be repeated.

If it failed, trephining was recommended.

In only 39.5 percent of cases of glaucoma following cataract extraction was the final vision 20/70 or better. (1 table, references.) Bennett W. Muir.

Posner, A., and Schlossman, A. **The role of inheritance in glaucoma.** Tr. Am. Acad. Ophth. pp. 145-158, Jan.-Feb., 1948. (See Section 19, Congenital deformities, heredity.)

Simonelli, Mario. **The use of prostigmine in the treatment of glaucoma.** Riv. di oftal. 2:119-124, March-April, 1947.

The author concludes that prostigmine used as a collyrium in three-percent solution induces a miosis and a drop in ocular tension sufficiently marked to make it especially indicated in the therapy of glaucoma. Prostigmine has an action which is more effective than that of pilocarpine and can be compared with eserine. However, it is of prompter action, longer duration, and, above all, does not show the usual secondary reactions characteristic of eserine even though it is used over a long period of time. Finally, prostigmine is completely stable.

The author used prostigmine in 18 cases of glaucoma (6 acute, 4 chronic inflammatory and 8 chronic simple), and in all cases the results were superior to those obtained with pilocarpine. In the patients with chronic inflammatory glaucoma, pilocarpine and prostigmine were used alternately and there was always a rise in tension after pilocarpine and a lowering after prostigmine.

Francis P. Guida.

Thomassen, Thore Lie. **The cause of the increase of tension in iridocyclitis glaucomatosa.** Acta ophth. 25:243-252, 1947.

Two series of experiments were performed in this investigation. Five eyes with iritis glaucomatosa were subjected to a weight compression of 25 gm. during two minutes and the ocular tension measured before the compression, and 5, 15, and 35 minutes after the removal of compression. The data show that the response of eyes with iridocyclitis with hypertension to compression is the same as it is in simple glaucoma. In the increasing phase of ocular tension there is a distinct relative hypertension and no fall in pressure; in the decreasing phase there is a marked fall in pressure, with no relative hypertension. The fall in pressure in response to compression is believed to be due to the pressing out of the aqueous through Schlemm's canal, which is hampered in the rising phase.

The material for the second series consisted of nine eyes with iridocyclitis glaucomatosa. Curves of the ocular pressure and of the pressure in the episcleral veins were made daily for 12 days. The technic used was identical with that applied to the study of simple glaucoma, except that the tension was taken every hour, instead of every half hour because of the increased sensitiveness of these eyes. The curves of the data thus obtained show that the relations between the ocular and venous tensions are the same in iridocyclitis with high tension and in simple glaucoma. The venous tension is high in proportion to the intraocular pressure in its rising phase, in the decreasing phase the venous tension is low. The changes in the venous tension precede those of the intraocular pressure. The conclusion of the studies is that the rise in intraocular pressure in iridocyclitis glaucomatosa as well as in simple glaucoma is due to functional changes in the vascular system of the eyes. (2 curves.)

Louis Daily, Jr.

Thomassen, Thore Lie. **The arterial tension in glaumatous eyes.** Acta ophth. 25:253-264, 1947.

A review of former investigations on the arterial ocular tension and its relation to the general blood pressure and the

ocular tension brings out the scarcity of established data. The author's experimental work consisted of measuring with a water manometer the diastolic and systolic arterial tensions in an anterior ciliary artery at the point where it enters the sclera. The pressure was taken at the first discernible pulsation, and at the moment when the artery became empty. The material consisted of 16 glaucomatous eyes, and the ocular tension and the tension in the episcleral vein were taken as well. Because of the great pressure to which the globe must be subjected in these measurements, the arterial tension was taken only a few times daily; it was, however, taken at hours of greatest variation in the ocular tension. The curves of the data show that the arterial tension remains constant despite marked oscillations in the ocular and venous tensions. The instillation of pylocarpine into one eye also failed to affect the arterial tension, while producing a distinct fall in the ocular and venous tensions. Applying these data to the explanation of the pathogenesis of glaucoma the author concludes that the primary change in disturbances of ocular tension takes place in the minute vessels of the eyes, in which resistance to the blood flow becomes reduced; this leads to a rapid rise in the pressure of the capillaries and veins. The increased capillary tension promotes an augmentation in the quantity of aqueous humor with the consequent rise in ocular tension. The rise in the venous tension takes place rapidly, while the increase of aqueous humor takes place more slowly; this conception is supported by the experimental data, which show that the rise in venous tension precedes the rise in ocular tension. Louis Daily, Jr.

10
CRYSTALLINE LENS

Arruga, H. **Comments on cataract extraction.** Arch. soc. oftal. hispano-am. 8: 5-22, Jan., 1948.

Because a small pupil facilitates the making of a peripheral iridectomy or iridotomy and holds back the vitreous after rupture of the hyaloid membrane, Arruga operates by preference with a pupil of 6 mm. He uses larocain which does not dilate the pupil, or adds 1 percent pylocarpine to instillations of cocain and adrenalin. In restless patients he uses 30 percent alcohol with the akinesis, which prolongs the relaxation of the lids, at the price of a somewhat painful injection, and lid edema. He makes a corneal section, and closes the wound with corneal sutures, using as many as five in restless patients. The corneal section prevents hemorrhage during and after the operation; healing however, is slower, and corneal suturing requires very fine and sharp needles. For this purpose he found the American atraumatic needles inadequate. He makes two peripheral iridotomies. The importance of a good capsule forceps for intracapsular extraction is emphasized and the Arruga forceps is described and illustrated in detail. The anterior chamber is filled with sterile water after loss of vitreous. (11 illustrations.)

Ray K. Daily.

Buffington, W. R., **Congenital ocular anomalies resulting from (a) premature birth (b) rubella infection of mother during pregnancy.** New Orleans M. and S. J. 100:466-474, April, 1948.

Three cases of bilateral retrolental fibroplasia in premature infants are reported and two cases of congenital cataract in infants whose mothers had German measles in the first two months of pregnancy. Irwin E. Gaynon.

Doherty, W. B. **A discussion of deformities of the shape of the lens. With a report of a case of posterior lenticonus.** Am. J. Ophth. 31:455-460, April, 1948. (2 figures, 35 references.)

Gill, E. G. **Cataract surgery: recent advances.** South. M. J. 41:191-197, March, 1948.

The author uses local anesthesia, van Lint akinesia, a keratome incision widened to 180 degrees with scissors, a combination of two corneoscleral sutures, and a 180-degree conjunctival flap closed by additional sutures. The lids are held open, and the eye down with silk sutures, and the lens is delivered by the Verhoeff method. The patient is generally allowed to get out of bed 24 hours after operation. With this technic the author has achieved a visual acuity of 20/25 or better in 90 percent of patients; he has reduced hemorrhage to 3 percent and vitreous loss to 2 percent. He emphasizes that this operation is not designed for speed but for safety and accuracy.

Theodore M. Shapira.

Heinz, K. **Cataract infection in spite of sulfonamid prophylaxis.** Proc. Ophth. Soc. Vienna, p. 29, Oct. 26, 1942.

The right eye of a man, 66 years of age, was operated on by Prof. Lindner for an intumescent cataract extracapsularly with loss of vitreous and subsequent infection. In spite of extensive therapy this eye was lost. Five weeks later a cataract was extracted from the left eye, again with loss of vitreous. On the day of operation patient had received one milk injection and prontosil. Nevertheless this eye also showed signs of severe infection on the sixth postoperative day but the eye recovered after the use of sulfa drugs and injections of milk and typhoid vaccine. The resulting vision was 6/8.

F. Nelson.

Kadesky, David. **A modified forceps for intracapsular extraction of cataract.** Arch. Ophth. 38:259, Aug., 1947.

The author describes a capsule forceps shaped so that the radius of curvature of the jaws corresponds to that of the average convexity of the anterior surface of the lens. (2 figures.)

John C. Long.

Kirby, D. B. **The extraction of cataract in the presence of fluid vitreous.** Am. J. Ophth. 31:585-606, May, 1948. (2 tables, 15 references.)

Ladato, G. **Concerning a case of bilateral cataracta nigra.** Riv. di oftal. 2: 145-154, March-April, 1947.

The author discusses one case of bilateral cataracta nigra in which he carried out a histochemical investigation. This revealed the presence of fatty substances which he considers a localized metamorphosis of lenticular protein, especially the amino acids.

Francis P. Guida.

Schulte, D. **Abscess-like collection of pus between the lamina of the posterior lens capsule.** Klin. Monatsbl. f. Augenh. 112:193-203, 1947.

An eye which had been enucleated because of an acute metastatic panophthalmitis had a collection of more or less encapsulated pus between the lamina of the posterior lens capsule. Such a finding is extremely rare. The author assumes that the leucocytes entered the lens capsule along the zonula and the limiting membrane of the vitreous through the Wieger ligament and the lamina of the zonula. The histologic findings confirm the anatomic concepts concerning the Wieger ligament, the anterior limiting membrane of the vitreous and the connection between vitreous, lamina of the zonula and lens. They also illustrate the lamellar structure of the lens capsule. (8 figures, references.)

Max Hirschfelder.

Velhagen, K., Jr. **Cataract operation in myopia.** Klin. Monatsbl. f. Augenh. 112: 225-232, 1947.

The author discusses the advantages and disadvantages of intracapsular and

extracapsular cataract extraction in patients with high myopia. The various complications such as loss of vitreous, retinal detachment, iris prolapse and late hemorrhage are statistically compared for the two methods of operation. The author's figures and extensive statistics from the literature are cited. The author prefers intracapsular extraction in high myopia, in spite of a slightly higher percentage of complications. He points out that these complications can be dealt with more easily than in the extracapsular extraction but the latter is often disappointing because of the particularly bad secondary cataract in myopic patients. The average end result with intracapsular extraction was 0.4 vision, whereas in extracapsular extraction it was only 0.28. The author's own figures for vitreous loss in high myopia were 6 percent for the intracapsular and 3 percent for the extracapsular method. (Bibliography.)

Max Hirschfelder.

Williamson-Noble, F. A. **A complication of intracapsular cataract extraction.** Brit. J. Ophth., 32:161-162, March, 1948.

This very brief article explains the author's technique for extracting a lens after the capsule has ruptured unexpectedly. Rather than use a loop, he inserts two cystitomes into the lens and pulls it out with some pressure assistance of a squint hook. He has used this procedure in three cases. Morris Kaplan.

11
RETINA AND VITREOUS

Arruga, H. **Some observations on the treatment of retinal detachment.** Arch. Soc. oftal. hispano-am. 7:1001-1008, Oct., 1947.

Advancement in the treatment of retinal detachment has raised the percentage of cures to 70 to 80 percent of the eyes that are operated upon. Eyes with retinal holes, which are operated on before detachment takes place always heal perfectly. In patients who had a retinal detachment in one eye the recognition of early visual disturbances in the other eye may lead to the diagnosis of the retinal hole before the retina becomes detached. In 23 such cases Arruga achieved perfect results, without a diminution in visual acuity, by coagulation with a weak current. Coagulation with a weak current of vacuolar degenerated retinal areas in the remaining eye of a patient who lost the other from retinal detachment is also productive of good results. Poor surgical results, in cases in which one expected success because the retina returned to its normal position after rest in bed, are attributed by Arruga to an increased sensitivity of the choroid, or to the presence of a chronic inflammatory process which is activated by the surgical procedure. There is no way of predicting this unfavorable reaction. Macular holes have a poor prognosis, and their surgery is technically difficult. They are produced not by a pull of the vitreous as is the case with retinal holes in other areas, but by the push of the choroidal exudate on the retina towards the interior of the eyeball. They are round holes, without flaps, and the retina does not flatten after rest in bed. Disinsertions at the ora serrata are never reattached; the surgical goal is here to reattach the retina to the underlying choroid, but not to its original insertion. The lateral portion of the retina must be sacrificed to save central vision. To achieve this it is useless to coagulate at the periphery; the retina should be coagulated so that the disinserted area is thoroughly isolated. Detachments with holes in the lower portion of the retina also have a poor prognosis, chiefly because they interfere but little with vision at first, and patients come to the ophthalmologist after the underlying choroid has degenerated and become incapable of pro-

ducing an exudate. In such cases also coagulation is effective only in isolating the detached retina, but not in reattaching it. Ray K. Daily.

Arruga, H. **Considerations on the treatment of detachment of the retina.** Proc. Roy. Soc. Med. 65:68-72, Jan., 1948.

The author presents substantially the same material as in the preceding abstract.
F. H. Haessler.

Belmonte González, José. **Experimental vitreous transplantation.** Arch. Soc. oftal. hispano-am. 7:1091-1096, Nov., 1947.

The technical methods of vitreous transplantation are the same as described by Cutler. Rabbit's vitreous was used in this work. Some was transplanted immediately and others 6 hours, 24 hours, 3 days, or 6 days after the enucleation of the eye. A biomicroscopic study was made in every case. It was found that better results were obtained when fresh vitreous or vitreous obtained only a few hours after the enucleation was used. The donor's eyes were preserved in isotonic saline solution. (Several colored pictures.)
J. Wesley McKinney.

Bockhoven, S., and Levatin, P. **Treatment of Lindau's disease.** Arch. Ophth. 38:461-467, Oct., 1947.

Lindau's disease is an angiomatosis of the central nervous system characterized by the occurrence of single or multiple hemiangioblastomas in the cerebellum, brain stem or spinal cord, associated with angiomatosis of the retina (von Hippel's disease). The authors report a case of Lindau's disease in a 27-year-old negro. Signs of spinal cord involvement developed. At operation an extensive sclerosing hemiangioma of the cord was found. An asymptomatic angioma was found in the upper temporal portion of the fundus, with marked dilatation of the vein and artery. This was treated by diathermy puncture which largely destroyed the growth but did not completely occlude the feeding blood vessels. The electrocoagulation was carried out without any loss of vision and is regarded as the method of choice in treating retinal angiomatosis. The tumor of the cord was treated by roentgen radiation but further cord involvement occurred.
John C. Long.

Calhoun, F. P. **Observations on the treatment of detachment of the retina.** South. M. J. 41:311-316, April, 1948.

A normal retina does not become detached. Careful examination with maximum dilatation, repeated especially after bed rest, is of utmost importance. Transillumination should always be done. The author prefers local anesthesia, with O'Brien or Van Lint akinesia, without subconjunctival injection. Muscles are retracted by a suture passed beneath them rather than with a muscle hook. He prefers to localize a hole ophthalmoscopically after a test application of nonperforating diathermy. Then the initial localization is surrounded by a double ring of partially penetrating applications with a 0.5-mm. electrode at intervals of three millimeters. Frequent ophthalmoscopic examination during operation is stressed. Holes for drainage should be a short distance from the retinal hole rather than right over it, and cutting current, if available, is used, with a 1.5-mm. Kronfeld or Pischel electrode. If air is injected it should be through the flat portion of the ciliary body away from the area of diathermy, for which a large pointed electrode 2 to 3 mm. long is used first, then a needle and syringe. The amount of air usually is 2 to 3 cc. More often air is put into the anterior chamber through a paracentesis wound, at the end of operation. One half to one cc. usually is enough. The causes of failure are sometimes quite obvious, such as large or multiple rents, or trac-

tion bands, but often there is no obvious reason. (2 figures, discussion, references.)

Bennett W. Muir.

Doggart, J. H. **The prognosis in macular lesions.** Tr. Ophth. Soc. U. Kingdom 65:347-353, 1945.

The ophthalmologic picture of primary degeneration may closely simulate that of changes due to previous inflammation or trauma. The progress of a lesion is difficult to determine without repeated examinations as deterioration may be arrested at any stage.

The first step towards prognosis is the attempted recognition of the similarity of the lesion to one in one of the groups identified by authoritative observers. Systematic exploration of the whole fundus and the comparison of the two eyes are helpful in diagnosis as well as prognosis.

The prognostic value of case records is enhanced by a series of drawings indicating the size and position of macular changes at successive examinations.

Beulah Cushman.

Friede, R. **The nature of inherited retinitis pigmentosa.** Klin. Monatsbl. f. Augenh. 112:214-221, 1947.

The factors which conceivably can play a part in the pathogenesis of retinitis pigmentosa are discussed. Such inherited factors may act locally or generally. The anatomic or pathologic structure of the choriocapillaris may be involved, as it influences the flow of blood and, therefore, the nutrition of the underlying retina. There is often only little choroidal sclerosis in retinitis pigmentosa. In the author's opinion, the lamina vitrea plays the primary and most important part in the development of retinitis pigmentosa. It is the vitrea which regulates the nutrition of the neuroepithelium by osmosis. Hyalinization of this structure leads to serious disturbance of the metabolism of the retina. It also prevents the passage of vitamin A and produces the accompanying hemeralopia. The possibility that retinitis pigmentosa is only a part of a generalized disturbance is discussed. Patients in whom the disease is associated with inherited deafness or with the Laurence-Moon-Biedl syndrome are cited. Leber's theory of an overstimulation of the retina by light and the theories of a primary liver disturbance are mentioned, but their correctness is held to be questionable.

Max Hirschfelder.

Gartner, S., and Priestley, B. S. **Transplantation of the vitreous.** Arch. Ophth. 38:487-493, Oct., 1947.

Transplantation of vitreous has been successfully performed in rabbit eyes. Vitreous from the other eye of the same rabbit or from the eyes of other rabbits was used, as well as vitreous from the human eye and from the kitten eye. A method of simultaneous injection and withdrawal of vitreous with a specially devised double syringe and needle arrangement was the only method found to give regularly successful results. It was found that unless the injection of new vitreous was carried out simultaneously with the withdrawal of vitreous extensive hemorrhages and deteriorative changes followed.

Further studies are needed before the method is applicable to the human eye.

John C. Long.

Gordon, D. M. **The experimental treatment of retinitis pigmentosa.** Tr. Am. Acad. Ophth. pp. 191-195, Jan.-Feb., 1948.

The records of 128 patients who received a reasonable amount of treatment by Filatov's tissue therapy are critically reviewed. This therapy consists of injections of cod liver oil and the implantation subconjunctivally or subcutaneously of placenta and other substances ranging from aloes to ovaries. These patients, 16 to 73 years of age, had visions that ranged from the ability to barely count fingers

to 20/20. In 26 percent there was slight improvement in vision in at least one eye; of these 11 showed slight improvement in visual fields, 4 in light adaptation and 2 were doubtful. The visual improvement was so slight, however, that one wonders whether or not the greater urge to see was not the most important factor. No change in the fundus was observed. Temporary improvement is also obtained by large doses of nicotinic acid and vasodilators and there the duration of such improvement as well as the secondary reaction is questionable. This treatment is not advised until its advantages and disadvantages have been much more thoroughly investigated. Chas. A. Bahn.

Hayden, R. **Retinitis pigmentosa with unilateral involvement of fundus.** Proc. Ophth. Soc. Vienna p. 16, May 18, 1942.

A woman, 39 years of age, noted progressive deterioration of vision and increasing night blindness for the last five years. The corrected vision in the right eye was normal, but dark adaptation curves showed diminishing of threshold values. The left eye showed typical advanced pigment degeneration of the retina, minimal visual acuity, concentric contraction of the visual field to 10 degrees and a high degree of hemeralopia. Since both eyes had hemeralopia the retinitis pigmentosa cannot be called unilateral though the fundus of the right eye appeared objectively normal. F. Nelson.

Kaplan, M., Morax, P. V., and Bernard, J. **The Tay-Sachs type of amaurotic family idiocy: a case report.** Ann. d'ocul. 181:32-35, Jan., 1948.

The patient was a practically blind, one and one-half year old boy of Oriental-Jewish extraction, whose father and mother were cousins. The direct and indirect pupillary reactions were diminished, but equal, and most of the other ocular reflexes were absent. The macular region was observed as a yellowish disc with a bright, red central depression; otherwise, the fundus was objectively normal. Chas. A. Bahn.

Kurz, O. **Differential diagnosis of lesions of the macula.** Ophthalmologica 114: 262-273, Oct.-Nov., 1947.

Three cases of lesion in the macula are reported in detail: one of central serous chorio-retinitis (corresponding to the central angiospastic retinopathy of Gifford and Marquardt), one of hypertensive retinopathy and one of a congenital familial anomaly of the macula. The importance of the distinction between cystoid macular edema and localized subretinal exudates is stressed. Examination of the macula by means of the slitlamp, the binocular corneal microscope and the fundus contact lens gives clues unobtainable by binocular ophthalmoscopy in mixed or redfree light.

Peter C. Kronfeld.

Lindner, K. **Bullous retinal detachment cured by waiting and operation.** Proc. Ophth. Soc. Vienna p. 23, June 29, 1942.

An almost total bullous retinal detachment of two or three weeks duration was found in the right eye of a 52-year-old woman. Only in the lower nasal quadrant was the detachment flat. A tear was found. Since the author felt that the prognosis was hopeless he waited four months before he decided to operate on the eye. The retina returned to its normal site and remained in place since, but the vision regained was only 3/24 as a result of the long delay. F. Nelson.

Matteucci, P. **Papilloretinitis of arterial hypertension and papilledema.** Riv. di oftal. 2:105-111, March-April, 1947.

One case of "cerebro-retinal" edema is reported. On the basis of this observation and of studies of retinal venous and arterial pressure studies on patients with

various types of arterial and intracranial hypertension, the author discusses the pathogenesis of hypertensive retinopathies. He also emphasizes the diagnostic value of the retinal venous pressure which seems to bear a close relationship to the intracranial pressure.

Francis P. Guida.

Michaelson, I. C. **Intra-mural new vessels in an occluded retinal vein.** Brit. J. Ophth. 32:164-166, March, 1948.

A 60-year-old woman developed an obstruction of a branch of a superior temporal vein near the optic disc. Five months later examination revealed numerous newly-formed collateral vessels between the affected and unaffected branches of the vein. Within the opacified walls of the obstructed vessel, two well formed veins were found extending into the distal column of blood. One of these vessels could be seen leaving the affected vessel and draining into an unobstructed vein.

Morris Kaplan.

Missiroli, Giuseppe. **Bilateral symmetrical paramacular tapetoretinal degeneration.** Boll. d'ocul. 26:655-660, Oct., 1947.

The only complaint of the patient, a 24-year-old female medical student, was that she became tired after reading. The parents were not related; there was no eye disease in the family and in two siblings. With correction of a medium degree of hypermetropic astigmatism, the patient has a visual acuity of 10/10. There was an absolute paracentral scrotoma for colors and a relative one for white in both visual fields which were peripherally normal. Color sense and adaptation were normal. In both retinas temporally from the macula lutea, there was an oval area of yellow-brown color, measuring 2 by 1½ papillary diameters, pigmented and sharply outlined; in the right retina this area was crossed by a retinal artery. For four years the lesions and the functional findings did not change; in the fifth year of observation, a slight but definite enlargement of both retinal lesions, to 3 by 2 papillary diameters, was found. The disease is one of the group of familial macular degenerations. The author suggests that the cases with paramacular localization may occur more often but are not described frequently because visual disturbances are missing; the present case would not have been detected were it not for the asthenopic symptoms caused by the astigmatism. (1 colored fundus picture, 6 references.)

K. W. Ascher.

Morgan, O. G. **A case of crush injury to the chest associated with ocular complications.** Tr. Ophth. Soc. U. Kingdom 65:366-368, 1945.

A small boy who was run over by a cart sustained minimal injuries to the chest. The following day he developed a typical picture of angiopathia retinae traumatica. He had a subconjunctival hemorrhage on the inner side of each cornea and three days later vision was reduced in the left eye to 6/12. The left fundus showed numerous whitish patches, some small hemorrhages along the main vessels and edema of the macula. The right eye showed a few whitish patches but no hemorrhages. The condition gradually cleared in three weeks and visual acuity was 6/6.

This must be an unusual complication of a minor chest injury. (1 colored plate.)

Beulah Cushman.

Rosen, Emanuel. **Solar retinitis.** Brit. J. Ophth., 32:23-35, Jan., 1948.

In the 23 cases described, exposure occurred for a few minutes to an hour and was not confined to direct gazing into the sun. Several cases of severe sun blindness were caused by watching the sun's reflection, as in a lake or in a bucket of water. In every case there were one or two easily

visible macular holes and heavy damage to vision. The destruction of the retinal tissue was irremediable. The ophthalmoscopic picture is quite characteristic; in the macula a deep crater, deep crimson in color, one-eighth disc diameter in width, the edges of which are sharply cut and irregular in shape, is surrounded by a soft cloud of pigment. (14 Figures.)

Morris Kaplan

Rosengren, B. **The operative treatment of retinal detachment.** Acta ophth. 25:111-126, 1947.

Among the factors accounting for the failure of operations for retinal detachment Rosengren considers errors in localization and faulty cauterization as insignificant, and believes that the majority of failures are due to the lack of contact between the retina and choroid. If the subretinal fluid is not withdrawn, healing is impossible. To maintain contact between the retina and choroid Rosengren injects air into the vitreous, and places the eyeball in such position that the hole is upward. The air bubble forces the retina against the choroid by pushing against it. The author advises bed rest until the elevation within the cauterized area has completely disappeared, that is for about five to six weeks. He keeps a binocular bandage for three to four weeks. The tabulated data on 100 patients show 81 cured. Reference is made to the author's former report on the technique of coagulation, in which he advocates nonperforating electrocoagulation with a ball electrode 1.25 to 1.00 mm. in diameter. (4 figures, 6 tables.) Ray K. Daily.

Verrey, F. **Myotonic dystrophy associated with degeneration of the macula.** Ophthalmologica 114:281-284, Oct.-Nov., 1947.

A typical case of myotonic dystrophy showed the following eye findings: bilateral ptosis, limitation of all ocular movements, slight reduction of corneal sensibility and fine, but typical lens opacities. The unusual finding was a bilateral degeneration of the macula (multiple yellowish dots within the retina) without gross visual impairment.

Peter C. Kronfeld.

Verrey, F. **Symmetrical involvement of the retinae in pigmentary degeneration.** Ophthalmologica 114:278-280, Oct.-Nov., 1947.

A white female patient, 51 years of age, complained of impaired vision in the dusk for the last ten years, and increasing reading difficulty for the last five years. Her vision was 20/20 in the right eye and 20/33 in the left. The fundus findings were those of retinitis pigmentosa confined to symmetrical sectors in the two eyes. The upper-temporal quadrants with portions of the adjacent quadrants had remained uninvolved, so that the lower halves of the visual field were almost normal. In the affected sectors the retinal vessels were much narrower than in the unaffected areas. Other members of the family could not be examined. Peter C. Kronfeld.

12

OPTIC NERVE AND CHIASM

Friedenberg, Sidney. **Tryparsamide optic neuritis treated by 2,3, Dimercaptopropanol** (B.A.L.). J.A.M.A. 135:1072, Dec. 20, 1947.

The author presents the first recorded case of tryparsamide optic neuritis successfully treated with 2,3, Dimercaptopropanol (B.A.L.). The arsenicals are thought to be toxic because they block the functioning of physiologically essential chain groups within the cells by combining with them. B.A.L. competes successfully for the arsenic with the sulfhydryl bond (the most vulnerable) by forming a stable compound with the arsenic which is rapidly excreted in the urine.

After tryparsamide injections the patient had loss of the inferior portions of the visual fields and general constriction. The last functions were recovered because of prompt B.A.L. therapy.

O. H. Ellis.

Igersheimer, Joseph. **Binasal hemianopsia.** Arch. Ophth. 38:248-258, Aug., 1947.

A case of binasal quatranopsia with central scotoma of the right eye in a 59-year-old man is reported. Exploratory operation showed a supraclinoid type of saccular aneurysm lateral to and apparently covered by the nerve. Diagnostic aspiration of blood from the aneurysm was done. Following the surgery there was marked loss of vision of the right eye but very considerable improvement in the vision of the left. The causes of binasal hemianopsia are discussed in some detail. The author concludes that the field of action in such cases is not the chiasm but the short portion of the intracranial part of the optic nerve in front of the chiasm. If the lesion is unilateral and the other optic nerve is also involved, this involvement can be explained only mechanically by pressure against the nerve, probably of sclerosed vessels, or by a local nutritional deficiency. The author believes, with Caramazza, that the presence of binasal hemianopsia combined with unilateral central scotoma points to a vascular disease, in the middle fossa and not a tumor of the pituitary body or a suprasellar tumor. John C. Long.

Jefferson, Geoffrey. (The Doyne lecture) **On compression and invasion of the optic nerves and chiasma by neighboring gliomas.** Tr. Ophth. Soc. U. Kingdom 65: 262-304, 1945.

The author describes in great detail his clinical data on eight patients with gliomas near the optic nerve and chiasm and discusses the significance of his findings to an understanding of the pathologic process and its clinical manifestation. Beulah Cushman.

Pallarés, J. J. **The occurrence of several cases of optic neuritis, of undetermined etiology, during an epidemic of neurotropic virus infections in Valencia.** Arch. Soc. oftal. hispano-am. 8:30-44, Jan., 1948.

From January to July, 1947, Pallarés saw four cases of isolated, unilateral, retrobulbar optic neuritis with an acute onset and terminal atrophy. Before the development of optic atrophy peculiar perivascular foci appeared at the point of emergence of the vessels from the papilla which seemed to be typical of this type of neuritis. Therapy was futile in three patients and the fourth improved on therapy with colloidal sulfur. Reference is made to Benedict's study of 225 cases of retrobulbar neuritis. Because the author's cases occurred following an epidemic of neurotropic virus diseases, it appears probable that a virus infection is the cause of the optic neuritis. Because of the perivascular foci it is suggested that the virus is transmitted along perivascular lymph spaces. (8 visual fields. 4 fundus drawings.) Ray K. Daily.

Rabadán Fernández, Pedro. **Posthemorrhagic, unilateral atrophy of the optic nerve.** Arch. Soc. oftal. hispano-am. 7: 1193-1198, Dec., 1947.

Complete and permanent loss of vision occurred in the right eye of a woman, 24 years old four days after a severe hemorrhage from the stomach. When seen five days later, she had no pupillary reaction to light, no light perception, the optic nerve was pale, the arteries narrow, and there was a slight peripapillary haziness. Two weeks later the optic nerve presented a picture of post-neuritic atrophy.

Ray K. Daily.

Vogelsanger, W. **A case of optico-chi-**

asmatic archnoiditis. Ophthalmologica 114:273-277, Oct.-Nov., 1947.

In a white man, aged 22 years, without any tangible antecedents, the vision of both eyes became rapidly reduced to light perception in small islands of the visual field. The ophthalmoscopic appearance of the discs and the results of a thorough general examination were normal. Within the next few weeks the peripheral vision improved spontaneously and only central scotomata persisted. The discs, however, became pale with distinct borders and normal vessel caliber. The gradual recovery of the visual field was interrupted by two fairly acute setbacks, one nine weeks and another 16 weeks after the onset of the visual disturbance. A few days after the latter the chiasma was explored surgically. A heavy arachnoiditic strand was found crossing both optic nerves from above just in front of the anterior angle of the chiasm. This strand was coagulated and severed. The author reports a very marked improvement in vision after the operation. After a few more spontaneous fluctuations the final vision was 20/20 in one eye and 20/200 in the other. Both discs remained snowy white.

Peter C. Kronfeld.

Werner, L. E. **Retrobulbar neuritis.** Tr. Ophth. Soc. U. Kingdom 65:376-393, 1945.

The syndrome of retrobulbar neuritis consists of: 1. rapid loss of vision in one or both eyes; 2. presence of central or paracentral color scotoma; 3. normal fundus in 85 percent of the cases and swelling of the disc in 15 percent; 4. pain on movement of the eyes and on pressure of the globe; and 5. occasional peripheral field defects.

The immediate treatment advised by the author is the daily intraorbital injection of 1 cc. of one-percent acetylcholine solution preceded by 0.25 cc. of novocaine with no adrenalin. Irrigation of the sphenoidal sinus, the removal of teeth that may have apical abscesses and the use of foreign proteins and sulfadiazine are considered necessary. The consultation with the neurologist can come later.

Beulah Cushman.

13

NEURO-OPHTHALMOLOGY

Esposito, A. C. **Acute syphilitic bilateral total ophthalmoplegia.** Arch. Dermat. and Syph. 55:686-690, May, 1947.

The author reports a case with diplopia, bilateral ptosis and bilateral third nerve paralysis with loss of pupillary reaction to light and in accommodation. The Wassermann reaction in the spinal fluid was positive and a tabetic type of gold curve was found. The patient responded to potassium iodide drops, bismuth subsalycilate and tryparsamide therapy.

Irwin E. Gaynon.

Focosi, M., and Levi, M. **A case of myasthenia gravis with predominantly ophthalmoplegic signs; diagnostic value of certain functional and laboratory tests.** Boll. d'ocul. 26:545-561, Sept., 1947.

Sometimes the differentiation of myasthenia gravis from chronic progressive nuclear ophthalmoplegia may become difficult. A 46-year-old man developed a partial paralysis of his left oculomotor nerve followed by ptosis of the right upper lid; later, his legs became weak and occasionally had slight cramps; there was no increase of symptoms during the day and the degree of the ptosis varied irregularly. Botulism and syphilis were excluded and the differentiation between myasthenia gravis and progressive nuclear ophthalmoplegia was undertaken by further study. Basal metabolism was plus 15 percent; lymphocytosis and eosinophilia were discovered in repeated blood counts. The beta-glycerophosphatase of the blood serum was markedly diminished; the blood serum contained

normal amounts of both calcium and potassium, and its inorganic phosphorus content was low. After oral administration of potassium chloride, the potassium content of the blood serum remained high for a longer period than in normal individuals; prostigmine administration had a favorable influence on all the muscle functions. The diagnosis of myasthenia gravis was accepted. K. W. Ascher.

Kravitz, Daniel. **Visual-field interpretations in chiasmal lesions.** Am. J. Ophth. 31:415-426, April, 1948. (10 figures, 6 references.)

Marín, Amat, M., and Marín Enciso, M. **Foster-Kennedy syndrome with unilateral exophthalmos in a child 3 years old.** Arch. Soc. oftal. hispano-am. 7:1190-1192, Dec., 1947.

A 3-year-old child, who had fallen on the floor, was brought for consultation because of exophthalmos of the left eye. She had a 6-mm. exophthalmos, hyperopia of 11 diopters in the left eye, and of 2 diopters in the right, atrophy of the right optic nerve and a choked disc in the left eye. X-ray examination of the skull revealed an osseous lesion in the roof of the left orbit in the region of the small ala of the sphenoid. A fracture of the small ala of the sphenoid and a congenital neoplastic or vascular lesion were considered in the diagnosis.

Ray K. Daily.

Mooney, A. J. **Visual manifestations of head injuries,** Tr. Ophth. Soc. U. Kingdom 65:394-404, 1945.

The author reviews 16 cases of injury to the optic nerve from road accidents. Fractures of the base of the skull involving the sphenoid bone and injuries of the external angular process of the frontal bone were common and were primary factors in lesions of the subchiasmal pathway. The visual nerve fibers are especially exposed to injury in the optic canal because of their close relationship to the bone in the case of fracture, and the limited area in which expansion can take place during hemorrhage into the vaginal space.

X-ray examination of the foramen was done routinely, but in no case did it reveal a lesion. Ocular paralysis co-existed with damage to the optic nerve in two cases only. If combined second, third, fourth and sixth nerve lesions co-exist it points toward basal hemorrhages with some infiltration into the optic canal. The weight of evidence suggested that severe lesions are due to laceration of the optic nerve and mild lesions to rupture of the nutrient vessels with or without bleeding into the sheath, although these conclusions are based entirely on theory.

Prognosis should be guarded. Improvement may take place in the field more than a year after the accident. If the margin of the defect in the visual field is shelving, the lesion is probably not stationary and improvement can reasonably be expected. A steep margin usually indicates a stationary and permanent lesion. If no perception of light is present two months after the accident, the disc pale, and the pupils inactive a bad prognosis can be given. Beulah Cushman.

Roessler, F. **Quadrant hemianopsia. (Observation with post-mortem findings).** Proc. Ophth. Soc. Vienna p. 17, May 18, 1942.

A 56-year-old man suffered a loss in three quadrants of both visual fields after sudden dizziness. Only the left lower quadrants were partly preserved. The patient died three days later of apoplexy. Post-mortem examination revealed thrombosis of the right and left arteria vertebralis, pronounced sclerosis limited to the posterior central arteries and cystic degenerations in both occipital lobes.

F. Nelson.

Rubino, A. **"Morgagni's syndrome" with upper quadrant bitemporal hemianopsia associated with partial retinitis pigmentosa.** Riv. oto-neuro-oftal. 22:237-252, July-Aug., 1947.

In a woman, 51 years of age, with obesity which started at the time of the menopause, hypertension, frontal headaches and other symptoms of the syndrome of Morgagni, radiographic evidence of an internal frontal hyperostosis of the skull were associated with a superotemporal heteronymous hemianopsia and a partial pigmentary degeneration in the lower nasal sector of the retina. The pigmentary degeneration of the retina is ascribed to a lesion of the "retino-hypothalamic" system. The bitemporal hemianopsia is a part of the Morgagni syndrome and must be considered an expression of a chiasmatic involvement.

Melchiore Lombardo.

Sedgewick, R. P. **Pure visual verbal agnosia with spatial disorientation.** Bull. Los Angeles Neurol. Soc. 13:64-66, March, 1948.

A patient had visual verbal agnosia, which is due to a subcortical lesion, but no agraphia, which is a cortical function. He could copy letters, but was unable to recognize them. He also had spatial disorientation, in that he had lost the power to revisualize objects, right homonymous hemianopsia, and retinal arteriolar sclerosis. At autopsy a softening of the brain in the distribution of the left posterior cerebral artery was found. O. H. Ellis.

Westerlund, E. **Ophthalmoplegia interna.** Acta ophth. 25:201-206, 1947.

The literature on ophthalmoplegia interna is reviewed, and four cases, occuring within a period of three months, are reported. The age of the patients was 11, 45, 47, and 24 respectively. The observation period was from three to five months. Two of the patients improved within this time, one recovered completely, and one showed a tendency to improvement. One patient complained of transitory headache. The disease in these patients was believed to be of undetermined infectious origin, as trauma, toxemia and lues could be excluded. Ray K. Daily.

14

EYEBALL, ORBIT, SINUSES

Campos, R. **Angioma cavernosa of the orbit with smooth muscle fibers.** Riv. di oftal. 2:81-104, March-April, 1947.

A woman, 53 years of age, had a slowly progressive unilateral exophthalmos. The first exploration of the orbit revealed a vascular tumor and brought about a transitory decrease in exophthalmos. Within a month the exophthalmos began to increase and vision began to fail. A superior orbitotomy allowed the removal of a retrobulbar tumor, the size of a pigeon's egg. Histologic examination revealed an angioma cavernosa in an advanced stage of fibrosis. In addition to the usual elements of blood-filled cavities, fibrous masses, lymphatic nodules, cellular infiltration, thrombosed vessels and hypertrophic walls, many strands of smooth muscles were found in a somewhat disorganized arrangement. Special mention is made of the infrequency of variations of the exophthalmos in angiomata cavernosa of the orbit. The origin of the smooth muscle and of the mechanism of formation of angioma is discussed. Francis P. Guida.

Carelli, P. V., and Cangelosi, J. P. **Angiosarcoma of the orbit.** Am. J. Ophth. 31:453-456, April, 1948. (3 figures, 13 references.)

Fritz, M. H., and Hogan, M. J. **Fat embolization involving the human eye.** Am. J. Ophth. 31:527-534, May, 1948. (6 figures, 9 references.)

Godtfredsen, Erik. **Studies on orbital tumors. Exophthalmos due to malignant tumors in the paranasal sinuses.** Acta ophth. 25:295-310, 1947.

Of 14 patients with paranasal sinus carcinomas penetrating into the orbit, 10 were over 60 years old, 3 were between 50 and 59, and one was a 3 year old boy. Eight of the patients were women. The origin of the tumor in eight was the antrum, in five the ethmoids, and the maxillo-ethmoid cells in one. The disease is characterized by early exophthalmos, with or without trigeminal neuralgia, dislocation of the eyeball upward and temporally, obliquity of the palpebral fissure, disturbances of motility, palpable mass in the orbit, and visual disturbances. In 10 patients the initial symptom was exophthalmos, associated in four with homolateral pain in the maxillary area. By the time the diagnosis was made all 14 patients had exophthalmos, and 9 had trigeminal neuralgia. The initial symptoms came from the nasal region in only one patient, and there were nasal symptoms in only five. Metastasis to the cervical glands were insignificant. Naso-pharyngeal tumors, which are frequently sarcomas, must be considered in the differential diagnosis. They occur in younger individuals and nasal symptoms, ophthalmoplegias, and metastasis to the cervical glands are pronounced. An early diagnosis is important, because the prognosis is good if operation or irradiation are instituted early. (7 illustrations.)

Louis Daily, Jr.

Godtfredsen, Erik. **Studies on orbital tumors. Nature and incidence of orbital tumors over a period of 15 years, (1932-1946).** Acta ophth. 25:279-293, 1947.

This is an analysis of the material of the Eye Department of Karolinska Sjukhuset, which is the largest university clinic in Sweden. There were 78 patients with orbital tumors, about 1 percent of admissions, and in 56 cases the diagnosis was verified histologically. Two-thirds of the tumors were primary orbital, originating in decreasing order of frequency from the lacrimal gland, nervous tissue, bone and vascular tissue. Two-thirds of the secondary tumors were extensions from the nose, and one-third was due to ocular neoplasm. Histopathologically half of the verified tumors were malignant. Because of the compression of the optic nerve and retinal vessels three-fourths were considered malignant biologically. Therapy is surgical and radiological, or a combination of both. It is emphasized that diagnosis and treatment call for close cooperation between ophthalmologists, roentgenologists, neuro-surgeons, oto-rhinologists, internists, and histopathologists. (1 table.)

Louis Daily, Jr.

Greear, J. N., Jr. **The use of buccal mucosa in the restoration of the orbital socket.** Am. J. Ophth. 31:445-453, April, 1948. (30 references.)

Inigo, L. **Ophthalmoeuliasis interna. Report of a case.** Arch. Soc. oftal. hispano-am. 8:45-63, Jan., 1948.

Ophthalmoeuliasis is the term applied to invasion of the eyeball by a parasite in its larval stage, and this, Inigo believes, is the first case of this type reported in Spain. An 11-year-old girl awakened during the night with an intense pain in the left eye, which radiated to the whole side of the head. The pain subsided within several hours, and she went back to sleep, but arose next morning with slight discomfort in the eye. During the next two months she developed a violent iridocyclitis with synechia, pain in the eye, and disturbance of vision. In the iridocorneal angle a whitish-yellow cylindroid body, about 7 to 8 mm. in length, and 1¼ mm. thick was found. The ocular tension was raised, and vision reduced to perception of large

objects. The parasite was extracted, and found somewhat adherent to the iris, and some iris pigment came away with it. The patient made a prompt and complete recovery within ten days. Examination of the cornea with the slit-lamp revealed a small punctiform corneal opacity, through the entire thickness of the cornea which was probably the point of entrance of the parasite. It was a larva of Hipoderma movis, which is abundant in the Iberian peninsula, and a frequent cause of diseases of cattle. Ray K. Daily.

Lavery, F. S. **Post-operative intraocular infection controlled by penicillin.** Brit. J. Ophth. 32:247, April, 1948.

A case of intraocular infection four days after an extracapsular cataract extraction is reported. Pus was present in the anterior chamber. Fifty thousand units of penicillin were injected subconjunctivally three times at 24 hour intervals, and massive doses were injected parenterally for four days. The eye improved rapidly, and the patient was discharged from the hospital with good light projection. Subsequently the eye was found to have a corrected vision of 6/6.
Orwyn H. Ellis.

Rebello Machado, Nicolino. **A case of bacteriemia with bilateral orbital cellulitis and thrombophlebitis of the cavernous sinus. Recovery.** Rev. brasil. oftal. 6:145-171, March, 1948.

The patient was a physician aged 37 years. The initial condition was an abscess of the epiglottis which occurred about the middle of June, and which was neglected by the patient. He first sought professional assistance after six days, when he was already in a state of advanced toxemia. Within two weeks he sustained an abscess of the left tonsil, which he himself opened. Next came a right peritonsillar abscess, and an arthritis of the left knee. There followed right exophthalmos, and during the next three weeks the left orbit became involved with the typical picture of thrombophlebitis of the cavernous sinus. The infective process is thought to have reached the lesser circulation by way of the lingual vein, the internal jugular, the brachiocephalic, and the superior vena cava. Significant details of the anatomy of the cavernous sinus are cited. The history of a chill with headache, septic temperature, swelling of the eyelids, and exophthalmos beginning on one side and extending to the other in a day or two suggests thrombosis of the cavernous sinus. Treatment in hospital included penicillin, streptomycin, Cibisol (a sulpha drug to which major credit is given), Heparin, and Dicumarol. Recovery was complete. (3 illustrations, references.)
W. H. Crisp.

Rosen, E. **An implant with bridges for attachment of muscles.** Brit. J. Ophth. 32:166-170, March, 1948.

The author designed an acrylic implant bearing six bridges to which the muscles can be attached. The implant is a truncated cone with a convex base; its anteroposterior diameter is 18 to 24 mm. and the diameter of the base measures 16 to 18 mm. After severing each muscle, plain 0000 gut sutures are placed in it and after the enucleation and insertion of the implant the muscle is brought through the bridge and sutured back upon itself. Tenon's capsule comes back into proper anatomical position and is left unsutured. The conjunctiva is then sutured in a horizontal line with very close approximation of interrupted sutures. The implant cannot be expelled and its mobility is unquestioned. The plastic bridges may be supplanted by metal bridges so that accurate X-ray study can be made of any orbital shift in the implant. (2 figures.) Morris Kaplan.

Rundle, F. F. **Some observations on exophthalmos.** West. J. Surg. 55:578-583, Nov., 1947.

The author describes the orbital contents, and lists the causal mechanisms of exophthalmos. In post-mortem examinations of a group of thyrotoxic patients with exophthalmos, fat deposition accounts for 70 percent of the total bulk increase and is mostly in the fibro-fatty tissue.

Clinically exophthalmos is only one sign of orbital overfilling. Lid protrusion is another and far more reliable sign, best determined not with the eyelids open, but lightly closed. A widened palpebral aperture is sometimes misleading. Examination with the lids closed is also helpful in determining unilateral lid protrusion. The occasional difficulty in diagnosing exophthalmos because of the wide variation in normal persons is mentioned. The best method is periodic, say monthly, measurements and plotting of the readings. (3 figures, 1 table, 1 chart, references.)

Bennett W. Muir.

Salgado Benavides, E. **Penicillin in the treatment of ophthalmitis neonatorum and septic endophthalmitis.** Arch. Soc. oftal hispano-am. 7:1121-1128, Nov., 1947.

Good results were obtained by the use of penicillin in the treatment of these infections. Large doses are needed and are administered locally and parenterally. The intravitreous injection of penicillin was considered dangerous and was not effective in controlling the infection.

J. Wesley McKinney.

Schultz, Abraham. **Bilateral chalcosis lentis with endophthalmitis of the right eye. Report of a case.** Am. J. Ophth. 31: 463-466, April, 1948. (1 figure, 7 references.)

Valière-Vialeix. **Myositis and subacute orbital cellulitis.** Ann. d'ocul. 181:1-31, Jan., 1948.

A 57-year-old man developed blepharoconjunctival edema with exophthalmus on the right side and subsequently on the left. Vision in the right eye was soon reduced to light perception, in the left, to 0.5. In both discs a glaucoma-like excavation was observed, though the ocular tension in both eyes remained normal and the field of the left eye was approximately normal. The motility of the left eye was slightly limited vertically and horizontally. The general well-being was normal, and bodily examinations and serological tests were essentially negative. A resection of the lateral orbital wall on the left side was first performed under local anesthesia. The external rectus muscle was much enlarged. Fifteen days later a fistula with suppuration developed. Under general anesthesia, a large orbitotomy was then performed. Lardaceous edema in the orbital cone was observed. The fistulous tract was curetted and a mass of inflammatory tissue removed. Healing followed with residual ptosis. Microscopic study of the inflammatory tissue revealed only the usual cellular changes of chronic inflammation. The inflamed lacrimal gland contained lymphoplasmocyte infiltrations along the blood vessels and gland acini. The inflammatory process involved especially the muscles and interfascicular septa. The symptomatology, pathology, and evolution of the condition are discussed at some length. The differential diagnosis involved: 1. malignant thyrotrophic exophthalmus; 2. Mikulicz's disease; 3. blood dyscrasias such as leukemia; 4. chronic and acute inflammatory orbital diseases such as chronic myositis and phlebitis. All these have been classified as inflammatory pseudo-tumors. Pathologically, they include inflammatory edemas as well as diffuse and local inflammatory cellular changes of different types and severities.

In the case reported, the diagnosis of subacute myositis and orbital cellulitis was based on the inflammatory and degenerative changes in the muscles and their sheaths. The etiology is not definitely understood. A pre-existing constitutional vascular degeneration in the orbit is presumed to have been followed by an inflammatory process due to an undetermined toxin. Chas. A. Bahn.

15

EYELIDS, LACRIMAL APPARATUS

Bangerter, A. **The treatment of stenosis of the lacrimal canaliculi.** Ophthalmologica 114:195-202, Oct.-Nov., 1947.

Both canaliculi of one eye of a young ex-soldier had become completely obliterated as an aftermath of a severe acute conjunctivitis. The author repaired this "stenosis" by making a direct anastomosis between the conjunctival and the lacrimal sac. The lacrimal sac was exposed through the usual incision for dacryocystorhinostomy. The sac was opened at the anterior junction of its medial and lateral walls. The latter wall was freed all the way back to the posterior crista. Through a conjunctival incision just anterior to the caruncle the tissues of the inner canthus were split into an anterior and posterior layer, until the previously freed lateral wall of the tear sac was exposed. A broad anastomosis between conjunctiva and tear sac was made by suturing the free anterior border of the lateral wall of the sac to the posterior lip of the conjunctival wound. A mucous membrane flap from the mouth provided the anterior wall of the anastomosis, having been sutured to the anterior edge of the medial wall of the sac and to the anterior lip of the conjunctival wound. A rubber drain was sutured and left in place for seven months, when it was replaced by a silver cannula. Ten months after the operation the cannula was removed. Two years later the patient reported no tearing or any other ocular discomfort. Peter C. Kronfeld.

Barri Rodríquez, Julio. **A contribution to dacryocystorhinostomy.** Arch. Soc. oftal. hispano-am. 7:1141-1148, Nov., 1947.

The author discusses the advantages of the crown-shaped burr for making the nasal opening rapidly without danger of injurying the nasal mucosa.

J. Wesley McKinney.

Friedenwald, J. S., and Guyton, J. S. **A simple ptosis operation: utilization of the frontalis by means of a single rhomboid-shaped suture.** Am. J. Ophth. 31:411-414, April, 1948. (2 figures.)

Gittler, R. **Successful treatment of blepharitis ulcerosa with albucid.** Proc. Ophth. Soc. Vienna p. 28, Oct. 26, 1942. 1942.

In a man, 43 years of age, severe ulcerous blepharitis responded neither to extraction of lashes, cauterization with silver nitrate nor X-ray treatment but healed within two weeks after intravenous injections of albucid. F. Nelson.

Godtfredsen, Erik. **Pathology of mucous and salivary gland tumours in the lacrimal gland and the relation to extra-orbital mucous and salivary gland tumours.** Brit. J. Ophth. 32:171-179, March, 1948.

The modern, revised view of the genesis of mixed tumors is that they are not mixed at all but rather come entirely from the ectoderm; the apparent mesenchymal elements of these tumors are not mesodermal but ectodermal products of the epithelial cells which to a great extent undergo metaplasia. These changes may present all transitional forms from benign to malignant. There are two main histopathologic types: the fibro-myxo-epithelioma and the basalioma both of which may be benign or malignant. The

former occurs more frequently than the latter and malignant ones are more frequent than benign. Treatment consists mainly in surgical removal and irradiation. However, the best 5-year-cure reported is 50 percent.

The author presents 10 case reports. Exophthalmos, ptosis, visual impairment, palpable cervical nodes and palpable tumor were the most common signs and symptoms. Five of the tumors were malignant although from a biological aspect all are malignant because the tumor proliferation has a delerious effect on the optic nerve or the retinal vessels. (2 figures.)

Morris Kaplan.

Redi, Francesco. **Plasma cell granuloma of the lacrymal passages.** Rassegna ital. d'ottal. 16:441-459, Nov.-Dec., 1947.

Three cases of plasma cell granuloma are described. Often these tumor masses are called plasmocytomas or plasmomas, which is incorrect, since these latter are pathologic neoplasms, which frequently metastasize to lymph glands and bones. As a result of this inexactness many plasmacellular granulomas are reported as plasmomas. Also occasionally included in the group are peritheliomas of the canaliculi. In the three cases described, the author suggests that the particular vascularization of the palpebral conjunctiva, the chemistry of the tears and the secretion of the various glands may play an important part in the etiology. It is also true that many cases described as trachoma of the lacrymal passages do not show the pathological changes characteristic of trachoma. (5 figures.)

Eugene M. Blake.

Sherman, A. E. **Choice of procedure in ophthalmic plastic surgery.** New York State J. Med. 48:861-868, April, 1948.

General principles of ophthalmic plastic surgery are reviewed: (1) the early accurate repair of lacerations about the orbit with careful closure of subcutaneous tissue and skin often makes later repair unnecessary, (2) the use of intermarginal lid adhesions for two to three months after burns of the eyelids may be sufficient to prevent ectropion, (3) correction of deformities from lacerations or burn should not be attempted from three to four months after the initial repair because scar tissue will by that time become compact and relatively avascular, (4) scar tissue should be thoroughly excised and the tissues approximated without undue tension, (5) eyelid structures should be used to replace eyelid structures, (7) simple procedures should be followed, (8) a well-placed pressure dressing is very important.

Two cases of neoplasms are shown in which the simple excision of the tumors, with undermining and careful closure of the surrounding normal tissues was adequate. Two cases of deformities of the medial canthal area are shown. The first was repaired by excising scar tissue, mobilizing the lid and suturing a small tongue of denuded tarsus in a pocket up to the medial canthal ligament, and the other by means of excising all scar tissue and the tear sac, freely mobilizing the entire medial canthal area, removing displaced bone, transposing Z-plasty flaps, and overcorrecting the deformity. The correction of an eyebrow deformity is demonstrated by a Z-shaped incision and interposition of flaps. In this patient iliac bone grafts were used for orbital rim defects.

The Wheeler secondary implant is discussed. The implantation of an acrylic wedge (about 2½ cm. by 1½ cm. by 0.8-0.4 cm.) on the orbital floor to elevate the eye in cases of depression and enophthalmos due to fracture of the floor of the orbit, is described. Cicatricial contraction of a portion of the eye socket is corrected by excision of underlying scar tissue, adequate enlargement of that por-

tion of the socket, and the use of a mucous membrane graft from the inner surface of the lower lip.

When there has been extensive loss of tissue so that the best result one could hope for would be immobile unnatural eyelids with a staring conspicous artificial eye, he prefers to remove the remains of conjunctiva and lacrimal gland, and to cover the orbit with a continuous layer of smooth skin. (26 photographs.)

Alston Callahan.

Weekers, L. **The operative technique of ptosis: diathermic coagulation.** Ann. d'ocul. 180:657-663, Nov., 1947.

In all cases of hypofunction of the levator, the Blaskovics operation is considered basic. As supplementary operations those of Motais and Machek may be advisable if additional superior rectus or orbicularis function is also needed. Skin excision may also be necessary. In the Blaskovics operation, the Agatston technique and diathermic coagulation of the tarsus are preferred. A 1-mm. electrode is used with a 4-mm. exposure and the current volume is adjusted at the time of operation. Diathermic coagulation is especially applicable in chronic inflammations of the palpebral connective tissues and the tarsus, such as trachoma. The term "blepharochalasis" is applied to several entities; one is characterized by epidermal relaxation followed by recurrent inflammation of the subcutaneous tissues and subsequent degenerative changes here and in the muscles. Depending upon the stage and severity, the operative procedures for the relief of blepharochalasis may include skin excision and the operations of Blaskovics or Machek.

Chas. A. Bahn.

Wheeler, Maynard. **Discoloration of the eyelids from prolonged use of ointments containing mercury.** Am. J. Ophth. 31:441-444, April, 1948. (8 references.)

16

TUMORS

Loewenstein, A., and Foster, J. **Two unusual sclerocorneal neoplasms.** Brit. J. Ophth. 32:1-12, Jan., 1948.

A small tumor appeared at the limbus in a 15-year-old boy and began to grow rather rapidly; it was yellow, painless and hard. Biopsy revealed a spindle cell sarcoma of a mature type, markedly vascularized and with giant cell formation in the vessel walls. A considerable number of large mast cells with big round nuclei was present. After the biopsy the remaining tumor grew faster than before and the eye was excised. The exact nature of the tumor could not be ascertained though it was felt to be a transmissible tumor, probably caused by a filterable virus. A second small tumor that arose from a degenerative pannus in a blind eye occurred in a 65-year-old woman.

The suggestion that a filterable virus was the etiologic agent is speculative and without proof, as the idea of animal inoculation was a fruit of the histologic investigation, when it could no longer be carried out. Such cases should in the future be investigated from the biologic viewpoint before the histologic. The amount of material required for injection into the anterior chamber of an animal is so small that it need not interfere with the usual histologic investigation.

Morris Kaplan.

Owens, N., and Stephenson, K. L. **Hemangioma: an evaluation of treatment by injection and surgery.** Plast. and Reconstruct. Surg. 3:109-123, March, 1948.

Only surface hemangiomas are considered, and they are described as tumors of the independently growing blood channels with their origin in embryonic rudiments of mesodermal tissue. A brief but interesting history of their treatment is presented and various methods of therapy

are mentioned. The incidence in the female is twice that in the male. Fifty-two percent of all hemangiomas occur in the area of the head.

Important diagnostic points are the discoloration, reexpansion after compression, increase in size if the patient's head is lowered, and enlargement of the mass if the jugular veins are occluded by pressure.

Injection therapy is indicated in areas where surgical excision would require the loss of a part such as around the eye, nose or lip, or the exenteration of the orbit. A cure resulting from sodium morrhuate injection accomplishes the desired results and saves the functioning part of the body. Of 39 patients treated by this method the youngest was six weeks of age and the eldest 35 years. Five typical cases are reported, in three of which there were involvements of the eye and adnexa. From 0.5 cc. to 4.0 cc. of sodium morrhuate was injected from a tuberculin syringe with a 25 or 26 gauge needle, the amount being determined by the clinical appearance and the response at the time of infiltration. Smaller doses are used in areas about the eye or lip or in a mucous-membrane-covered surface. At intervals of from ten days to five weeks the injections are repeated. The injection of sodium morrhuate causes thrombosis with secondary sclerosis, atrophy, and absorption of the vessels. To be effective it does not have to come in contact with the vessel lining. Complications of injection were central necrosis and ulceration, and in one case diffuse thrombosis. No allergic reaction accurred and the necrosis was not painful. The authors have injected this sclerosing solution into the conjunctiva, but have not used more than 2 cc. at any one time in this area.

Surgical removal is utilized in areas where the problem of the loss of the part of the body does not exist and in patients in which the injection treatment has not been successful. The location of the tumor should be carefully considered, particularly with reference to the availability of tissue repair, the ease of surgical excision and the possibility of complete eradication by one surgical maneuver. Of the 56 hemangiomas removed by excision from individuals of from six weeks of age to 50 years, four are reported in detail, but in none of these were the eye or adnexa involved.

A case report of massive ocular and adnexal involvement is included in which neither excision nor injection was attempted because of the size of the lesion. The authors advised against carbon dioxide snow, Xray or direct application of radium or radon to surface lesions. This type of therapy has not proved successful in regions having well differentiated endothelium. Alston Callahan

17

INJURIES

Cibis, P. **Lid formation and lid elevation by means of fenestrated implants made from "Supramid."** Klin. Monatsbl. f. Augenh. 112:232-238, 1947.

The author used a plastic lid support for repairs of defects of the lower lid. This support rests on the lower orbital rim by means of a base plate. A fenestrated frame is attached to this plate and serves as a support of the structures of the lower lid to the contours of which it conforms. The material is inserted through a lateral incision after the scarred area has been loosened and extensively undermined. The author presents pictures of several cases of anophthalmus and trauma to the lower lid after military injuries. The method proved cosmetically satisfactory and no disadvantages or complications were encountered. (11 photographs, 3 drawings.)
Max Hirschfelder.

Cibis, P. **Plastic lid repair by pedicu-**

lated skin flaps in combination with creeping flaps. Klin. Monatsbl. f. Augenh. 112: 238-243, 1947.

It is possible to transplant skin from distant parts by a repeated process of folding and subsequent stretching. This method was first used by Lexer in 1907 for repair of the eyebrow with skin from behind the ear. The author repaired traumatic defects of the upper and lower lid in the following way: he first implanted a pediculated flap from the forehead into the upper or lower lid. In a later operation he formed a double fold in line with the principles of the creeping flap. The fold was subsequently unfolded and stretched and served as material to repair the other remaining lid. The use of this type of flap from basal parts of pediculated flaps is recommended. (10 figures.)

Max Hirschfelder.

Leydhecker, F. K. **Experiments with a new assembly to prove the touching and grasping of metallic foreign bodies.** Klin., Monatsbl. f. Augenh. 112:255-258, 1947.

The article describes a relatively simple electric assembly which is used in connection with a forceps made of two electrically isolated prongs of different metals. The sound produced in a loudspeaker varies from a short knock at touch to a lasting signal, when the foreign substance is firmly grasped. Max Hirschfelder.

Lindner, K. **Saving of infected eyes with injured lenses.** Proc. Ophth. Soc. Vienna p. 25. June 29, 1942.

Lindner advocates as thorough removal as possible of lenses which have been injured by perforating trauma and from eyes that have become infected.

F. Nelson.

Neubert, F. R. **An attempt to treat a perforated eye with subconjunctival penicillin.** Brit. J. Ophth. 32:162-163, March, 1948.

This brief case report describes the unsuccessful use of penicillin in an eye with a severe perforation. A smear on the third day revealed the presence of penicillin-sensitive cocci. Subconjuntival injections of 50,000 units of penicillin in novutox and intra-muscular injections of 30,000 units were given. After three days the eye was much worse and was removed. The pathologic report indicated the presence of panophthalmitis. Morris Kaplan.

Papamatheakis, N. **Iridocyclitis caused by intraocular glass splinter.** Proc. Ophth. Soc. Vienna p. 38, Feb. 22, 1943.

Recurrent inflammation occurred some time after the eye had been injured in an accident. X-ray films revealed no intraocular foreign body, but 13 years later a very small glass splinter could be localized in the chamber angle at 6 o'clock and was removed under slit lamp control. Apparently even very small glass particles within the eyeball cannot be tolerated indefinitely. F. Nelson.

Paufique, L. **Anterior chamber puncture to facilitate scleral foreign body extraction.** Ann. d'ocul. 181:35-37, Jan., 1948.

Preliminary paracentesis temporarily reduces the ocular tension, and is therefore a valuable adjunct to numerous operations. First among these is the removal of posterior intraocular foreign bodies. Vitreous loss and other complications may thus be avoided or minimized, especially if section of the extraocular muscles is necessary. In the removal of a posterior intraocular foreign body, the transcleral route is generally preferred. This is especialy true if the foreign body is imbedded in the coats of the globe or if its removal predisposes to uveal or choroidal prolapse or retinal detachment. An illustrative case is presented. Chas. A. Bahn.

Thiel, R. **Electrodynamic power effects on nonmagnetic metals. A method to re-**

move nonmagnetic foreign bodies from the eye. Klin. Monatsbl. f. Augenh. 112: 258-267, 1947.

The theoretical background of this striking attempt to move non-magnetic metals by electric power lies in the utilization of so called "electrodynamic powers" and in the production of Foucault or eddy currents. Whereas it is difficult to abstract the theoretical parts of the article, the basis for the method may be described as follows. An alternating current of high frequency is sent through a primary coil. A Foucault current of opposite direction is created in a metal ring which lies in the electrodynamic field of this coil. A similar current corresponding in direction to that running through the metal ring is excited in a second nonmagnetic piece of metal which might well be an intraocular foreign body. As bodies containing alternating currents of equal direction attract each other, the second body, even though nonmagnetic, will move in the direction of the metal ring. Experiments in collaboration with the physicist Johann proved the correctness of this theoretical calculation. For practical use in ophthalmology one will need relatively high powers, and certain difficulties have yet to be solved. (6 references.) Max Hirschfelder.

Zwahlen, P. **Priscol in the treatment of ocular burns.** Ophthalmologica 114:241-245, Oct.-Nov., 1947.

In severe ocular burns the University Eye Clinic of Lausanne uses the following procedure in order to decide whether conservative or surgical treatment should be instituted. The burned conjunctiva is pricked with a fine needle. If this prick causes no bleeding or pain whatsoever, the author believes surgical treatment, that is, replacement of the burned conjunctiva by a mucous membrane flap after Denig, is indicated. If the needle prick causes bleeding or pain, the eye is treated conservatively. The author has obtained gratifying results with repeated instillations of a histamine derivative called Priscol.

Peter C. Kronfield.

18

SYSTEMIC DISEASE AND PARASITES

Bardhan, P. N. **Reiter's disease.** Indian M. Gaz. 82:577-580, Oct., 1947.

Four cases of Reiter's disease are reported. The triad of purulent urethritis, purulent and mucopurulent conjunctivitis, and arthritis usually affecting the larger joints characterizes the disease. Associated features are iritis, scleritis, keratitis, neutrophile leucocytosis, lymphadenitis and increased sedimentation rate. The etiology is unknown, the disease is not venereal and recovery is spontaneous.

Irwin E. Gaynon.

Fisher, E. D., and Main, L. B. **Tuberculous meningitis as a cause of papilledema.** Bull. Los Angeles Neurol. Soc. 13:56-59, March, 1948.

Bilateral papilledema in a patient with symptoms of early tuberculous meningitis is reported. At autopsy a suspected space-occupying lesion was found to be a meningioma. It is emphasized that in tuberculous meningitis with papilledema, the presence of a coincidental tuberculoma or an associated intracranial tumor must be suspected. O. H. Ellis.

Lyle, D. J. **The ocular syndrome of cataract and papilledema in the manifest form of parathyroid deficiency.** Am. J. Ophth. 31:580-584, May, 1948. (17 references.)

Rodriguez, R., and Root, H. F. **Capillary fragility and diabetic retinitis with a note on the use of rutin.** New England J. Med. 238:391-397, March 18, 1948.

The literature on capillary fragility in relation to diabetic retinitis is reviewed.

Measurements of capillary fragility by the petechial index of Gothlin were done

in 156 diabetic patients. Forty percent of 100 unselected diabetic patients showed an increased capillary fragility. This abnormality was found in practically all patients with diabetic retinitis, whether or not hypertension was present. In 11 cases hypertension was present with increased capillary fragility, but no retinal damage was observed. In 56 selected cases of retinitis, no patients showed a normal petechial index; the petechial index was increased in 47, near the upper limit of normal in nine. The incidence of increased capillary fragility was related to the duration of the diabetes more clearly than to the age of the patient. Forty-one percent of 82 patients with retinitis were under 40 years of age, and increased capillary fragility was observed as early as the age of 21 years, but with long duration of diabetes.

Rutin was administered to 70 patients with retinitis and increased capillary fragility. The initial dose was 20 mg. three times a day, and this was increased to 40 to 60 mg. three times a day in 20 cases. (A dosage of 300 to 400 mg. daily may be used.)

Capillary fragility can be brought to normal with the use of rutin in sufficient dosage, but in no patient did the retinitis improve. Increased capillary fragility occurs in diabetic patients as an early evidence of generalized arterial disease and is closely correlated with the development of retinitis and nephritis.

Theodore M. Shapira.

Stuart, R. D., and McWalter, D. **Primary meningococcal conjunctivitis in children.** Lancet 1:246-248, Feb. 14, 1948.

Six sporadic cases of acute meningococcal conjunctivitis in infants and young children are described.

Meningococci were isolated from five of these infections and in four instances they belonged to group one.

In two instances meningococci were present in the nasopharynx of a close contact, and the probable source of infection was the respiratory tract.

Attention is drawn to a simple method for transporting specimens from an outlying clinic to a central laboratory, which overcomes the frequent difficulty of immediate culture. The possibility of confusion between meningococcal and gonococcal conjunctivitis is emphasized, and the importance of full bacteriological investigation is urged.

Theodore M. Shapira.

19

CONGENITAL DEFORMITIES, HEREDITY

Mata, Pedro, **Ocular manifestations of tuberous sclerosis.** Arch. Soc. oftal. hispano-am. 7:1176-1189, Dec., 1947.

An exhaustive description of the various manifestations of the disease, and brief reports of three cases are presented. A girl 16 years old, with a mental age of 9 years, had adenomas of Pringle, periunguinal tumors of Koenen, psychic disturbances, epileptic attacks, and typical retinal protuberances; cranial calcification was not demonstrable. Another patient, 17 years old, with Pringle's adenomas and mental retardation, died without developing retinal involvement. The third patient, 14 years old, had three typical retinal nodules, without other symptoms. (3 photographs, 2 fundus pictures.)

Ray K. Daily.

McCulloch, C., and McCulloch, R. J. R. **A hereditary and clinical study of choroideremia.** Tr. Am. Acad. Ophth. pp. 160-190, Jan.-Feb., 1948.

A genetic study was made of two families, with over 600 members, and 86 cases of this disease. In the female it is present in a latent form, causes no visual defects, and is essentially unchanged throughout life. In the males, however, the disease is progressive and begins at ages ranging

from 3 to 40 years. The first symptom is night blindness and in the very early stages, the fundus resembles the female type. The choroid is gradually absorbed with equatorial and peripheral field changes; central vision remains good. Mentality is not affected, but impairment of hearing is not infrequent. Choroideremia is a recessive sex linked character; the female is the carrier, the male has the progressive form of the disease. In the female, the differential diagnosis includes pigmentary retinal degeneration, diffused choroiditis and the salt and pepper type of chorioretinitis. In the male, the differential diagnosis includes pigmentary retinal degeneration, gyrate choroidal atrophy of Fuchs, diffuse choroidal sclerosis, choroidal atrophy in high myopia, and diffuse choroiditis (Oguchi's disease). The authors do not think choroideremia is a form of pigmentary retinal degeneration. Chas. A. Bahn.

McKernan, R. L. **Sturge-Weber Syndrome.** Tr. Ophth. Soc. U. Kingdom 65: 407, 1945.

The author advises that the name be changed to "angiomatosis ophthalmicus" because of the similarity in the distribution of the focal manifestations to herpes zoster ophthalmicus.

Beulah Cushman.

Posner, A., and Schlossman, A. **The role of inheritance in glaucoma.** Tr. Am. Acad. Ophth. pp. 145-158, Jan.-Feb., 1948.

In this study of 373 unselected patients with primary glaucoma 51, or 13.7 percent, knew of one or more relatives who had the disease. These 51 belonged to 30 families. The mechanics of dominant, recessive and sex-linked heredity in glaucoma is explained as are terms like penetrance and expressivity. In 20 of 25 sibships the penetrance was 80 percent. In evaluating the specific roles of the several types of heredity in the constitutional predisposition to potential and actual glaucoma, at least two factors must be considered. First, there is no sharp contrast between dominant and recessive genes, which means that in sporadic cases the exact mode of transmission is not yet understood. Second, primary glaucoma is essentially a bilateral, progressive, constitutional, degenerative disease which affects both the corneoscleral filterability and the intraocular vascular permeability. A more careful study of the pedigree of glaucoma patients is advised. Charts of ten glaucomatous families are presented with their pedigrees carried to the third and fourth generations.

Chas. A. Bahn.

Rieger, H. **A family with irregularily dominant hereditary retinitis pigmentosa of atypical character.** Klin. Monatsbl. f. Augenh. 112:203-213, 1947.

The author presents a family tree in which the mother, her offspring from two marriages and her grandchildren had atypical pigment degeneration of the retina. Not all the members were involved, but five had serious involvement of retina and choroid, resembling retinitis punctata albescens. Seven others had gross granular pigmentation of the fundus which is probably a more benign form of the same inherited process. The hereditary biological factors of this disease are discussed.

Max Hirschfelder.

Sauer, H. **Total atypical coloboma of iris and choroid and staphyloma verum in a child.** Proc. Ophth. Soc. Vienna p. 15, May 18, 1942.

A child was presented who had a normal right eye. In the left he had a large coloboma of the iris between 9 and 10 o'clock and another at 6 o'clock as well as a circumpapillary staphyloma verum.

F. Nelson.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Arjona, J. **Old age and the eye.** Arch. Soc. oftal. Hispano-am. 7:1097-1110, Nov., 1947.

The ocular changes characteristic of old age in the eyelids, conjunctiva, cornea, iris, lens, vitreous, retina, and sclera are briefly described. Several suggestions for the alleviation of ocular symptoms in senile patients are made.

J. Wesley McKinney.

Campbell, D. A. **Clinical report on miners' nystagmus.** Brit. J. Ophth. 32: 193-198, April, 1948.

The author presents a clinical survey of 44 certified cases of miners' nystagmus. The symptoms of active nystagmus, giddiness and photophobia were usually present. After medical supervision with rehabilitation and proper treatment, the average duration of disability was six months. These men are unable to return to work underground, but can fill good jobs if not required to work in poor illumination and in awkward postures. A plea is voiced for better working conditions underground, particularly in the matter of illumination. Orwyn H. Ellis.

Marshall, Don. **Military ophthalmology in the European theater.** Am. J. Ophth. 31:545-561, May, 1948. (13 figures, 12 references. Discussion by F. P. Calhoun, Jr. and Trygve Gundersen.)

Maxwell, Euphan, **A cross-sectional view of injuries in an ophthalmic practice in Eire.** Brit. J. Ophth. 32:134-153, March, 1948.

This very long article is a reminiscence of the author's many years of ophthalmic practice in Dublin. The review covers three-quarters of a century. Almost every conceivable complication of ocular injury was encountered and many of these are described. Morris Kaplan.

Nelson, H. A. **Eyes: compensation and medicolegal problems.** Tr. Am. Acad. Ophth. pp. 267-272, Jan.-Feb., 1948.

In medicolegal cases the doctor's function is to state his findings and conclusions without regard to the result. Efficient treatment of industrial diseases and injuries is obligatory. Necessary preoccupational and occupational examinations are strongly advised. The system used in Wisconsin is considered equitable to both employer and employee. A panel of physicians including ophthalmologists is selected by the State Medical Society, employers and insurance carriers. A choice of physician or eye specialist by the employee is made from this panel. Independent medical examiners are freely used by the state commission. Total loss of vision in one eye in Wisconsin entitles the victim to compensation of 250 weeks, enucleation, 275 weeks. The A.M.A. committee ratings are generally used. Permanent visual loss should not be estimated too quickly. Complicating conditions such as detached retinas, toxic cataracts and epidemic conjunctivitides must be evaluated individually on their merits. Intelligent coöperation among industrial physicians, employers and insurance carriers is strongly advised.

Chas. A. Bahn.

Sappington, C. O. **Medicolegal problems in industrial ophthalmology.** Tr. Am. Acad. Ophth. pp. 260-267, Jan.-Feb., 1948.

After a few general remarks a few case histories are reported, and a brief discussion of ophthalmic procedure in industry as an expert witness follows. Some twenty industrial chemical substances which may affect the eye internally are mentioned. Chas. A. Bahn.

Stern, E. S. **The psychiatric aspect of miners' nystagmus.** Brit. J. Ophth. 32: 209-224, April, 1948.

The author presents detailed reports of psychiatric examinations of miners with and without nystagmus. Miners' nystagmus is a psychosomatic affection which usually does not develop until the man has been working underground in the dark and with an upward gaze for at least 10 years, and more commonly for 30 years. The dangerous occupation of mining, coupled with economic anxiety, produces a varying degree of conversion into a hysterical state and the presence or absence of nystagmus itself is relatively unimportant. These people should be under psychiatric supervision, and the term "miners' nystagmus" should no longer be used. Orwyn H. Ellis.

Vail, Derrick. **The teaching of ophthalmology.** Am. J. Ophth. 31:535-541, May, 1948.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATH

Dr. Louis Abraham Feldman, Brooklyn, New York, died February 2, 1948, aged 57 years.

ANNOUNCEMENT

CHICAGO CLINICAL CONFERENCE

The Chicago Ophthalmological Society announces its 2nd annual clinical conference to be given November 29 to December 4, 1948. Special attention will be paid to the pathologic and the clinical aspects of glaucoma and retinal diseases. Recent advances in general ophthalmic therapeutics will also be presented. The class will be limited to 50. For further information address: Miss Maud Fairbairn, 8 West Oak Street, Chicago 10, Illinois.

MISCELLANEOUS

IOWA POSTGRADUATE COURSE

The State University of Iowa, College of Medicine, gave a postgraduate course in ophthalmology on June 14, 15, 16, 17, 18, and 19. The course was under the direction of the staff of the department of ophthalmology: Dr. C. S. O'Brien, head of the department; Dr. J. H. Allen, Dr. P. J. Leinfelder, Dr. G. L. Walker, and Dr. Otis S. Lee, Jr.

The guest instructors and their subjects were: Dr. Moacyr E. Alvaro, "Hemostasis in Ophthalmology" and "Radiation Therapy in Ophthalmology"; Dr. A. D. Ruedemann, "Industrial Ophthalmology"; Dr. Paul A. Chandler, "Glaucoma"; Dr. Daniel B. Kirby, "Surgery of Strabismus," "Surgery of Glaucoma," "Surgery of Cataract," and "Complications in Eye Surgery"; Dr. Kenneth C. Swan, "Ocular Therapeutics."

SOCIETIES

AKRON GUEST SPEAKER

At the May 3rd meeting of the Akron Academy of Ophthalmology and Otolaryngology, Dr. E. Bruce Fralick, professor of ophthalmology at the University of Michigan, presented a very interesting paper on the "Surgical Anatomy of Glaucoma." Members of the Cleveland Club of Ophthalmology were guests of the Akron Academy.

CENTRAL ILLINOIS MEETING

The Central Illinois Society of Ophthalmology and Otolaryngology met on April 23rd, 24th, and 25th at the Orlando Hotel, Decatur. The guest speaker in ophthalmology was Dr. B. Y. Alvis, St. Louis, who discussed glaucoma and its various phases.

Two of the active members, Dr. Edgar T. Blair, Springfield, and Dr. G. E. Hartenbower, Bloomington, presented papers. Dr. Blair discussed "Gonococcal Conjunctivitis," and Dr. Hartenbower lectured on "Obscure Foci in the Throat."

The next meeting of the Society will be held at the Abraham Lincoln Hotel, Springfield, Illinois, November 12th, 13th, and 14th. The officers of the Central Illinois Society of Ophthalmology and Otolaryngology are: President, Dr. Clarence E. McClelland, Decatur; president-elect, Dr. Clifton S. Turner, Peoria; vice-president, Dr. Harold Watkins, Bloomington; secretary-treasurer, Dr. Philip R. McGrath, Peoria.

CHICAGO SOCIETY OFFICERS

The Chicago Ophthalmological Society has elected the following officers for 1948-49: president, Dr. Arlington C. Krause; vice-president, Dr. George P. Guibor; secretary-treasurer, Dr. J. Robert Fitzgerald; councilor, Dr. Cyril V. Crane; corresponding secretary, Dr. Richard C. Gamble.

READING MEETINGS

The 81st meeting of the Reading Eye, Ear, Nose, and Throat Society was held jointly with the Reading Dental Society. Harold M. Covert, D.D.S., chief of Oral Surgery Section, Allentown General Hospital, and Dr. Kerwin N. Marcks, chief, Department of Plastic and Reconstructive Surgery, Allentown General Hospital, presented a paper on "Diagnosis and Treatment of Mouth and Face Pathology."

On May 5th, the Study Club of the society was addressed by Dr. Ferris T. Ketcham on the subject "Pathologic Explanation of Common Ophthalmoscope Findings."

PERSONAL

APPOINTED SPECIAL LECTURER

Dr. Adalbert Fuchs has been appointed special lecturer in ophthalmology in the postgraduate division at New York University College of Medicine beginning October 1, 1948.

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 31 AUGUST, 1948 NUMBER 8

THE CLINICAL COURSE OF GLAUCOMA*

A REVIEW OF 474 CASES FROM PRIVATE PRACTICE

ADOLPH POSNER, M.D., AND ABRAHAM SCHLOSSMAN, M.D.
New York

It is well known that the clinical course of primary glaucoma shows great variability from patient to patient. At one extreme, the disease is so mild that the diagnosis cannot be made with certainty except after long periods of observation. At the other extreme are those malignant cases which progress rapidly and inexorably to ultimate blindness within six months or a year. The majority of glaucoma patients fall somewhere between these two extremes.

The present study is a correlation of 474 glaucoma cases from private practice, of which 373 are primary glaucoma. Of these, 158 patients have been followed for 5 years or longer and 21 of these have been observed for 20 years or longer (fig. 1). Such cases, representing as they do, the life-cycle of the disease, can add greatly to our understanding of the nature of glaucoma. These studies are all the more valuable since they are based on carefully kept and richly annotated records which are the legacy of the late Dr. Mark J. Schoenberg. Shorter case histories have been included mainly to enhance the statistical value of this study.

The available material was correlated analytically to uncover the many variations in the symptomatology and course of the disease. An attempt was then made to synthesize these findings so as to achieve a better understanding of the many-faceted clinical picture of primary glaucoma. The ophthalmologist's experience with an individual case may be limited to only one stage in the life cycle of the disease. We hope that this paper will aid him in the evaluation of the past history of the case and in the formulation of a plan of treatment.

INCIDENCE

The exact incidence of primary glaucoma in the general population is unknown. It has been estimated that from 0.5 percent to 2 percent of all patients consulting ophthalmologists or clinics, suffer from glaucoma. According to Carvill[1] 1.33 percent of all the new patients attending the Massachusetts Eye and Ear Infirmary between 1928 and

TIME UNDER OBSERVATION

No. of years under observation	Primary glaucoma	Indeterminate group
5-10	72	3
11-15	36	4
16-20	22	
21-25	14	1
26-34	5	1
TOTAL 5-34	149	9

Fig. 1 (Posner and Schlossman). One hundred fifty-eight patients have been followed for five years or longer.

* Presented at the III Pan-American Congress of Ophthalmology, Havana, Cuba, January 8, 1948.

1930 had glaucoma; 57 percent of these were primary. Lehrfeld and Reber[2] give the incidence of glaucoma at the Wills Eye Hospital between 1926 and 1935 as 0.78 percent. This figure includes both primary and secondary glaucoma. In our series the incidence of primary glaucoma among 12,000 case histories was 3.1 percent.

Classification

The most widely accepted classification divides glaucoma into three types: acute congestive, chronic congestive, and chronic simple. Other classifications were proposed at various times. Von Graefe[3] recognized acute and chronic inflammatory glaucoma as well as another disease which he called "amaurosis with excavation." The last named group probably contained many cases of chronic simple glaucoma in addition to those of glaucoma without hypertension. Heerfordt[4] divided glaucoma into "haemostatic" and "lymphostatic" forms; but this classification was not widely accepted because it contained etiologic implications which were not well founded. Elschnig[5] substituted the terms "compensated" and "incompensated" glaucoma for the chronic simple and congestive forms, respectively. This terminology is confusing, since most cases of chronic simple glaucoma are, in the physiologic sense, incompensated.

Raeder,[6] in 1923, proposed a classification of glaucoma based on the depth of the anterior chamber. More recently, this idea was elaborated by Barkan,[7] Sugar,[8] and Kronfeld[9] with the aid of gonioscopy. In this country the terms "narrow" and "wide-angle" glaucoma have almost supplanted all other terminologies. While every new line of approach in the study of glaucoma is a distinct contribution toward the ultimate solution of this baffling problem, we feel that the present state of our knowledge does not warrant the adoption of an etiologic classification.

The term "narrow-angle glaucoma" is based on the assumption of the iris block mechanism as the primary cause of this form of the disease. In "wide-angle glaucoma" the implication is made that the trabeculum-canal of Schlemm apparatus is, in some way, the primary offender. It is apparent that these two mechanisms are not mutually exclusive. Individuals who have eyes with narrow angles may develop disturbances in the trabeculum or elsewhere in the eye of a type similar to that found in the "wide-angle" glaucoma. A case of this sort cannot be classified except on the basis of its clinical picture.

We believe with Troncoso[10] that "shallowness of the angle should be considered as a predisposing and not . . . as the primary cause of hypertension." It is true that in some eyes with narrow angles, mydriasis may cause closure of the angle and thus precipitate an acute attack. Even here we do not know to what extent other factors are responsible for the rise of tension.

Bangerter and Goldmann[11] have called attention to the fact that, while 18 percent of normal eyes have narrow angles and 22 percent have wide angles, as many as 60 percent fall into an intermediate group. Since the incidence of glaucoma of all forms is 0.5 to 3 percent of all eye patients (the congestive type representing about one third of the total), a very small percentage of eyes with narrow angles develop glaucoma.

We have observed several cases with wide angles who were subject to acute attacks. The regular use of miotics does not necessarily prevent congestive attacks. On the contrary, we have gained the impression that, in some cases, the prolonged use of pilocarpine, while it lessens the frequency, increases the severity of attacks. Homatropine frequently fails to provoke an attack in the narrow angle type, and, furthermore, it occasionally produces a congestive attack in a case of chronic simple glaucoma with an intermediate or wide angle.[10] In two cases, whose angles are wide at present, the dis-

ease was ushered in with an acute attack. Ten-percent neosynephrine has been used by us even in chronic congestive glaucoma without increasing the tension. In fact, it may make the eye more responsive to the subsequent use of pilocarpine.[12] Hamburger[13] has made the same observation with regard to glaucosan. In certain cases, the pupil remains widely dilated following an acute attack, and yet the tension remains normal, either with or without the use of miotics.

We have adopted the classical nomenclature of acute congestive, chronic congestive, and chronic simple glaucoma, since it carries no etiologic implications and is based on the clinical course of the disease. The diagnosis of acute glaucoma was made when the patient had only one congestive attack, or a second one after many years. Recurrent ocular pain or congestion determined the diagnosis of chronic congestive glaucoma. A case was classified as chronic simple glaucoma even when colored halos and slight discomfort were occasionally present.

In our series of 373 cases of primary glaucoma, 152 were males and 221 were females (fig. 2). In terms of eyes, the total number

TOTAL NUMBER OF PATIENTS

TYPE	TOTAL	MALE	FEMALE
PRIMARY GLAUCOMA	373	152	221
SECONDARY GLAUCOMA	76	36	40
INDETERMINATE GROUP	25	12	13
TOTAL	474	200	274

Fig. 2 (Posner and Schlossman). Incidence of sex in the cases studied.

was 657 eyes (some cases were monocular), of which the males represented 262 and the females 395. The preponderance of women is much more pronounced in the congestive types, where the ratio is 64 male eyes to 171 female eyes (fig. 3).

In attempting to separate the chronic simple from the chronic congestive forms, it was often difficult to make a decision in borderline cases. In view of the fact that the subjective reaction to ocular disturbances varies widely with the psychic make-up of the individual, the use of subjective criteria, such as pain and congestion, may have led to the inclusion in the chronic simple group of some patients who actually suffered from chronic congestive glaucoma or a combination of the two forms. For example, some of the patients had no symptoms at first, but after treatment began to have ocular discomfort or to see occasional halos. The only patients whom we can classify with certainty as chronic simple glaucoma are those who never showed any symptoms except for the loss of field. It is interesting to note that in this group the sex distribution is equal (77 females to 77 males). Thus, even in the chronic simple form, the preponderance of females may be due to the inclusion of cases which have a congestive element in them. The higher incidence of congestive attacks in females may

EYES WITH PRIMARY GLAUCOMA

TYPE	MALE	FEMALE
Acute congestive	10	61
Chronic congestive	44	96
Chronic simple c congestive attacks	10	14
TOTAL CONGESTIVE	64	171
Chronic simple c symptoms	121	147
Chronic simple s symptoms	77	77
TOTAL CHR. SIMPLE	198	224

Fig. 3 (Posner and Schlossman). The congestive form shows a predominance of females over males, while chronic simple glaucoma without symptoms is equally distributed between the sexes. The slight predominance of females over males in the total group of chronic simple glaucoma indicates that some of these cases may exhibit a congestive element.

be related to their generally more labile vasomotor reactions.

Among the cases which were observed for five years or longer, many followed a clinical course which did not fit into any single category of our classification. Some of them behaved like chronic simple glaucoma but had one or more congestive attacks, either spontaneously while under treatment, or after the use of atropine or homatropine. In several cases the disease was initiated following the use of a mydriatic, either for refraction or in the treatment of a corneal ulcer; yet the subsequent course assumed the characteristics of chronic simple glaucoma. In other cases the disease began as asymptomatic glaucoma, but congestive attacks made their appearance after the prolonged use of miotics. In one case the acute attack occurred in connection with childbirth. Schmidt-Rimpler[14] has called attention to this group and has named it "glaucoma simplex with intermittent congestive attacks." We feel that the term is descriptive and we have adopted it in our classification. This group comprises 18 patients with a total of 24 affected eyes.

MIXED GROUP

FIRST EYE	SECOND EYE	No. OF CASES
CONGESTIVE	CHR. SIMPLE	18
CHR. SIMPLE & CONG. ATTACKS	CHR. SIMPLE	9
CHR. SIMPLE & CONG. ATTACKS	ACUTE CONG.	1
CHR. SIMPLE & CONG. ATTACKS	SAME	6
CHR. SIMPLE & CONG. ATTACKS	NORMAL	2

Fig. 4 (Posner and Schlossman). This "mixed group" of cases emphasizes the importance of an extended and careful study of the life history of a patient with glaucoma.

There were 28 cases in which one eye suffered from glaucoma of a type different from the other. In 18 of these, one eye had chronic simple glaucoma and the other congestive glaucoma. In 9 cases, one eye had chronic simple glaucoma and the other chronic simple glaucoma with congestive attacks. In one case, one eye suffered from chronic simple glaucoma with congestive attacks while the other had congestive glaucoma. This group of cases, together with the cases of chronic simple glaucoma with congestive attacks referred to in the previous paragraph, form a "mixed group" which is shown in Figure 4.

This "mixed group" of cases emphasizes the importance of an extended and careful study of the life history of a patient with glaucoma. In some instances, it may be necessary to defer classifying a case for several years until its true nature is revealed. At times, it may even be impossible to place a given case of glaucoma in any single category. This brings up the question, whether primary glaucoma should be considered as a single disease or as several diseases. It is possible that, with further advances in our knowledge, different cleavage lines will be used in the classification of glaucoma. In the light of our present information, however, the classification which we adopted is a practical one in that it offers the clinician a means of segregating his cases for therapeutic and prognostic purposes. In a future paper we hope to present some typical life histories of glaucoma patients, so as to give a more concrete basis for the evaluation of the various clinical pictures.

In following a case of glaucoma, it is important to obtain a detailed account of the patient's symptoms, and to record it, preferably in the patient's own words. The history may be the only clue to the diagnosis in many cases, especially in the congestive form during the glaucoma-free interval. These patients may present themselves immediately after a mild attack when the tension in the affected eye frequently drops to a lower level than that of the other eye. At this time, even provocative tests may give nega-

tive results. In this connection we would like to remark that pupillography may represent the only confirmatory evidence. One patient was carried for over a year by several ophthalmologists as a psychoneurotic, because the tension of his eye was always taken after a mild attack and found to be low normal.

Monocular cases

Our experience with the mixed group of glaucoma cases has forced the conclusion upon us that one cannot assume that both eyes will necessarily develop the same type of glaucoma or that they will show identical responses to miotics, surgery, or provocative tests. Even the gonioscopic appearance may be different in the two eyes. This lack of parallelism between the two eyes is graphically demonstrated by the comparatively large number of monocular cases which constitute 18 percent of the total (fig. 5). The incidence of monocular glaucoma was more than three times as great in the congestive (31 percent) types as in chronic simple (9.6 percent) type. The reasons for these differences are obscure, but some clinical evidence is available to permit a tentative explanation. Pupillographic studies have shown that even the monocular cases probably represent a binocular disturbance, since the pupillary reaction-curve is similar in the two eyes.[15] Mydriatics, acute disease, pregnancy, surgical procedures (ocular or general), emotional disturbances, trauma, excessive reading, movies, card playing, and occasionally even miotics may provoke a congestive attack. These precipitating factors probably act indirectly by disturbing the balance of the autonomic nervous system. It is possible that in chronic simple glaucoma the tension-regulating mechanism has achieved a certain degree of stability, although, of course, at a higher level, and hence is not apt to respond violently to disturbances of the autonomic nervous system.

In the congestive form, on the other hand, the tension-regulating mechanism is only occasionally embarrassed as a result of the aforementioned provocative factors. It may be assumed that there exists a threshold of vasomotor irritability which has to be passed before the disturbance of the equilibrium can provoke a congestive attack. This is independent of the tension because the degree of congestive symptoms need not be directly proportional to the height of the tension. Cases are observed in which the tension is over 70 mm. Hg (Schiøtz); yet congestive

MONOCULAR AND BINOCULAR CASES OF PRIMARY GLAUCOMA

	CONGESTIVE		CHRONIC SIMPLE		TOTAL	
	No.	%	No.	%	No.	%
MONOCULAR	49	31	20	9.6	69	18
BINOCULAR	108	69	188	90.4	296	82
TOTAL	157	100	208	100	365	100

Fig. 5 (Posner and Schlossman). The incidence of monocular glaucoma was more than three times as great in the congestive types as in the chronic simple.

AGE OF ONSET IN PATIENTS WITH PRIMARY GLAUCOMA

AGE	ACUTE CONGEST.	CHRONIC CONGEST.	MIXED GROUP	TOTAL CONGEST.	CHRONIC SIMPLE	TOTAL CASES
UNDER 20	1			1		1
21—25		1	2	3	1	4
26—30					3	3
31—35	1	1	3	5	10	15
36—40	2	12	2	16	15	31
41—45	5	10	4	19	28	47
46—50	5	11	6	22	34	56
51—55	4	13	9	26	37	63
56—60	6	13	5	24	31	55
61—65	5	12	2	19	26	45
66—70	2	3	2	7	11	18
71—75		2	1	3	9	12
76—80	8	2		10	1	11
81—85		1		1	1	2
86—90	1			1	1	2
TOTAL	40	71	36	157	208	365

Fig. 6 (Posner and Schlossman). The largest number of acute congestive glaucomas in any single 5-year period occurred between the ages of 76 and 80 years.

symptoms are entirely lacking. On the other hand, severe congestive attacks may be accompanied by tensions no higher than 35 mm. or 40 mm. Hg (Schiøtz).

Bloomfield[16] has shown that there is a deficiency of cholinergic substance in the aqueous of glaucomatous eyes. Pilocarpine, in addition to its effect on the tension, conserves this substance and raises the threshold of vasomotor irritability. Consequently, it lessens the frequency of attacks. The observation was made in 15 instances that the institution of treatment with pilocarpine was paradoxically followed by the appearance of acute attacks in previously asymptomatic forms of glaucoma. In some patients who

suffered from frequent mild attacks, miotic therapy decreased the frequency but increased the severity of the attacks to the extent that it was necessary to resort to surgical intervention.

This concept of a threshold explains the prevalence of monocular cases in congestive glaucoma. Even though the disturbance is present in both eyes (cf. pupillography) the threshold is exceeded only in one eye, in which case the other eye appears clinically normal. When the vasomotor imbalance becomes great enough to exceed the threshold, it probably acts like a trigger mechanism to set off a congestive attack. All this indicates that in chronic simple glaucoma the disturbance of the ocular and autonomic equilibrium is more stable, but at the same time more deeply rooted, than in the congestive forms.

Age incidence

The age of onset is shown in Figure 6. This table points out that 79 percent of cases began between the ages of 36 and 65 years. The drop in incidence in the higher age groups is less marked than appears in the figure, because of the progressive decrease in population in the higher age groups. In this connection, it may be significant that the largest number of acute congestive glaucomas in any single 5-year period occurred between the ages of 76 and 80 years. With this exception, the age incidence is approximately the same in congestive as in chronic simple glaucoma.

REFRACTIVE STATUS

REFRACTIVE ERROR (IN DIOPTERS)	EYES WITH CONGESTIVE GLAUCOMA	EYES WITH CHRONIC SIMPLE GLAUCOMA
PLANO	15	38
+.25 to +.50	25	44
−.25 to −.50	4	15
+.75 to +1.50	47	75
−.75 to −1.50	13	20
+1.75 to +3.00	29	50
−1.75 to −3.00	11	21
GREATER THAN +3.00	38	44
−3.00 to −6.00	7	27
GREATER THAN −6.00		15

Fig. 7 (Posner and Schlossman). The spherical equivalents shown above were used in tabulating the refractive errors of 538 eyes.

Refractive status

The refractive errors of 538 eyes were tabulated in groups, using spherical equivalents as shown in Figure 7. In order to be able to compare the relative frequency of the refractive states with those found in the general population, the figure was arranged to conform with the scheme used by Jack-

REFRACTIVE ERROR IN DIOPTERS	CONGESTIVE		CHRONIC SIMPLE		TOTAL GLAUCOMA		NORMAL (JACKSON)	
	No.	%	No.	%	No.	%	No.	%
EMMETROPIA (−.50 to +.50)	44	23.3	114	27.8	141	26.2	—	12.4
HYPEROPIA above +.50	114	60.3	169	48.4	283	52.6	—	70.4
MYOPIA above −.50	31	16.4	83	23.8	114	21.2	—	17.2

Fig. 8 (Posner and Schlossman). Summary of refractive status as compared with Jackson's normals for the general population.

son.[17] He regards as emmetropic all errors between −0.50 and +0.50. Figure 8 shows that there were 52.6-percent hyperopic eyes and 21.2-percent myopic eyes in our cases of primary glaucoma. Jackson finds, for the general population, in the age group between 30 and 40 years, 70.4-percent hyperopes and 17.2-percent myopes. In the congestive group, there is a slightly higher percentage of hyperopic eyes than in chronic simple glaucoma, though the ratio of myopes to hyperopes still follows closely the normal distribution. It is apparent that a myope is just as susceptible to glaucoma as a hyperope. These conclusions agree with those of Loehlein[18] and Holst.[18a]

INCIDENCE OF HEREDITARY CASES

NUMBER OF EYES

CASES	CONGESTIVE AND MIXED	SIMPLE	TOTAL
OVERALL	235	422	657
HEREDITARY	35	53	88

Fig. 9 (Posner and Schlossman). All forms of glaucoma are represented in the hereditary group and they do not differ clinically from the nonhereditary group.

Of the 114 myopic eyes, 49 showed errors greater than −3.0D., and 15 of these had a myopia higher than −6.0D. These very high myopes were found only among patients with chronic simple glaucoma. Arnold Knapp[19] described 33 cases of glaucoma in high myopes and called attention to the fact that in these cases the tension tends to be low, even though the field deteriorates. Our experience corroborates his observations.

Hereditary glaucoma

Hereditary factors are present in many metabolic and nervous diseases, and glaucoma is no exception. The present study reveals 50 patients in 29 different families who had one or more relatives affected with primary glaucoma. This represents 13 percent of all cases of primary glaucoma. The total known number of affected patients in the 29 families is 100 (figs. 9 and 10). While in most families all of the members are affected with the same type of glaucoma, there are exceptions to this rule. All forms of glaucoma are represented in the hereditary group and they do not differ clinically from the nonhereditary forms.

Since 1842, when Benedict first called attention to the familial aspects of the disease, approximately 90 pedigrees have been reported in the literature. Because a large percentage of these deal with juvenile cases, and since hereditary tendencies are more conspicuous in the younger group (20 percent),[20] the impression was created that juvenile glaucoma is the only hereditary form. In our series there were only five patients (or 10 percent of the hereditary cases) in whom the disease began at the age of 35 or less.

In the families which were studied, the heredity seems to be of a dominant type. The incidence of hereditary glaucoma is likely to be even higher than our statistics indicate. It may even be possible that some sporadic cases are either mutations or the result of recessive inheritance. Only extensive genetic investigations could adequately explore the

HEREDITARY GLAUCOMA

NUMBER OF CASES IN EACH FAMILY	NUMBER OF FAMILIES	TOTAL NUMBER OF CASES IN ALL FAMILIES
2	10	20
3	8	24
4	6	24
5	1	5
6	2	12
7	1	7
8	1	8
TOTAL OF HEREDITARY GROUP	29	100

Fig. 10 (Posner and Schlossman). The total known number of affected patients in 29 families is 100.

hereditary mechanisms in this disease, particularly with respect to the possibility of a recessive form. A more detailed review of the subject will be published elsewhere,[21] and further investigations are now in progress.

It is important to be aware of the hereditary potentiality of glaucoma because it frequently enables the physician to make an earlier diagnosis. Through a study of hereditary glaucoma, one can obtain a great deal of insight into the early and the mild forms of the disease. If careful pedigrees were routinely taken on all glaucoma patients, the pooling of this data would materially advance our knowledge of the disease.

Juvenile glaucoma

Juvenile glaucoma cannot be sharply separated from adult glaucoma. This is borne out by the fact that the upper limit of the age of onset has been variously placed at between 30 and 40 years by different authors. The clinical picture of juvenile glaucoma does not differ fundamentally from adult glaucoma. We use the age of 35 years as the upper limit, as was suggested by Loehlein.[20] In our series there are 23 cases of so-called "juvenile glaucoma." There undoubtedly were cases which were not included in this group, merely because the glaucoma was not discovered until after the age of 35 years. It is obviously illogical to regard juvenile glaucoma as a separate disease. According to Anderson[22] 87 percent of hydrophthalmos cases are recognized during the first year of life; while Loehlein's figures show that 78.9 percent of juvenile glaucoma begins between 15 and 30 years of age. Of our cases 78 percent had their onset between the ages 26 and 35 years. This is in line with the statistics of Haag[23] who finds a progressively increasing incidence with increase in age. Because of the wide gap between the peaks of incidence (according to age) in hydrophthalmos and juvenile glaucoma, it is improbable that more than a small fraction of juvenile cases are related to congenital glaucoma.

Myopia is said to be much more prevalent in juvenile than in adult glaucoma. In our series there were only 6 myopes out of 23 and only 2 of them had a myopia higher than −3.0 diopters.

Mild vs. Severe glaucoma

A review of the cases which were followed for many years reveals a wide variation in the severity of the disease. While some cases end in blindness within a few years, others remain in the mild stage for 20 years and longer. The majority of glaucoma cases fall somewhere between these extremes. It seems absurd to refer to a case of mild glaucoma, which has lasted 20 years, as "preglaucoma" (Gradle),[24] prodromal glaucoma, or early glaucoma. From the clinical point of view, it is important to be able to prognosticate the probable severity and course in a given case. The criterion for placing a case in the mild group is the lack of deterioration of the field of vision over a period of several years. We had 40 such cases in our series. A number of these would never have been discovered had it not been for the fact that other members of the family suffered from the disease.

One illustrative case is that of L. C., whose father and brother suffered from primary glaucoma. A tentative diagnosis of glaucoma was made 25 years ago. She has symptoms of recurring mild ocular pain and blurring of vision. The only clinical evidence obtained has been the occasional elevation of tension to between 30 mm. and 35 mm. Hg (Schiøtz) and a pupillographic curve similar to that found in primary glaucoma. Even homatropine did not raise the tension during a glaucoma-free interval, but the Knapp adrenalin test[25] was positive. Fields and central vision have remained normal.

This type of case may be looked upon as a true compensated glaucoma, since the rise

TABLE 1

EYE CONDITIONS ASSOCIATED WITH PRIMARY GLAUCOMA

Type	No. of Cases
1. Cataract	59
2. Corneal opacities	16
3. Diabetic retinopathy	7
4. Drusen in macular area	7
5. Retinal arteriosclerosis	6
6. Hypertensive retinopathy	5
7. Macular degeneration	5
8. Corneal dystrophy	4
9. Divergent strabismus	4
10. Trachoma	4
11. Thrombosis, central retinal vein	3
12. Retinal detachment	3
13. Uveitis	2
14. Ptosis	2
15. Exophthalmos	2
16. Vitreous opacities	1
17. Retinal changes secondary to myopia	1
18. Convergent strabismus	1
19. Occlusion, central retinal artery	1

of tension is not detrimental to the function of the eye; on the contrary, it may even help maintain its physiologic functions.

At the other extreme is a group of cases, generally of the chronic simple type, which do not respond to miotics, which show rapid deterioration of the fields and react unfavorably to any form of iris surgery. These are the malignant cases.* Fortunately, the incidence of this type of glaucoma is low. We had 11 such cases in our group. If such a case is suspected, it may be wise to resort to cyclodialysis, particularly if a filtering operation (involving trauma to the iris) has proved disastrous despite good surgical technique. As a general rule, if a case of glaucoma fails to respond satisfactorily to a mechanically well-executed filtering operation, it is advisable not to repeat the same type of surgery immediately. Whenever possible, it is better to wait, since the normalization of tension may be delayed as long as six months to a year. If the field continues to deteriorate, cyclodialysis should be the operation of choice.

*In the literature malignant glaucoma is usually referred to as synonymous with hemorrhagic glaucoma. We do not use this term in the same sense.

For the majority of the more typical glaucoma cases, Elliot's classification scheme[26] is of practical clinical value. He divides his cases into: (1) Early glaucoma, (2) established glaucoma, and (3) late glaucoma. Following a somewhat similar pattern, Kronfeld and McGarry[27] have divided their cases into four stages depending on the degree of field loss. They claim that this has prognostic value.

ASSOCIATED DISEASES

Tables 1 and 2 list the associated ocular and general diseases respectively. Among the former were 59 cases with cataract, 16 cases

TABLE 2

GENERAL DISEASES ASSOCIATED WITH PRIMARY GLAUCOMA

	Cases
1. Essential hypertension	64
2. Diabetes	31
3. Arthritis	26
4. Arteriosclerosis	15
5. Gall bladder disease	14
6. Allergy	11
7. Coronary disease	10
8. Obesity	8
9. Asthma	8
10. Deafness (nerve)	7
11. Hyperthyroidism	7
12. Psychoneuroses	7
13. Prostatitis	6
14. Lues	5
15. Sinusitis	3
16. Peptic ulcer	3
17. Migraine	3
18. Pernicious anemia	3
19. Hypothyroidism	2
20. Pyelitis	2
21. Bronchiectasis	2
22. Spondylitis	2
23. Paralysis agitans	2
24. Complete alopecia	2
25. Oxycephaly	1
26. Anosmia	1
27. Nasal polyps	1
28. Paget's disease	1
29. Myasthenia gravis	1
30. Colitis	1
31. Tuberculosis	1
32. Gonorrhea (inactive)	1
33. Pemphygus	1
34. Psoriasis	1
35. Gout	1
36. Meniere's syndrome	1
37. Amyotrophic lateral sclerosis	1
38. Buerger's disease	1
39. Spinal tumor	1
40. Otosclerosis	1

of corneal opacity, 7 cases of diabetic retinopathy, and 7 cases of drusen in the macula. It is difficult to know whether any causal relationship exists or whether these conditions are merely coincidental.

Among the general diseases associated with glaucoma, there were 64 cases of essential hypertension, 31 cases of diabetes, 25 cases of arteriosclerosis (including coronary disease), 14 cases of gall bladder disease, 8 cases of obesity, 11 cases of allergy, 8 cases of asthma, 7 cases of hyperthyroidism, and 3 cases of migraine. Clinical, as well as pupillographic evidence, points to a probable etiologic connection between glaucoma on one hand, and hypertension, diabetes, and obesity on the other. Elwyn[28] has pointed out that in glaucoma, like in hypertension and diabetes, there is a disturbance of the regulatory center of the autonomic nervous system, probably in the hypothalamus.

Seven cases of nerve deafness were observed in association with the simplex form. Some of them had a long history of intermittent tinnitus. One patient gave a family history of deafness. We are unable to state definitely the relationship between deafness and glaucoma, but there may be a disturbance of the pressure equilibrium in the inner ear analogous to that present in the eye.

Although definite psychoneurosis was present in only 7 cases, many more patients showed emotional instability of a less pronounced degree. This is in accord with a currently accepted notion, emphasized by Schoenberg,[29] that psychosomatic factors play an important role in the pathogenesis and course of glaucoma.

Glaucoma without hypertension

The occasional finding of optic atrophy with cupping and field changes has given rise to speculation as to the relationship of such cases to glaucoma on the one hand and to the optic atrophies on the other. Thiel[30] has introduced the term "pseudoglaucoma" for these cases. He believes that the majority of them are related to calcification of the internal carotid arteries. Knapp[31] has reported 10 cases of this type. Sjogren[32] in a recent discussion of this subject prefers to confine the use of the term pseudoglaucoma to those cases in which the optic atrophy and cupping can be definitely ascribed to pressure upon the optic nerve or chiasm. He believes that glaucoma without hypertension is a type of chronic simple glaucoma, because of the many transitional and atypical forms of glaucoma found in association with this condition. We subscribe to his view. In our group of chronic simple glaucoma, there were two patients who had typical field defects and cupping of the nerve without hypertension.

We have had under observation over periods of many years eight patients who show deep cupping similar in appearance to that found in glaucoma but without field changes or elevation of tension. Such cases could also be included under pseudoglaucoma. It is interesting to speculate that an optic atrophy superimposed upon a deep physiologic cupping may give a picture indistinguishable from glaucoma without hypertension.

Indeterminate group

The diagnosis of primary glaucoma should be limited to those cases in which the cause is not known. As soon as an adequate cause is discovered, it is mandatory to reclassify the case as secondary glaucoma. In recent years there has been a tendency, however, to speak of glaucoma as secondary, whenever a coexisting ocular condition is found, without being too critical about the causal relationship. For example, glaucoma which follows cataract extraction is, as a matter of course, regarded as secondary. Careful analysis and prolonged observation of these patients revealed that 8 out of 19 cases in the aphakic group might actually have been suffering from primary glaucoma. The cataract surgery may have had no relation

to the development of the glaucoma or it may have hastened the onset in a predisposed patient.

F. G., a 66-year-old woman with high myopia, had a cataract extraction in her left eye at the age of 58 years. This was followed by glaucoma with deep cupping and loss of the nasal field. Five years later, the tension in the right eye was found to be elevated to between 33 and 36 mm. Hg (Schiøtz). A diagnosis of asymptomatic glaucoma simplex of the right eye was made. A positive lability test[33] was obtained recently. The patient was observed for eight years.

A. S., a 75-year-old woman, developed asymptomatic glaucoma 18 months after a Ziegler discission on her right eye at the age of 64 years. The tension was consistently between 40 and 50 mm. Hg. Pallor and cupping of the disc with progressive loss of field ensued. The other eye remained normal. However, paredrine used as a provocative two years after the onset of the hypertension in the right eye, raised the tension of the left eye from 20 to 35 mm. Hg. This patient was followed for 16 years.

The fact that the glaucoma in these two cases was asymptomatic and that chronic simple glaucoma or a tendency to it was demonstrated in the unoperated eye, leads one to suspect that the aphakic eyes were probably predisposed to glaucoma even prior to surgery. Without a long follow-up, the true nature of the glaucoma in some of these cases would probably not have been uncovered. Before committing oneself to a diagnosis of secondary glaucoma in an aphakic eye, one should always do a provocative test, preferably a lability test or a water-drinking test,[34] on the unoperated eye.

There is a great deal of confusion regarding the relationship between glaucoma and iridocyclitis. According to the prevailing dogma, any case of glaucoma which shows the presence of cellular elements in the aqueous or on the posterior surface of the cornea, no matter how few in number, is relegated to the class of secondary glaucoma. Yet, no one can explain satisfactorily in what manner a few cells in the aqueous or a few keratic precipitates can produce ocular hypertension in the absence of a plasmoid aqueous.

We reported nine patients who showed recurrent unilateral attacks of glaucoma with mild cyclitic signs.[35] These may be regarded as a clinical entity and they probably form an intermediate group which shows characteristics of both primary and secondary glaucoma. We have proposed the name of "recurrent glaucomato-cyclitic crises" for this syndrome.

There were two cases which showed iridocyclitis as a complicating incident in the course of primary glaucoma. On the other hand, there were 18 cases of chronic uveitis in which true secondary glaucoma supervened. Glaucoma with uveitis may be classified in the following manner:

1. Iridocyclitis, either precipitating an acute attack of primary glaucoma or incidental to the course of primary glaucoma.
2. The syndrome of recurrent glaucomato-cyclitic crises.
3. Iridocyclitis producing true secondary glaucoma as a result of changes in the filtration channels or by the osmotic effect of a plasmoid aqueous.
4. Late secondary glaucoma as the sequel to organic alterations produced by iridocyclitis, like iris bombé.*

Two cases of mild bilateral glaucoma were associated with nevus flammeus. In one case the nevus occupied the right arm and right half of the trunk but spared the face. There were some aneurysmal dilatations over the right disc. The other case showed a nevus flammeus of the face on the right side. Pupillography in both instances showed cen-

* We do not wish to imply that even in this condition the mechanical factors (anterior and posterior synechias) are alone responsible for the ocular hypertension. Weiss, in *Kurzes Handbuch für Ophthalmologie*, Vol. II, p. 67, makes note of the fact that there are cases of iris bombé which are not accompanied by glaucoma.

tral sympathetic disturbances, but not of the type found in primary glaucoma. The water-drinking test was positive in each case, the right eyes showing greater elevation of tension. Both patients responded well to 1-percent pilocarpine.

Usually the glaucoma associated with nevus flammeus is infantile or juvenile and limited to the affected side. Ehrlich[36] reports one case of bilateral glaucoma with unilateral nevus flammeus and refers to the only other similar case in the literature. The glaucoma in both of these cases was of a severe degree and of the juvenile type. In our two cases the glaucoma was bilateral and unusually mild. Even if vascular dilatations, as is generally assumed, were present in the uvea on the affected side, it is difficult to see how this could account for the bilateral mild glaucoma which was present in these cases. For this reason, we thought it best to set them apart from the general group of secondaries.

One patient had attacks of glaucoma associated with marked edema of the lids and conjunctiva since the age of 38 years. She also suffered from allergies, asthma, and hyperinsulinism. Attacks often occurred after menstruation. It is possible that this is a case of chronic congestive glaucoma with manifestations suggestive of allergy. We have classified this patient, for the present, as allergic glaucoma.

One patient, A. L., a man with myopia of −20D. developed retinal detachment of the right eye at the age of 18 years. This was followed seven years later by an asymptomatic glaucoma in the same eye. The tension of the left eye was normal at this time; but five years later, at the age of 32 years, it became elevated. The fundus shows no chorioretinal degeneration. Cyclodialysis has normalized the tension in the left eye for the past 1½ years. In this patient the glaucoma in the right eye might have been regarded as secondary to retinal detachment. However, the subsequent development of asymptomatic glaucoma of the simplex type in the other eye casts doubt on the original diagnosis.

Two cases of glaucoma were associated with retinitis pigmentosa. W. F., a 52-year-old man, has retinitis pigmentosa which was discovered in 1936 at the age of 41 years. Following a head injury, in 1940, he began to see halos around lights. The tension was moderately elevated in both eyes, but responded temporarily to pilocarpine. Two weeks after medication was instituted, an acute attack occurred in the right eye. Bilateral iridencleisis normalized the tension. The fields are those characteristic of retinitis pigmentosa. The second patient, N. F., a 38-year-old white woman, with retinitis pigmentosa, developed bilateral glaucoma of the chronic congestive type. Two of her sisters have retinitis pigmentosa, but only one of them has developed glaucoma. One brother and one sister are normal.

The association of retinitis pigmentosa and glaucoma was first noted by Galezowski in 1862.[37] Since then, numerous cases have been cited in the literature. Schmidhauser (cited by Leber[38]) found the incidence of glaucoma in retinitis pigmentosa to be 2.78 percent, while the incidence of glaucoma in all patients of the Tuebingen Clinic was 0.73 percent. Leber interprets this difference in incidence to mean that the association of the two diseases is not purely coincidental. Von Hippel[39] suggests as the cause for the glaucoma, an obstruction of the drainage channels by pigment. Blessig[40] reports a sibship of nine members of whom two sisters had chronic simple glaucoma alone, while two brothers and one sister suffered from pigmentary degeneration without ocular hypertension. The glaucoma associated with retinitis pigmentosa may be either of the congestive or the chronic simple variety. It behaves no differently from primary glaucoma. The data on this condition is insufficient for reliable statistical studies and the paucity of the anatomic material makes it difficult to determine the causal relationship between the two diseases.

The indeterminate group (fig. 11) was introduced here primarily because of the difficulty of classifying certain cases of glaucoma as either primary or secondary, even after prolonged and careful study. The

INDETERMINATE GROUP

TYPE	NO. OF CASES
GLAUCOMATO-CYCLITIC CRISES	9
PROBABLY PRIMARY GLAUCOMA IN APHAKIA	8
NAEVUS FLAMMEUS WITH MILD GLAUCOMA	2
ALLERGIC GLAUCOMA	1
GLAUCOMA WITH RETINAL DETACHMENT	1
GLAUCOMA WITH RETINITIS PIGMENTOSA	2

Fig. 11 (Posner and Schlossman). Even after prolonged and careful study, it is difficult to classify certain cases of glaucoma as either primary or secondary.

eight cases associated with aphakia, as well as the cases with allergic glaucoma and with retinal detachment, are probably primary glaucoma. The nine cases of recurrent glaucomato-cyclitic crises are probably an entity. They may be considered intermediate between primary and secondary glaucoma. The glaucoma associated with nevus flammeus is probably secondary. The cases with retinitis pigmentosa are difficult to classify. Even Thiel[41] admits that their pathogenesis is obscure.

Secondary Glaucoma

The 76 cases of secondary glaucoma are listed in Table 3. The most common cause was uveitis. Cataract extraction, including discissions, accounted for 11 cases. This number does not include the eight patients mentioned in the indeterminate group. There were nine cases of buphthalmos and one case of microphthalmos. Of the former, eight were males and only one was a female.

Two cases associated with detachment of the anterior layers of the iris are included. Schoenberg, in 1927, reported the first case in a man aged 51.[42] The second case is a 46-year-old man with high myopia, microcornea, and congenital lues. Detachment of the anterior layers of both irides was first noted at the age of 34 years. Four years later, he saw rainbows and the tension was found to be elevated. Subluxation of the left lens was present.

Vogt[43] notes the association between detachment of the anterior mesodermal layer of the iris, spontaneous subluxation of the lens, and glaucoma. He considers this condition to be due to senile degeneration of the mesodermal structures. However, both of our cases occurred in patients under 55 years of age. The glaucoma in these cases may be the result of analogous degenerative changes in the pectinate ligament.

As is evident from Table 3, secondary glaucoma is a heterogeneous group which is characterized by the association of ocular hypertension with some other ocular disease or abnormality. We need not necessarily assume a direct causal relationship between the two conditions in every instance. Very often the exact mechanism involved in the

TABLE 3

Secondary Glaucoma

	Cases
1. Uveitis	19
2. Cataract extraction	11
3. Buphthalmos	9
4. Hemorrhagic glaucoma	3
5. Tumor	3
6. Rubeosis iridis diabetica	3
7. Detachment of anterior layers of iris	2
8. Detachment of retina	2
9. Chorioretinitis	2
10. Swollen lens	2
11. Interstitial keratitis (luetic)	2
12. Glaucoma capsulare	2
13. Microphthalmos and congenital cataract	1
14. Subluxation of lens	1
15. Subluxation of lens (Marfan's syndrome)	1
16. Perforating injury of cornea	1
17. Needling of congenital cataracts and congenital lues	1
18. Nonmagnetic foreign body	1
19. Recurrent corneal ulcers	1
20. Traumatic cataract	1
21. Needling of congenital cataracts	1
22. Rupture of eyeball	1
23. Retinal degeneration in high myopia	1
24. Unknown etiology	6

production of hypertension is not known. Duke-Elder,[44] in his definition of secondary glaucoma, is careful not to imply a cause and effect relationship. The difficulty of deciding, in a given case, whether the glaucoma is primary or secondary is borne out by the fact that patients with primary glaucoma are no less subject to other ocular diseases than nonglaucomatous individuals (see fig. 4). Three cases of primary glaucoma developed thrombosis of the central retinal vein some time after the diagnosis of glaucoma had been made. Moreover, patients with other ocular diseases may, in the course of time, develop glaucoma.[45]

Comments

This study is an attempt to consider the glaucoma problem from a purely clinical point of view. The latest developments in research along experimental and physicochemical lines will be dealt with at a future time. The statistical and analytic study of our material reveals certain features which will be briefly reiterated in order to clarify a few more or less fundamental concepts.

When one compares an isolated case of acute congestive glaucoma which is cured by surgery with a case of asymptomatic chronic simple glaucoma in which the tension is within normal limits or only slightly elevated, one has the impression that here are two separate diseases. Analysis of a large number of cases, however, invariably reveals gradations in the symptomatology and course to such an extent, that one is unable to draw a sharp line of demarcation at any point in the series. Furthermore, there is a mixed group of cases in which one may find either a congestive glaucoma in one eye and chronic simple in the other or a chronic simple glaucoma with acute exacerbations in one or both eyes. One is forced to accept the inevitable conclusion that, in the present state of our knowledge, primary glaucoma should be regarded as a single clinical entity. It is possible that further investigations will reveal primary glaucoma to be more than one disease; but the criteria for such a classification will not be the same as those generally used at present. We have utilized the conventional nomenclature because it is useful from a clinical point of view, and because it does not carry any etiologic implications.

Further evidence for assuming a unitary concept of primary glaucoma is found in a study of hereditary cases. In the same family tree, one may find examples of congestive and chronic simple glaucoma. Pupillography,[46] which is a means of studying the state of the central autonomic nervous system through the pupillary response, shows the same type of curve in congestive and chronic simple glaucoma.

On the other hand, there are some points of difference between the two forms of glaucoma which may be used as arguments for regarding them as separate entities. The prevalence of females over males is greater in congestive than in chronic simple glaucoma. Also, there are more hyperopes and monocular cases in the former than in the latter. The shallow anterior chambers and narrow angles predominate in the congestive forms.

Glaucoma should be regarded as a constitutional disease in the sense of a dysfunction of the central regulatory mechanism[28] of the autonomic nervous system similar to the group of metabolic disorders such as diabetes, hypertension, and obesity. It is possible that this dysfunction constitutes the primary, or at least the predisposing cause, while the various anatomic and physicochemical conditions of the eye are modifying or precipitating factors.

The fact that congestive glaucoma occurs in a small percentage of eyes with narrow angles and may occur also in eyes with wide angles tends to indicate that the angle plays a secondary role in the etiology of the disease. It should be remembered that the width of the angle and the depth of the

anterior chamber are intimately related to the architecture of the remainder of the eye, such as the shape of the ciliary body, the mode of attachment of the iris root, and the position of the anterior surface of the lens. Thus, while eyes with narrow angles are more prone to develop the congestive form of glaucoma, the causal relationship between the angle and glaucoma has not been established. In fact, Busacca[47] has questioned the entire concept by pointing out that the angle is not a static structure but that its width varies from time to time.

It is common experience to find that the tension varies with different individuals within wide limits, but that it is fairly constant for each individual. Generally, both eyes have the same tension. This corroborates the hypothesis of a central regulatory mechanism for the intraocular pressure. A significant difference of tension between the two eyes is more important as presumptive evidence of glaucoma than an elevation of tension which is equal in both eyes. Downey[48] has recently emphasized this diagnostic point. At least four of our patients had a continuously elevated tension above 35 mm. Hg without showing any deterioration of field or ophthalmoscopic changes for from two to three years. It appears that in some cases, pathologically increased tension does not produce any interference with function. It may be assumed that intraocular pressure is kept at a definite level which is optimal for the maintenance of the normal function of that eye. The level varies with each individual. We do not know why these variations are present; nor do we know what constitutes the upper limit of normal for any given eye. Consequently, the assumption that a tension above 30 mm. Hg is abnormal need not hold for all cases. There are normal individuals whose tension is around 30 mm.; yet these patients show negative responses to provocative tests and never develop glaucoma. In the early stages of glaucoma, the ocular hypertension may be a necessary compensatory mechanism, serving a useful purpose in that it helps to maintain normal metabolic conditions in the eye. For example, sclerosis of the choriocapillaris or impaired permeability of the lamina vitrea may interfere with the nutrition of the neuroepithelium. It was shown by Evans[49] and Berens and Posner[50] that there is a circulation of intraocular fluid from the vitreous into the retina and optic nerve. Increase in intraocular pressure would tend to favor the flow of fluid into the retina and thus supplement the nutrition of the retina.

As long as this mechanism is adequate to maintain the normal function of the retina and the field does not deteriorate, one may regard the glaucoma as being in a compensated phase. As soon as field loss sets in, the limits of compensation have been exceeded. It may be interesting to speculate, in the light of this hypothesis, why the central area and the temporal periphery of the visual field are the last to be destroyed. The increase in intraocular pressure, while helping to maintain the function of the neuroepithelium, exerts a deleterious effect on the retinal circulation. Consequently, the relatively avascular areas of the retina (macula and nasal periphery) survive longer than the more vascular zones. This relationship is more fully discussed elsewhere.[51]

The following case is suggestive of the role which ocular hypertension may play in maintaining the normal metabolism of the lens. Since 1942, H. F., a 57-year-old chemist, has had an almost continuous right ocular hypertension, usually above 40 mm. Hg (Schiøtz). Up to the present, his visual acuity has remained 20/15 and his fields have shown no changes other than downward enlargement of the right blindspot. The tension of his left eye has consistently remained around 22 mm. Hg. Recently, he developed a posterior cortical cataract in his left eye, while his right lens has remained normal. The general impression that surgical intervention in a glaucomatous eye (with the subsequent reduction of tension) often hastens the development of a cataract, may

have a basis in an interdependence between the ocular tension and the metabolism of the lens.

The concept that a diseased process is an expression of an imperfect or inadequate attempt at compensation for another disturbance is in line with the principles of general pathology which have been excellently formulated by Aschoff.[52]

Earlier in the paper it was shown that the characteristics of congestive glaucoma as clinically observed may be better interpreted by assuming the existence of a threshold of vasomotor irritability which determines the ease with which a congestive attack becomes manifest. This may vary with different patients and at different times. It is not known why the threshold is more easily exceeded in some cases than in others, but a few clues are suggestive. In congestive glaucoma the ratio of male to female eyes was 1:26 while in asymptomatic chronic simple glaucoma, it was 1:1. Women, especially in the menopause, show greater vasomotor instability than men. The relationship of congestive glaucoma to vasomotor phenomena is further demonstrated by the prevalence of congestive attacks in association with allergy. Nine out of 11 patients with allergy had congestive glaucoma; 2 had chronic simple glaucoma.

We have considered the increase in tension as a compensatory mechanism which is controlled by the central autonomic nervous system. The nature of the primary affection in the eye is not known. It may be related to senile or nutritional changes. There is ample evidence that disturbances other than ocular hypertension play a role in the causation of the clinical picture of glaucoma. In the first place, the height of the tension bears no definite relationship to the severity of the field loss. Secondly, many patients who have been normalized by surgery or miotics, continue to have progressive deterioration of the visual field. While the aforementioned considerations are indicative of the presence of a factor other than hypertension, additional evidence may be adduced from a consideration of cases of glaucoma without hypertension. Magitot[53] divides this group into three categories:

1. Myopic glaucoma with low tension.
2. Mild intermittent unilateral glaucoma.
3. Field changes and excavation of the disc either with or without calcification of the internal carotids.

Sjogren[32] does not draw a sharp line between glaucoma with and without hypertension, but rather stresses the numerous transitional forms which are frequently observed. He believes that the basis of glaucoma lies in a circulatory disturbance independent of the intraocular pressure which constitutes only one symptom of the disease. Although our series includes only two cases of glaucoma without hypertension, there are others in whom the elevation of tension was never marked and who, nevertheless, showed extensive field loss. This is particularly true of the cases of chronic glaucoma associated with high myopia.

We feel that, although the tension undoubtedly plays an important role in glaucoma, there may be other factors which contribute to the causation of the disease. The following possibilities are suggested.

1. Disturbance of central autonomic nervous system (may include psychosomatic factors).
2. Vasomotor instability.
3. Hereditary factors.
4. Arteriosclerosis (a) General, and (b) Local.[54]
5. Blood pressure.[55]
6. Metabolic disturbances: diabetes, obesity, endocrine.
7. Relation of intracranial to intraocular pressure.[56]
8. Degenerative changes in the nervous tissue. (a) Lacunary degeneration in the brain and nerve;[32] and (b) Schnabel's cavernous atrophy.
9. *Local factors:*

a. Anatomic (Schlemm's Canal, chamber

angle, retinal circulation, choroid, and so forth).

b. Nutritional.

c. Congenital.

d. Physicochemical:

(1) Increased capillary permeability.

(2) Diminution in cholinergic substance.[16]

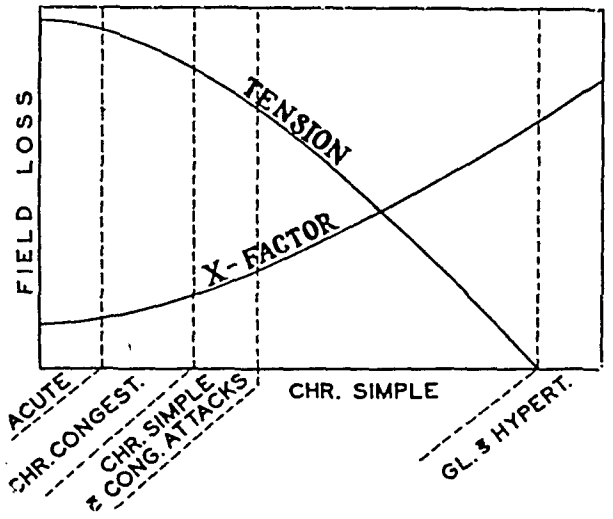


Fig. 12 (Posner and Schlossman). SCHEMATIC REPRESENTATION OF THE ROLES PLAYED BY OCULAR HYPERTENSION AND THE X-FACTOR* IN THE PRODUCTION OF FIELD LOSS IN PRIMARY GLAUCOMA. Glaucoma is shown as a single disease with varying clinical pictures. A representative sample of cases forms a continuous series in which the field loss appears to be dependent upon the aforementioned variables. In acute glaucoma, the duration and height of the ocular hypertension play the predominant role. In chronic congestive and chronic simple glaucoma with congestive attacks, the X-factor plays a more important role. In chronic simple glaucoma, the field change is dependent partly on the X-factor and partly on the hypertension. In this group there are cases with relatively low degrees of hypertension in which the progressive field loss suggests that the X-factor plays a predominant role. This group merges into glaucoma without hypertension where the X-factor is obviously the chief cause of the field loss.

* Sum total of all other disturbances.

In Figure 12 we have attempted to visualize graphically how the field changes may be regarded as a function of the tension and the sum total of the other factors, which we call the "X-factor" for the sake of simplicity. In acute congestive glaucoma, the tension factor plays the predominant role and the field changes appear to depend directly on the height and duration of the hypertension. In glaucoma without hypertension, on the other hand, the X-factor is chiefly responsible for the loss of field. The vast majority of the cases fall somewhere between these two extremes. In chronic simple glaucoma without symptoms, the visual field changes show less relation to the tension than in the chronic congestive form, while the mixed group which contains elements of both may be placed between chronic congestive and chronic simple glaucoma.

The hypotheses expressed in this paper represent the conclusions drawn from the material available for our study. They are offered with the hope of stimulating further investigations along these and other lines of thought.

SUMMARY

The present study is a correlation of 474 cases of glaucoma from private practice, of which 373 are primary; 158 patients have been followed for five years or longer.

In this series there are 71 eyes with acute congestive, 140 eyes with chronic congestive, and 422 eyes with chronic simple glaucoma. Twenty-four additional eyes showed chronic simple glaucoma with congestive attacks (Schmidt-Rimpler). In the congestive form the ratio of male to female eyes was 1 : 2.6. In glaucoma simplex there was only a slight preponderance of females over males, while in asymptomatic glaucoma simplex, the ratio was 1 :1. The incidence of monocular cases was three times as great in the congestive types as in chronic simple.

In 60 percent of the cases of primary glaucoma, the onset was between 41 and 60 years of age. Considering refractive errors between +0.5D. and −0.5D as emmetropia, there were 141 emmetropic, 283 hyperopic, and 114 myopic eyes. The ratio of hyperopes to myopes is similar to that found in the general population.

Fifty cases showed hereditary tendencies. The pedigrees studied exhibited dominant

inheritance. In 23 patients, the onset was below 35 years of age. These juvenile cases differed in no way from the rest of the group. Forty patients followed a very mild course and many of them would have remained unrecognized were it not for the attention paid to heredity.

Besides the cases of primary glaucoma, there were 25 which could not be definitely classified as either primary or secondary. Of this group, nine had the syndrome of recurrent glaucomato-cyclitic crises (recurrent attacks of unilateral glaucoma with mild cyclitic signs). Eight patients with aphakia had glaucoma which probably was primary. Bilateral mild glaucoma with unilateral nevus flammeus was present in two cases and two patients had retinitis pigmentosa associated with glaucoma.

In the light of present knowledge, primary glaucoma is regarded as a single disease in which the primary or predisposing cause consists of a dysfunction of the central regulatory mechanism, while the various anatomic and physicochemical conditions of the eye are modifying and precipitating factors.

A case of mild glaucoma without field loss is considered to be in a compensated phase, in the sense that the hypertension may serve a useful purpose. The prevalence of monocular cases in the congestive group, and the action of miotics in modifying the congestive attacks, may be explained by assuming the existence of a threshold of vasomotor irritability which must be exceeded before a congestive crisis manifests itself. In addition to ocular hypertension, there are other factors which influence the course of glaucoma. In the various forms of glaucoma, the tension and the other factors (X-factor) play a varying role in determining the progress of the field changes.

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SOME PROBLEMS IN THE CALIBRATION OF TONOMETERS*

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The present study was undertaken at the request of the Committee on Standardization of Tonometers of the American Academy of Ophthalmology and Otolaryngology and has been supported by a special grant from the Academy. Laboratory space for the work was provided by the Wilmer Institute and some of the human eyes used in the calibration measurements were supplied by the Eye Bank Associates, Inc. The present report concerns some of the preliminary aspects of the work and an attempted analysis of the factors that must be taken into consideration in such calibrating measurements.

The reasons for undertaking this work were many. In the first place, the magnificent study of Schiøtz in this field has never been comprehensively checked by any other investigator and, as will appear in the analysis below, Schiøtz's study is open to certain possible criticisms, the significance of which could be evaluated only by fresh experimental data.

In the second place, the Committee on Standardization of Tonometers has adopted certain specifications for the construction and dimensions of the Schiøtz tonometer. These specifications were based on a careful analysis of Schiøtz's own description of his instrument. It was found necessary, however, to specify some characteristics in respect to which Schiøtz's description is ambiguous. Choice in respect to such specifications has been guided by actual measurements on instruments certified by Schiøtz himself, but since some variation in the instruments was found there remained slight uncertainty as to how closely these modern specifications duplicated the instrument which Schiøtz used as a reference standard and which he used in his calibration experiments. Some of Schiøtz's calibrating measurements lend themselves readily to accurate reproduction and by this means the present standard instrument could be compared with that of Schiøtz.

In the third place the calibration experiments of McLean have led to a somewhat different estimate of the average normal intraocular pressure than had been reached by Schiøtz. The resulting disagreement between the Schiøtz and McLean scales has been a constant source of confusion. The present undertaking afforded an opportunity to test simultaneously a reference-standard Schiøtz, McLean, and also Gradle tonometer on the same set of eyes. While all sources of systematic error may not have been excluded in these measurements, it is to be expected that calibration scales based on these measurements would yield concordant clinical readings on the same eye with the three different instruments. For these measurements, a reference-standard Schiøtz instrument was contributed by the Sklar Company. This instrument was specially machined to correspond as closely as possible to the specifications of the Committee on Standardization of Tonometers. A similar reference-standard McLean tonometer, measured and adjusted by Dr. McLean, was contributed by Dr. McLean, and a reference-standard Gradle tonometer was contributed by the American Optical Company. Parallel measurements were made with all three instruments. The present report, however, concerns only those made with the Schiøtz.

I. OPEN MANOMETER READINGS

It will be recalled that in his calibrating experiments Schiøtz attached eyes to a manometer by a cannula inserted through the

* Presented at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947. From the Wilmer Ophthalmological Institute of The Johns Hopkins University and Hospital.

optic nerve (fig. 1). Introducing any desired pressure into the eye, he then rested the tonometer on the cornea and recorded the tonometer scale reading. Two sets of readings were made. In one set which he called the "open manometer" readings, the stopcock between the cannula and the manometer was

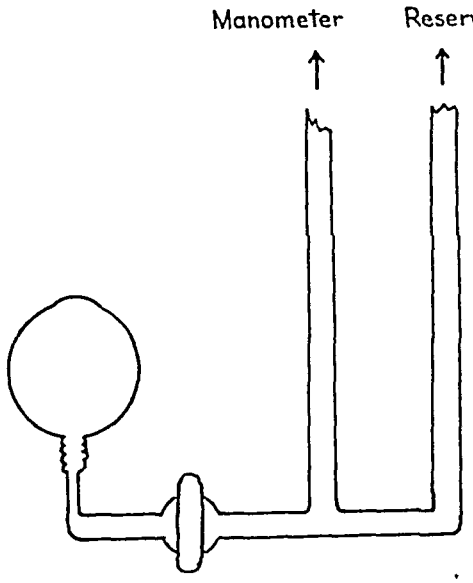
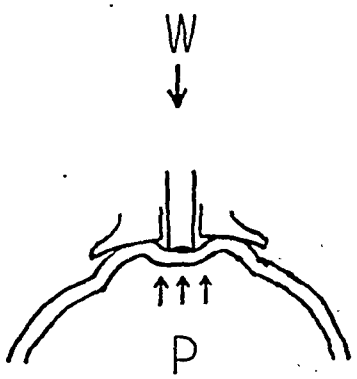


Fig. 1 (Friedenwald). Diagram of apparatus used by Schiøtz in calibrating his tonometer.

left open. These readings served to correlate the scale reading with the intraocular pressure in the eye while it carried the weight of the tonometer. In the second set of readings, which Schiøtz called "closed manometer" readings, a desired pressure was introduced into the eye, the stopcock then closed, and the tonometer applied. The closed manometer readings were the ones actually used for calibration purposes but the open manometer readings were useful to Schiøtz as a preliminary guide.

The open manometer readings showed, according to Schiøtz, much less experimental scatter from eye to eye than did the closed manometer readings, and this is indeed to be expected since variations in ocular rigidity would have much less effect on the former than on the latter readings. A repetition of the Schiøtz open manometer measurements could, therefore, afford a very good check in respect to whether the present reference-standard instrument does in fact closely resemble the original Schiøtz in certain important characteristics. Open manometer readings were, therefore, made on pig, cat, rabbit, and human eyes. Ten to 20 eyes of each species were used. Corneal curvatures were measured with a keratometer on all except the pig eyes, and cat and rabbit eyes were chosen whose corneal curvatures closely approximated the average normal human corneal curvature of 7.8- to 7.9-mm. radius.

In order to compare these various sets of data with each other and with the original observations of Schiøtz, some empyrical formula needs to be fitted to the data. The following argument was followed in arriving at such a formula. When the tonometer plunger comes to rest at a given scale reading, the downward force of the weight of the



$$W = PA$$

Fig. 2 (Friedenwald). Forces supporting the tonometer when it rests on the cornea.

plunger must be balanced by an upward force of the intraocular pressure acting over the area of indentation (fig. 2). This equality of the upward and downward forces can be expressed by the equation formulated by Fick and Maklakow:

$$W = PA$$

provided the weight W, pressure P, and area A are given in appropriate units. Thus if the

weight is given in grams, the area in square centimeters, the pressure must be expressed in grams per square centimeters. Now, if it should turn out that for a given tonometer scale reading, that is for a given depth of indentation, the area was constant then, by plotting our data with W/P as ordinate and scale readings as abscissa, all of the data for a given species of animal should fall on the same curve. The results of such a plot of the data obtained on cats, pigs, and human eyes is shown in Figure 3 in which Schiøtz's original data on human eyes are also shown. Each point plotted represents the average scale reading obtained on 7 to 20 different eyes with a given plunger load and intraocular pressure. It will be seen that the data do in fact fall on straight lines with no significant variation in respect to plunger weight. It follows that, for a given scale reading, the area of indentation is the same irrespective of whether this indentation is produced by a small plunger load at a low intraocular pressure or by a larger plunger load at a higher intraocular pressure. A straight line may be fitted to these data according to the formula

$$\frac{W}{P} = a + bR.$$

By the method of least squares, the values for a and b can be determined. For instance in the data on the cats' eyes a = 0.0795, b = 0.0091.

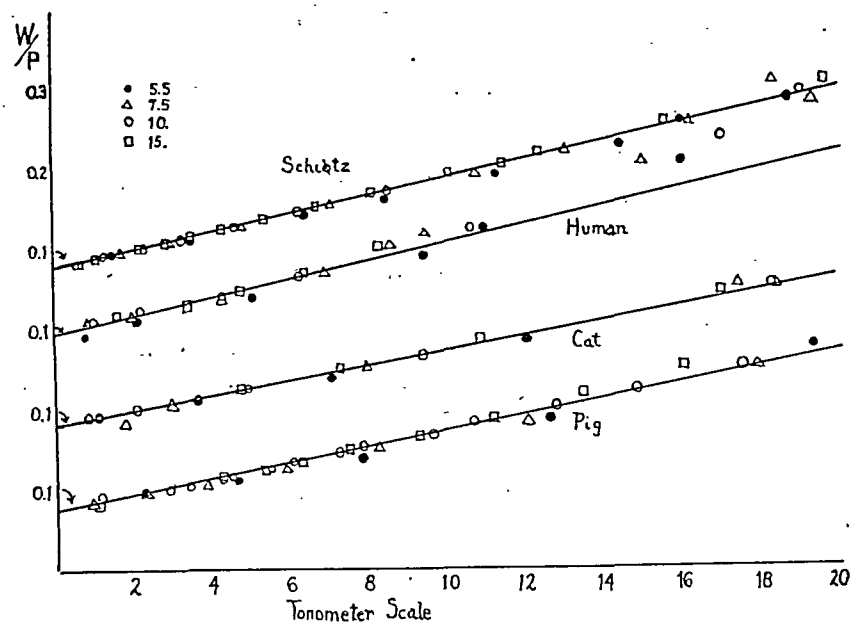


Fig. 3 (Friedenwald). Plot of open manometer data on human, pig, and cat eyes compared with Schiøtz original data on human eyes. The ordinate scale for each successive set of readings is shifted by 0.1 unit.

Applying the same analysis to the data obtained on the different species tested, and also to the data of Schiøtz's original measurements on human eyes,[1] one obtains a set of closely similar values for the coefficients a and b as shown in Table 1. The deviations between these different calculated values of the coefficients are probably statistically significant, but it is to be doubted whether they represent biologically significant differences. Thus, while there are differences between the values obtained on the four species, the values obtained from Schiøtz's data are identical with those I have obtained on the pig and differ slightly from those that I have

obtained on human eyes. Moreover, taking eyes with the same corneal curvature—cat, rabbit, and human—the corneal thickness is greatest in the cat, least in the rabbit. The coefficients, however, do not lie in any reasonable relationship to corneal thickness. In the calculations later in this paper I have used the coefficients derived from the measurements on cats' eyes, because these lie near to the average values for the whole series, and because the technician who made these particular measurements did so with unusual care and reliability.

TABLE 1

ANALYSIS OF DATA ACCORDING TO THE FORMULA $W/P = a + bR$

	a	b
Human	.085	.012
Human (Schiøtz)	.075	.0105
Pig	.075	.0105
Cat	.0795	.0091
Rabbit	.080	.0086
Average	.079	.0101
Value Chosen	.0795	.0091

In view of the close agreement between Schiøtz's open manometer data and those which I have obtained on these four species, it may be concluded that in respect to those aspects of tonometer construction which are involved in this type of reading, the present reference-standard instrument is a good reproduction of Schiøtz's original instrument.

The close agreement of the open manometer readings in the four different species requires some further comment. It is to be remembered that the pig's cornea is about 2-mm. thick, the rabbit's only about ½ mm., while the cat and human corneas fall between these extremes. Moreover, while the cat and rabbit eyes were chosen to have corneal curvatures closely approaching the average human, the radius of curvature of the pig's cornea is approximately 12 mm. If there were an appreciable resistance of the cornea to indentation one would expect an appreciable difference in the readings made on thick as against thin corneas. The fact that no difference was found which could be related to corneal thickness indicates that corneal resistance to indentation is negligibly small.*

One other aspect of these measurements should be noted. From the analysis above it is seen that the ordinates in these curves represent the area of the plunger indentation. Now, when the plunger is just flush with the foot plate, that is, for zero indentation, it must be supported by an area of cornea equal precisely to the area of cross section of the plunger. This area can readily be calculated and amounts to 0.0707 cm.^{2} One can inquire at what tonometer scale reading does the ordinate have this expected value.

As seen in Figure 4 which represents an enlargement of the type of curve plotted in Figure 3, the scale reading for zero indentation is not at zero on the tonometer scale but at minus one. The explanation of this apparent anomaly is quite simple. The radius of curvature of the tonometer foot plate and of the foot of the plunger are both 16 mm. When the instrument is put upon a test block of 16-mm. radius, the scale reading is minus one. Schiøtz, however, thought that the plunger would sink slightly into the corneal epithelium, deforming the epithelium before an actual indentation of the corneal stroma would take place. He estimated the depth of this epithelial deformation as 1/20 mm., or one tonometer-scale unit, and moved the zero of his tonometer scale one unit to the right to allow for this presumed effect. The results of the measurements with the open manometer show that this shifting of the zero

* The foot plate of the Schiøtz tonometer having a radius of curvature of 16 mm. is considerably flatter than even the pig's cornea. Similar measurements with the Gradle and McLean instruments, with their much more concave foot plates, yielded marked discrepancies between the open manometer readings on pigs as compared with the other species, but these tonometers also gave close agreement of open manometer readings on cats, rabbits, and humans.

by Schiøtz was not justified. I am not suggesting that the scale should be shifted back, since its present location has the merit of a familiar convention, but the erroneous location of the zero has bearing on some theoretical analyses of tonometric readings.

II. Closed manometer readings

The technique used by Schiøtz in his closed manometer readings has been briefly described. The eye is supported by being fastened on a cannula inserted through the optic nerve and the tonometer indents and distorts the cornea much as it does in ordinary clinical measurements, but since the full weight of the tonometer as well as that of the eye itself is supported by the cannula an additional indentation and distortion at the posterior pole results (fig. 5). The stresses placed upon the eye under these circumstances are very different from those imposed by the tonometer in vivo when the eye is supported by the orbital cushion. Schiøtz was himself aware of this discrepancy in his calibrating readings and attempted to avoid this in a later series of measurements in which eyes were studied postmortem without enucleation by inserting a fine cannula into the anterior chamber at the limbus. He found, however, that it was almost impossible not to distort the cornea by such a limbal cannula and that this method led to a very wide scatter in the experimental readings.

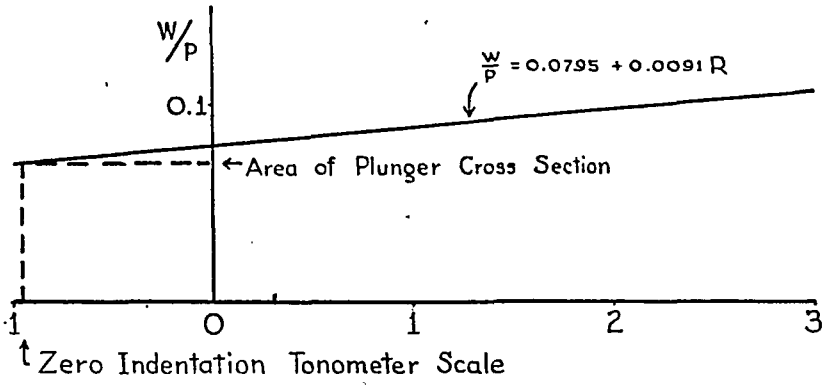


Fig. 4 (Friedenwald). Plot of open manometer data showing location of scale reading for zero plunger indentation.

In order to eliminate these difficulties and to support the test eye in a manner similar to that which occurs in the living patient, a somewhat more complicated apparatus has been developed (fig. 6). As in Schiøtz's original measurements, the eye is attached to a cannula inserted through the optic nerve, but this cannula is connected with a manometer through a universal joint and does not support the eyeball. A membrane is tied onto the cannula and arranged in such a fashion as to form a closed chamber, an artificial orbit, supporting the eyeball. This closed chamber is filled with fluid not con-

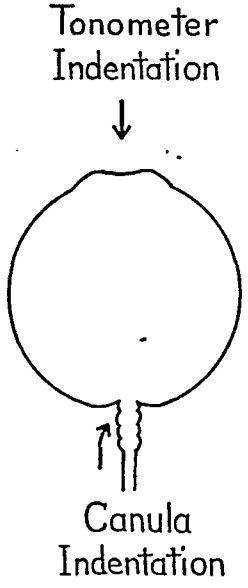


Fig. 5 (Friedenwald). Distortion of eyeball in Schiøtz's closed manometer readings.

nected with the manometric system, and the eyeball floats on this fluid chamber. When the tonometer rests on the eye, the globe is depressed slightly, the membrane stretches, and the pressure in the artificial orbit rises.

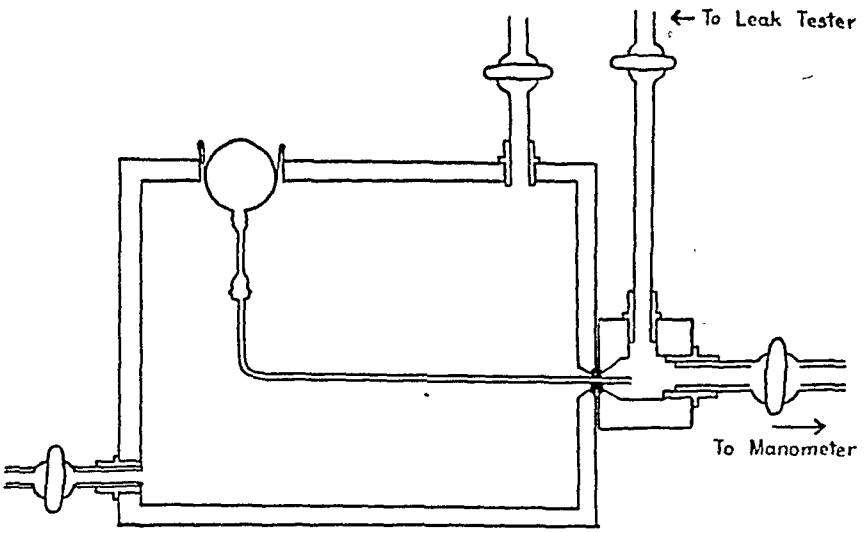


Fig. 6 (Friedenwald). Apparatus for closed manometer readings in which the eye is supported on an artificial orbit and indentation of the posterior pole by the cannula is avoided.

Only eyes that were quite fresh and free from disease or deformity were used for these measurements. After the cannula has been attached, it is necessary to aspirate some of the vitreous in order to insure a free flow of fluid in and out of the eye through the cannula. Only those eyes were used for closed manometer measurements in which a free connection was established with minimal manipulation. Finally, after the eye was attached in the calibrating apparatus it was tested for leaks and was rejected if at a pressure of 40 cm. of water more than one cubic millimeter of fluid leaked out per minute. Among the 30 human eyes which were obtained for this study, only four were found satisfactory by these very rigid requirements. The results of the closed manometer readings on these four eyes are given in Table 2.

The measurements on these four eyes do not, of course, suffice for calibration of the Schiøtz tonometer. They do, however, suffice to show that this method of calibration is unreliable. The first inkling that this was so was obtained by comparing the scale readings obtained with two different plunger loads at the same intraocular pressure. For instance at 30-cm. water pressure the av-

TABLE 2

RESULTS OF CLOSED MANOMETER READINGS ON FOUR HUMAN EYES PASSING RIGID REQUIREMENTS

Plunger Weight	5.5			7.5			10			12		
Pressure cms. H_2O	15	30	45	15	30	55	15	30	60	20	50	75
Human Eye												
1	11	6	0	12	7	2.25	15	10	4.5	14	7	4
2	8	4.75	0	9.5	5	1.0	10.5	8	3	11	5.75	3
3	8	5	3	11	7	2.0	13	9	3	12	5	2
4	7.5	3	0	8.75	5.5	2.0	11.5	8.75	4	13	7	4
Average Scale Reading	*8.63*	*4.69*	*0.75*	*10.31*	*6.13*	*1.81*	12.50	8.94	3.63	12.5	6.20	3.25
Log P mm. Hg	1.0465	1.3475	1.5236	1.0465	1.3475	1.6107	1.0465	1.3475	1.6485	1.1714	1.5693	1.7454
Log P_t mm. Hg	1.4121	1.5238	1.6746	1.5065	1.6143	1.7632	1.5842	1.6640	1.8192	1.6634	1.8163	1.9118
Δ Log P	.3656	.1763	.1510	.4600	.2668	.1425	.5377	.3165	.1707	.4920	.2470	.1663
V	21.10	12.56	6.24	20.61	12.02	5.70	21.55	14.13	6.21	20.51	8.91	5.29
Rigidity Coefficient Δ Log P/V	.0173	.0140	.0242	.0223	.0222	.0250	.0249	.0224	.0275	.0240	.0277	.0314

erage reading with the 5.5 weight was 4.7, while at the same pressure the average reading with the 10 weight was 8.9. Comparing these readings with similar pairs of readings that I had obtained some years ago on 500 normal human eyes,[2] it became evident that the rigidity of these dead eyes differed somewhat from that in the living. It was not apparent from these measurements whether the rigidity was the same throughout the set of measurements or whether it changed progressively. If the former were true, then correction factors might be calculated and an adequate calibration scale obtained provided a sufficient number of eyes were tested. If the latter were true, then the effort at direct calibration would have to be abandoned and some indirect procedure substituted. In order to find out what ocular rigidity corresponded to each one of these readings, it was necessary to get additional data as to the volume of fluid displaced by the tonometer foot plate and plunger when they were resting on the cornea.

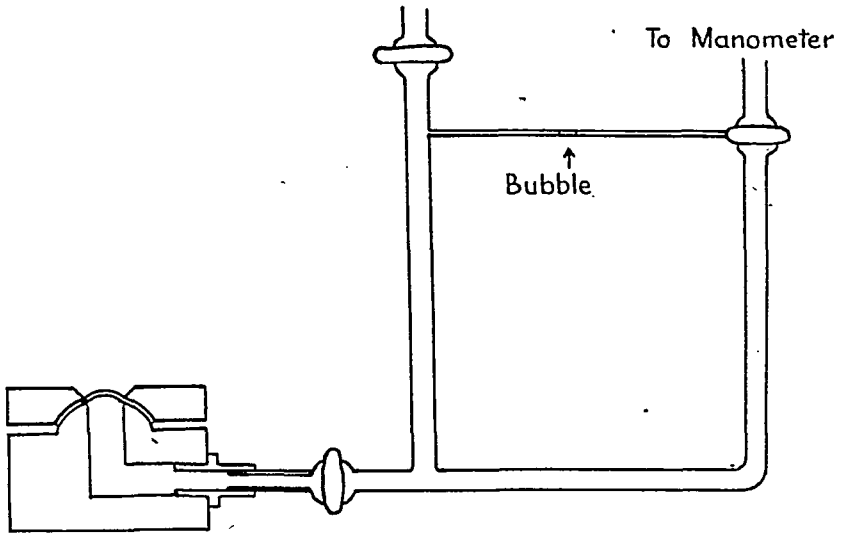


Fig. 7 (Friedenwald). Apparatus for measuring the volume of fluid displaced when the tonometer rests on the cornea.

III. Volume of indentation

To obtain the necessary data a new set of chambers was designed into which the anterior segment of an eye could be clamped leaving the cornea exposed (fig. 7). The chamber was connected with a manometer and reservoir through a calibrated capillary tube into which a bubble was introduced. With the pressure set at a desired level, the tonometer was lowered on to the cornea and the movement of the bubble recorded. Measurements were made on cat, rabbit, and human eyes at various pressures and with each of four different plunger loads.

Before analyzing the results of these measurements, the question of their reliability needed to be answered. It appeared possible that although the tissues were clamped into place with great care, the cornea might nevertheless be pulled or distorted in such a way as to make the readings unreliable. As a check against this possibility, we recorded the tonometer scale reading at each measurement and compared these, pressure for pressure, with our previous open manometer readings on whole eyes. The result showed that the open manometer readings were not distorted by this new method of attaching the eye to the manometer.

Each set of readings with a given plunger load on a set of eyes of the same species was found to fit quite satisfactorily an empyrical formula of the type:

$$P^N V = K$$

or the equivalent

$$\text{Log } P = B - \frac{1}{N} \text{ Log } V.$$

The numerical coefficients of these equations, N and K for the first, or N and B for the second, varied with the plunger load.

$$B = \frac{1}{N} \text{ Log } K.$$

Comparing eyes of the same species with different corneal curvatures, it was found that for a given pressure and plunger load the volume of the displaced fluid was greater the more deeply curved the cornea. This was to have been anticipated as may be seen from Figure 8, since, if the area of contact is the same in each case, more fluid will be displaced the higher the corneal dome.

Comparing eyes of the same corneal curvature but of different corneal thickness, for instance cats versus rabbits, it was found that the greater the corneal thickness the greater the volume of fluid displaced. This might also have been anticipated as may be seen from Figure 9 since, if the area on the inner surface in which the intraocular pressure supports the tonometer is the same in each case, more fluid will be displaced when the inner surface of the cornea is more deeply curved.

Comparing human eyes with those of rabbits and cats, it was found that the data on the human eyes agreed quite closely with those obtained on rabbits of the same corneal curvatures. Consequently the coefficients for the empyrical equations expressing the relation of pressure to volume of fluid displaced were first calculated from the rabbit data and then adjusted slightly to fit the human data. The combined results of these experiments and those with the open manometer correlate the tonometer scale reading with the intraocular pressure of an eye carrying the tonometer and the volume of the displaced fluid.



Fig. 8 (Friedenwald). *Schematic illustration of the relation between corneal curvature and volume of fluid displaced.* In each diagram the area of contact between tonometer foot plate and cornea is the same, but the cornea on the right is more deeply curved than that on the left.



Fig. 9 (Friedenwald). Schematic illustration of the relation between corneal thickness and volume of fluid displaced. In each diagram the curvature of the anterior corneal surface is the same and the area of the indentation of the posterior corneal surface is the same, but the cornea on the right is thicker, its posterior surface more deeply curved, and the volume of displaced fluid consequently greater.

These direct measurements of the volume of the displaced fluid may be compared with the indirect estimate which I made of the same volume in a study reported a number of years ago.[2] It is found that the volume actually measured is somewhat greater than that previously estimated. The reasons for this discrepancy are embedded in the various approximations used in the earlier calculations. No account was taken in those calculations of the fact that the curvature of the inner surface of the cornea differs from that of the outer surface. Furthermore the volume of the plunger indentation and of the foot-plate indentation were calculated inde-

pendently although the former influences the latter. Comparing the volumes of displaced fluid at the same intraocular pressure for two different plunger loads, there is quite good agreement between the two estimates, indicating that the earlier calculation of the volume of indentation produced by the plunger were reasonably accurate and that most of the errors in the earlier estimate concern the volume displaced by the tonometer foot plate.

With these new data we can now return to the closed manometer measurements on the four eyes reported above. For each reading we know the initial intraocular pressure. From the tonometer scale reading and the open manometer data we can calculate the pressure in the eye with the tonometer resting upon it. From this pressure and the known plunger load we can, with the aid of the new data, calculate the volume of fluid displaced. Knowing the initial and final pressure and the volume displaced one can, as has been shown elsewhere,[2] calculate the coefficient of rigidity. These calculations are shown in Table 2. It will be seen that, far from being constant during the experiment, the coefficient of rigidity of these eyes rose as the intraocular pressure was increased and as the experiment proceeded. It is evident that these dead eyes do not recover, as do living eyes, from the effects of transitory stresses. There is no reason even to believe that the ocular rigidity which characterized the very first reading in the series corresponded to that normally present in vivo. It is to be concluded, therefore, that the direct manometric calibration of tonometers on dead eyes is impossible and that errors due to abnormal rigidity are present not only in the closed manometer readings which I have just reported but also in the similar readings used by Schiøtz in his original calibrating measurements.

IV. Discussion

The situation, however, is by no means hopeless. The open manometer measurements and the measurements of the volume of displaced fluid are both unequivocally free from errors due to variations in ocular rigidity. From these data one can calculate calibration curves for any assigned value of ocular rigidity. Moreover, by finding out what are the most frequently paired readings obtained with different plunger weights on normal human eyes in vivo one can calculate the average normal ocular rigidity. Data on which such a calculation can be based are found in the report of paired readings with two plunger weights on each of 500 normal human eyes which I have previously reported.[2] I have calculated the average normal ocular rigidity from these clinical data using the current more reliable experimental data for open manometer pressures and volume of displaced fluid.

The calculations involved in the procedure are long and laborious and have not yet been completed, and I am not as yet prepared to present new calibration curves. I wish to confine the present report to the problems encountered in calibration experiments rather than to the final conclusions. Nevertheless, certain trends are already clearly visible in those parts of the calculations that have so far been completed. It seems clear that the calibration scales of Schiøtz and also of McLean are both too high and that the average normal intraocular pressure is probably between 18 and 19 mm. Hg rather than between 22 and 24 mm. Hg, as thought by Schiøtz or 27 to 28 mm. Hg, as thought by McLean.[3]

The best estimate that I am able to make for the coefficient of ocular rigidity of the average normal living eye has the value 0.0245 corresponding to an increase of 5.8 percent in the intraocular pressure for a displacement of one cubic millimeter of fluid. If one compares this average normal ocular rigidity with the values found on dead eyes in Table 2, it is seen that these eyes start out more flaccid than normal and become progressively more rigid during the course of the experiment passing through the normal range and finally reaching supranormal values. It should be noted that in these experi-

ments excessively high pressures were avoided. The highest pressure used was 75 cm. H_2O, that is, 55 mm. Hg. The cause of the abnormally low rigidity in dead eyes is not clear. One might have expected that with the loss of the compressible vascular bed, the enucleated eye would have a higher rather than a lower rigidity than in vivo.

If eyes with abnormally low rigidity are used for calibration measurements, then the scale determined by these experiments will give too high a pressure reading for eyes of normal rigidity. Conversely, if eyes with abnormally high rigidity are used for calibration, then the scale determined by these measurements will give too low a pressure reading for eyes of normal rigidity. Since the enucleated eyes used in closed manometer experiments start out with abnormally low rigidities and end up with abnormally high rigidities, a scale determined from such measurements will deviate from the true value in both directions. It is natural in such measurements to start with low pressures and proceed to higher ones. It would appear that this was the procedure used by Schiøtz and that in the region of normal pressures determined with the 5.5 weight his scale gives too high a pressure value, while at the upper limit with the heavier weights the scale is too low. McLean, on the other hand, who had only one plunger weight to deal with, and who was most meticulous in avoiding high intraocular pressures until the end of his experiments, appears to have done most of his measurements on eyes that were still in the abnormally flaccid state. His scale appears, therefore, to err throughout on the high side, though percentually the deviation decreases in the upper ranges.

It is perhaps of interest to note that Verhoeff on the basis of his experience with the Souter tonometer has for years maintained that the average normal intraocular pressure is not above 20 mm. Hg. The Souter tonometer, although afflicted with very large and erratic reading errors, is, at least theoretically, an instrument in which variations in ocular rigidity do not significantly affect the reading.

It should be pointed out that tonometric calibration based on the indirect method which I have outlined involves the use of a theory as to the role of ocular rigidity in the tonometric reading for which there is both a priori and experimental support, but which is, nevertheless, assuredly subject to further refinement and correction. In view of this, the calibrations that can be achieved by this method, although having a high probability of correctness, cannot be regarded as final even within the limits of error of the experimental data used for the calibration.

Finally, lest there be any misunderstanding, it must be clear that, no matter what the calibration scale in terms of millimeters of mercury, a tonometer scale reading under 3 with the 5.5 weight still means an abnormally high pressure or rigidity.

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BETA IRRADIATION AS A POSSIBLE THERAPEUTIC AGENT IN GLAUCOMA*

AN EXPERIMENTAL STUDY WITH THE REPORT OF A CLINICAL CASE

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Whatever the special etiologic factors may be in a given case of glaucoma, the condition is always the result of an increase in intraocular pressure. The increased tension is itself the result of (1) the production of an abnormal amount of intraocular fluid, or (2) decreased absorption of a normal amount of fluid, or (3) blockage of normal intraocular channels of drainage.

Medical and surgical therapeutic methods, none of which have given uniformly satisfactory results, have up to this time been chiefly aimed at increasing the rate of flow through drainage channels. Recently cyclodiathermy[1] has been employed, with the objective of decreasing the production of intraocular fluid by destruction of the secretory process of the ciliary body. The theory is sound, but the method is attended with too much risk to warrant its routine use. It may cause damage to the lens, the cornea, the iris, the retina, or the sclera. Loss of vitreous, hemorrhage into the anterior chamber, and scleral slough are always possibilities, and all may be associated with irreparable impairment of vision.

It occurred to us that the effect aimed at by the use of diathermy in glaucoma, that is, destruction of a portion of the ciliary body, with a resulting decrease in the production of aqueous and, in turn, a decrease in intraocular pressure, might be brought about without injury of the lens or other ocular structures by the use of irradiation. The considerable experimental work done up to this time on the effects of beta irradiation on the eye, as well as the clinical use of the method, has apparently been limited to the lids, the cornea, and the conjunctiva.[2-4] In Warren's[5] excellent review of the effects of irradiation on the tissues no mention is made of irradiation of the ciliary body, nor has an independent search of the literature revealed any such studies. The experiments reported herewith were therefore undertaken, for the purpose of determining (1) the effect of irradiation with beta rays on the ciliary body and (2) the degree of destruction which could be brought about in that structure without injury to the lens.

MATERIALS AND METHODS

The materials used in this study consisted of 18 adult rabbits, each weighing 5 pounds or more. Two animals (nos. 3B and 12) died of intercurrent disease early in the experiment, and another (no. 3), which developed cataract and exophthalmos 5 days after the first treatment, was discarded, since these are not the usual results of irradiation.

Treatment consisted of the application of 50 mg. of radium, in an applicator devised by Iliff, over the ciliary body of the left eye, for 30-minute periods. One group of animals received one treatment. Three other groups received, respectively, 2, 3, and 4 treatments, at 7-day intervals. All applications were made under anesthesia obtained by subcutaneous injections of nembutal. The rabbit was placed on the table, with the head to the side, and the applicator was so suspended that it was in direct contact with the eyeball. Its weight kept the eyelids open without difficulty, and the position of the eye was such that the rays passed into the ciliary body through the sclera.

Three animals (nos. 7, 14, and 16), which

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had had, respectively, 3 treatments, 2 treatments and 1 treatment, each, were preserved for further study. No gross changes have been observed in their eyes to the date of writing (20 weeks). The remaining 12 animals were killed at intervals of from 5 to 42 days after the first treatment. Paraffin sections of the eyes were made in 3 cases (nos. 5, 10, and 11), but the decision to employ this method proved unfortunate, since it did not permit satisfactory preparation of the lens. In the other 9 animals the eyes were prepared by the celloidin technique and were stained with hematoxylin and eosin. In each instance the untreated right eye was used as a control.

Results

Gross Findings

All the animals which received 2, 3, and 4 treatments developed severe mucopurulent conjunctivitis with necrosis of both the palpebral and the bulbar conjunctiva, obviously as the result of failure to protect these tissues from the rays. The results were what might have been expected and probably could be obviated by proper screening.

There were no gross changes and no ophthalmoscopic abnormalities in the iris or the lens in any case. The control eye was negative in every animal.



Fig. 1 (Haik, Breffeilh, and Barber). Section of left-eye ciliary body of rabbit No. 15, which received one application of 50 mg. of radium for 30 minutes and was killed 21 days later. The ciliary processes show edema, and there are slight endothelial changes in the walls of the capillaries.

Microscopic Findings

Group I. The 4 animals in the group (nos. 10, 11, 17, and 15) each received one treatment consisting of the application of 50 mg. of radium for 30 minutes. They were killed at 5 (no. 10), 9 (nos. 11 and 17) and 21 (no. 15) days after the first treatment. A 5th animal (no. 16) which was given the same treatment was preserved for further observation. The lens was lost in 2 animals (nos. 11, 10) as the result of preparation by paraffin section.

In animal No. 11, which was killed at 9 days, the ciliary body was swollen and showed marked infiltration of both acute and chronic inflammatory cells, with some necrosis. Degeneration of the ciliary epithelium and dispersion of pigment were also noted. The reaction in this eye was comparable to that observed after 3 treatments (50 mg. of radium for 90 minutes) and 4 treatments (50 mg. of radium for 120 minutes).

Animal No. 17, which was also killed 9 days after treatment, and animal No. 15, which was killed 21 days after treatment, both showed only slight edema of the ciliary processes and some scattering of pigment (fig. 1). The endothelial cells in the walls of the capillaries were clumped and swollen. The nuclei of the fibers of the lens were slightly scattered from the normal equatorial bow in both animals, and the fibers appeared hydropic.

Group II. The 5 rabbits in this group (nos. 5, 8, and 13) received 2 treatments

each at 7-day intervals (a total of 50 mg. of radium for 60 minutes). They were killed, respectively, 12, 15, and 28 days after the first treatment (5, 9, and 21 days after the last treatment). All the specimens presented the usual features of inflammation. The stroma of the ciliary body (fig. 2) was edematous, with early hyalinization. The epithelium was vacuolated and clumps of pigment could be seen in the stroma. Capillaries in the ciliary processes showed evidence of stasis. A few blood vessels in the stroma had thickened walls and the endothelium was irregular. There was no evidence of healing.



Fig. 2 (Haik, Breffeilh, and Barber). Section of left-eye ciliary body of rabbit No. 8, which received two applications of 50 mg. of radium at 7-day intervals for a total of 60 minutes and was killed 16 days after the first treatment. The ciliary processes show stasis, and there is early hyalinization of the stroma.

The sclera was somewhat less cellular than normal in all 3 rabbits but otherwise showed no changes. The lens in animal No. 5, which was prepared by paraffin section, was lost. The lenses in the other rabbits (nos. 8 and 13) were definitely damaged (fig. 3). The nuclei of the fibers were disarranged and the fibers were swollen and in some areas were liquefied. Cataractous changes were observed in both of these eyes.



Fig. 3 (Haik, Breffeilh, and Barber). Section of ciliary body of left eye of rabbit No. 4, which received four applications of 50 mg. of radium at 7-day intervals for a total of 120 minutes and was killed 16 days after the first treatment. The stroma of the ciliary body is smooth and hyalinized, and the epithelium is replaced by a layer of flat cells.

Group III. The 3 rabbits in this group (nos. 7, 9, and 6) received three treatments each at 7-day intervals (a total of 50 mg. of radium for 90 minutes). Rabbit No. 7 was kept for further study. Rabbits No. 9 and No. 6 were killed, respectively, 23 and 35 days after the first treatment (9 and 21 days after the last treatment). The inflammatory changes in both these specimens appeared more chronic than the changes observed in the animals in Group II, and in both there was slight evidence of healing. There was



Fig. 4 (Haik, Breffeilh, and Barber). Section showing ciliary body of normal control.

marked hyalinization of the stroma of the ciliary body and the blood vessels were seen only in faint outline. There was hemorrhage into the ciliary processes.

Changes in the lens (fig. 4) were more marked in these specimens than in the specimens in Group II. Vacuolation of fibers and fragmentation of nuclei in the treated eyes of both animals were observed, and cataracts were present in both.

Group IV. The 3 rabbits in this group (nos. 2, 1, and 4) each received four treatments at 7-day intervals (a total of 50 mg. of radium for 120 minutes). They were killed, respectively, 26, 30, and 42 days after the first treatment (5, 9, and 21 days after the last treatment). The changes observed in the treated eyes of rabbits No. 2 and No. 1 were similar to those described for the specimens in Group III, that is, obliteration of blood vessels, slight healing of the ciliary body, and cataracts. Rabbit No. 4, however, which was killed 21 days after the fourth treatment and 42 days after the first treatment, showed entirely different findings (fig. 5). There was considerable advance in the reparative process. The ciliary epithelium was completely absent over the area treated and was replaced by a thin, flat membrane. No blood vessels could be identified, and the stroma was smooth and hyalinized.

The lens (fig. 6) was cataractous, with necrotic nuclei and vacuolated, hydropic fibers. The sclera in the treated area appeared less cellular than in the untreated eye, and only a few scattered leukocytes could be seen. Early organization was apparent in the subconjunctival tissues. The



Fig. 5 (Haik, Breffeilh, and Barber). Section of lens of left eye of rabbit No. 8. The lens shows early cataractous changes in the fibers at the equator.

fact that this animal was an albino rabbit accounts for the lack of pigment in the specimen.

Control Specimens. None of the untreated right eyes used as controls showed any microscopic changes (figs. 4 and 8).

Discussion

The experiments reported in this communication were planned in the light of the changes in the vascular endothelium, leading to proliferation and various degrees of occlusion of the lumen, which have been reported after beta radiation and which are most marked in the endothelium.[2-4] The object of the study was to determine whether

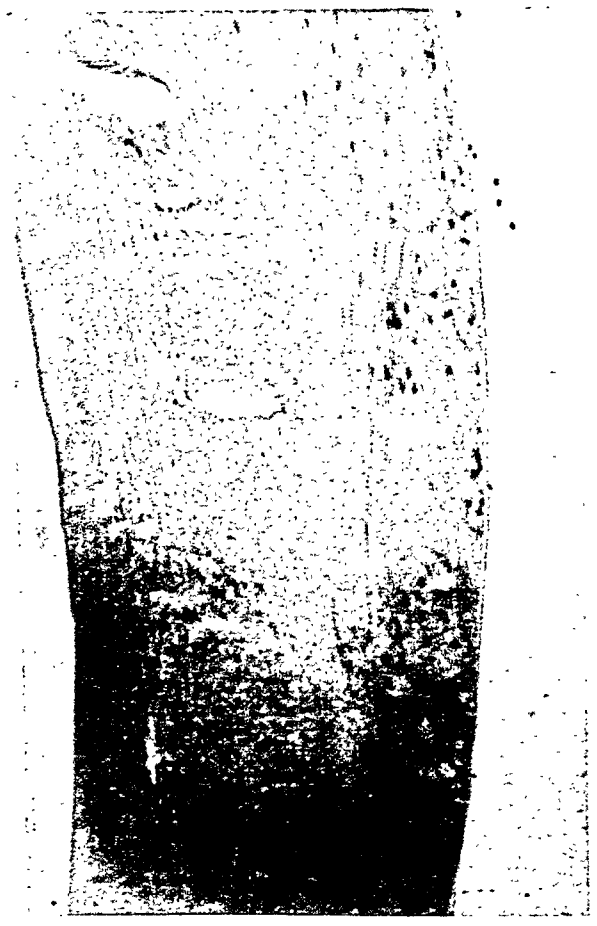


Fig. 6 (Haik, Breffeilh, and Barber). Section of lens of left eye of rabbit No. 9, which received three applications of 50 mg. of radium at 7-day intervals for a total of 90 minutes and was killed 23 days after the first treatment. The lens shows scattered nuclei and swollen fibers in the equatorial region.



Fig. 7 (Haik, Breffeilh, and Barber). Section of lens of left eye of rabbit No. 4. The lens is cataractous, with necrotic nuclei and vacuolated, hydropic fibers.

it was possible, by the use of such radiation, to reduce the aqueous production in the rabbit's eye by bringing about obliteration or partial occlusion of the capillaries in a portion of the ciliary body. An excessive dosage was deliberately used, to permit a study of the type and rate of the healing process.

In one animal (no. 11) the application of 50 mg. of radium for 30 minutes resulted in excessive destruction of the ciliary body. In 2 other rabbits (nos. 17 and 15) which had the same amount of treatment, there was only slight damage to the endothelium of the ciliary blood vessels. In the animals treated by two applications of 50 mg. of radium for 30 minutes per treatment definite obliteration of the vessels of the ciliary body resulted. When four treatments were given (50 mg. of radium for a total of 120 minutes), healing, as evidenced by hyalinization



Fig. 8 (Haik, Breffeilh, and Barber). Section showing lens of normal control.

of the ciliary stroma, was observed 21 days after the first treatment and was quite complete at 42 days. The cumulative effect of the dosage of radium did not seem to alter the histologic details to any great degree.

In planning these experiments, the observations of previous workers on other tissues were used as a starting point. According to Linser (cited by Warren[6]), maximum effects of irradiation are observed in the blood vessels by the 8th posttreatment day and the process of repair is well advanced by the 20th day. In our own experiments, although the reaction in the eye after irradiation is less marked than the reaction in other parts of the body, the peak of vascular dilatation was reached on the 9th day and healing was evident by the 3rd week after the last treatment, which are comparable intervals. Edema and inflammation of the palpebral and bulbar conjunctiva reached a maximum at about 10 to 12 days and healing was evident by the 3rd week after the last treatment.

The significant time interval, however, seems to be related to the number of days after the first treatment rather than after the last. Animals No. 13 and No. 4 were both killed 21 days after the last treatment. The ciliary body and the lens showed an equal degree of damage in both specimens, but the degree of healing differed. In animal No. 4, which was killed 42 days after the first treatment, there was definite evidence of healing, but in animal No. 13, which was killed 28 days after the first treatment, there was no evidence at all of healing. The reparative process therefore seems to require more than 28 posttreatment days, and the cumulative effects of radium seem to have little influence on the results.

Rabbits No. 11 and No. 17, both of which were killed 9 days after the first (only) treatment, showed no changes in the lens, and animal No. 15, killed 21 days after the first (only) treatment, showed only a slight change. All the other rabbits, regardless of the amount of treatment which they had received or the time at which they were killed, showed definite cataractous changes. To make this method practical, therefore, it will be necessary to establish the minimum dose of radium which will secure the desired vascular obliterative changes in the ciliary body without, at the same time, damaging the lens. It will also be necessary to develop an applicator which will permit the emanation of pure beta rays while at the same time excluding gamma rays, which are damaging to the lens. At the present time no such applicator exists.

Case report

In the following case the application of radium was a last resort. The method was resorted to because it was impossible to accomplish with it any more harm than had already been accomplished by the disease process.

A 4-year-old boy with congenital bilateral buphthalmos was first seen in the Charity Hospital of Louisiana Eye Clinic November 14, 1946. An iridotasis was performed on the left eye on November 18th and on the right eye on November 25th. Massive prolapse of the ciliary body occurred into the operative wound on the right side, the cornea became hazy, and there was marked injection of the ciliary body. Enucleation was therefore carried out on December 16. The specimen showed hydrophthalmos, dislocation of the lens, and detachment of the retina and choroid as the result of hemorrhage, chronic uveitis, and glaucomatous cup. Carcholin therapy was instituted, and the child was followed in the clinic until the end of May, 1947.

When he was next seen, in August, 1947, the tension in the remaining (left) eye was 55 mm. Hg (Schiøtz). It varied between 30 mm. and 49 mm. until October 2nd. On this date, 50 mg. of radium was applied to the nasal side of the limbus and 50 mg. to the temporal side, each application lasting 10 minutes; the Iliff applicator was used. A similar application was made on October 6th. The day after the second application the tension (Schiøtz) was 25 mm. Hg. On October 11th, it was 35 mm.; October 12th, 19 mm.; October 13th, 24 mm.; October 14th, 30 mm.; October 17th, 35 mm.; October 19th, 40 mm.; and October 21st, 40 mm. On October 21st, 50 mg. of radium was applied for 10 minutes at the 9-o'clock position. Between that time and the present writing (December 9, 1947) the tension has varied between 25 and 55 mm. It was above 40 mm. on only 7 of the 29 readings. It was consistently higher for a week after miotics were discontinued (November 20th), then showed a somewhat lower trend, although readings were still between 30 and 40 mm.

Vision at the time of the first application of radium had decreased to 3 to 4 feet. There has been no additional loss to date.

Whether irradiation will accomplish anything in this case it is impossible to say. To date, however, there have been no evidences of harmful effects, the only reaction following irradiation being a slight, transitory reddening of the eyelids. The most encouraging feature of the case is that since the application of radium there has been no progression of a condition which was progressing before treatment was instituted and the natural tendency of which is toward progression. A long period of observation will be necessary before definite statements can be made concerning results, and at the present time there would be no justification for using this method in any case which was not as clearly hopeless as this one was.

Summary and Conclusions

A series of experiments has been described, in which beta irradiation was applied to the ciliary body of rabbits in varying amounts over varying periods of time, in an endeavor to determine the practicability of treating glaucoma by obliteration of the vascular supply of the ciliary body, with the objective of bringing about a decrease in the production of intraocular fluid.

While vascular changes were achieved in the majority of cases, damage to the lens also resulted in almost every instance in which the desired changes were achieved.

The method proposed thus seems theoretically sound. To make it practical, however, a dosage of radium must be established which will achieve the desired changes in the ciliary body without at the same time damaging the lens. This objective could probably be accomplished if an applicator were available which would permit the emanation of beta rays but would screen out gamma rays.

A clinical case is presented in which irradiation was employed because the state of the eye was already practically hopeless. The treatment has apparently produced no ill effects but the therapeutic results are still inconclusive.

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FLARE-UP OF TRACHOMATOUS PANNUS DUE TO ARIBOFLAVINOSIS*

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Pannus is an essential manifestation of trachoma. Appearing at a very early stage of the disease it is decisive in the differential diagnosis. It represents the progress by continuity of the disease from the conjunctival lesion into the subepithelial tissue of the bulbar conjunctiva and the cornea. In one

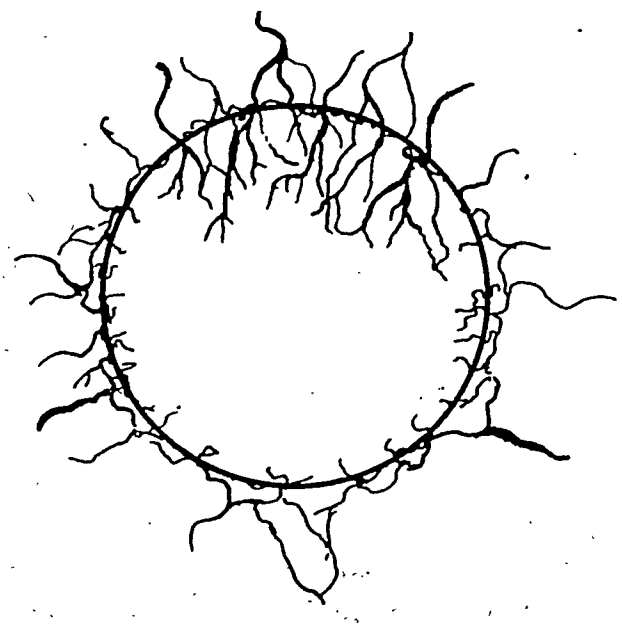


Fig. 1 (Landau and Stern). Trachomatous pannus and ariboflavinosis.

form or another it remains recognizable throughout the whole life of the patient.

Treatment of pannus in active trachoma coincides with the treatment of the palpebral conjunctiva. Once the conjunctival lesions enter the cicatrizing stage, the vessels of the pannus become thinner, anemic, and eventually almost invisible unless the slitlamp is used.

There are cases, however, in which a marked discrepancy exists between the aspect of the cornea and the palpebral conjunctiva. The latter may be entirely smooth and well cicatrized, and yet a marked pannus, that is, hyperemic blood vessels, may extend over the cornea. The patients complain of watering, itching, and burning, and sometimes exhibit even marked photophobia. This condition often proves very difficult to treat. Operations like peritomy and peritectomy suggested for such cases have been abandoned because their results are decidedly unsatisfactory.

When some cases of this kind were examined carefully with the slitlamp, it was found that the cornea was vascularized not only in its upper half, as in classical trachomatous pannus. The typical aspect of grayish infiltration in the corneal epithelium was present only in the upper part but fine blood vessels of 1 to 3 mm. in length could be seen encroaching upon the clear cornea from the limbus over the entire circumference, similar to the limbal "flush" described in ariboflavinosis (fig. 1). This peculiar finding induced us to attempt to influence the con-

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dition with riboflavin and other components of the vitamin-B complex in a number of cases.

Ten cases have been observed so far, and the history of a typical one follows. The relevant data of the other cases are presented in Table 1.

Report of a case

Case 6. J. K., a woman, aged 45 years, suffered during childhood from trachoma which had healed with corneal opacities. In the right eye vision was reduced to counting of fingers at 1 m. For the past few weeks she complained of photophobia and burning in both eyes. The corneas presented an acute trachomatous pannus and, in addition, a typical ariboflavinotic corneal vascularization. The pannus reached the pupillary region in the left eye, and visual acuity amounted to 6/36. The patient received 5 mg. of riboflavin twice daily by mouth. One week later, considerable improvement was noted. Vision in the left eye was 6/18 and the corneal vessels became much thinner. After another week of treatment, the subjective symptoms vanished, the corneal vessels were greatly constricted, and the pannus assumed the aspect usual in inactive trachoma. With a vision of almost 6/12 the patient declared that she had not felt so well for a long time.

TABLE 1

DATA ON 10 CASES OF TRACHOMATOUS PANNUS TREATED WITH RIBOFLAVIN

No.	Sex	Age	Trachoma Stage	Trachom. Pannus	Ariboflavinotic			Diet	Treatment	Time (days)	Result	Visual Acuity
					Corneal Vascularization	Cheilitis	Glossitis					
1	f	19	IV	+++	++++	—	—	good	Riboflavin 2×5 mg. daily	7	very good	
2	f	42	IV	+++	+++	+	+	very poor	Riboflavin 2×5 mg. Bevitex 1.5 g. Yeast 3 g.	14 14 14	very good	
3	f	18	IV	++	+	—	—	poor	Riboflavin 2×5 mg. daily	18	very good	
4	f	44	IV	+	+++	—	—	very poor	Riboflavin 2×5 mg. daily	7	very good	
5	f	42	IV	++++	++++	—	+	very poor	Riboflavin 2×5 mg. daily	7	very good	
6	f	45	IV	++	+++	—	—	poor	Riboflavin 2×5 mg. daily	9	very good	O.S., 6/60 *improved to* O.S., 6/12
7	f	14	IV	+++ O.D. ++ O.S.	+	—	+	poor	Riboflavin 2×5 mg. daily	4	very good	O.D., 6/24 *improved to* O.D., 6/18
8	m	62	IV	Total	Pannus	++	++	very poor	Betotal 2 cc. i.m. daily	6	good	
9	m	58	IV	Total	Pannus	++	++	very poor	Betotal 2 cc. i.m. daily	6	good	
10	f	22	IV	+++	++	—	—	good	Betotal 2 cc. i.m. daily	4	very good	

None of the patients received any kind of local treatment.
"Betotal" ampules (2 cc.) contain 3.0 mg. Vitamin B_1, 1.5 mg. B_2, 20 mg. nicotinic acid, 2.0 mg. B_6, 3.0 mg. calcium pantothenate and 400 mg. crude liver extract.
"Bevitex" tablets contain 3.3 mg. B_1, 2.0 mg. B_2, 20 mg. nicotinic acid, 0.4 mg. B_6, 3.0 mg. pantothenic acid.

Comment

All cases responded very well to medication with riboflavin alone or with vitamin-B complex in the form of yeast or proprietary preparations. The total B complex has lately been given preference because ariboflavinosis must be regarded as an expression of a relative deficiency in the other constituents of the B complex, as well. The normal dietary sources of riboflavin (meat, bread, dairy products) contain considerable amounts of thiamine, nicotinic acid, and so forth, and

it is correct to assume that an insufficient intake of riboflavin also entails a diminished intake of the other members of the group. The complex deficiency may remain subclinical with the exception of the riboflavin deficiency, because the eye seems to be a particularly sensitive indicator of a disturbance in cell metabolism. The corneal tissue, devoid of blood vessels, can be assumed to suffer first when the absence of riboflavin prevents the proper synthesis of the respiratory enzymes. It was, therefore, decided also to administer B-complex preparations, after the first cases that had received riboflavin alone had shown the prompt response described above.

To explain the therapeutic success with vitamin-B complex in such "intractable" pannus in cases of completely cicatrized trachoma, it must be remembered that the blood vessels constituting the pannus do not leave the cornea entirely once the trachoma has become inactive. Although contracted, they still exist and remain visible, with the slit-lamp, as minute channels with a sluggish, much reduced circulation. If a riboflavin deficiency occurs at this stage of trachoma, the well-known response of the cornea sets in—the limbic plexus becomes flushed and fine capillaries encroach upon the cornea, most probably in order to relieve the disturbance of the respiratory process of the corneal cells. In trachoma IV, where the disease has ceased to be active but where the vessels of the pannus are still present, the limbic vessels in this region do not seek new pathways to invade the cornea, having at their disposal the old channels of the trachomatous pannus. The vessels become engorged and present the picture of an active trachomatous pannus—with this difference that, in addition, newly formed vessels have invaded the cornea in the rest of its circumference, hitherto devoid of vessels.

Adequate provision of riboflavin will then, of course, exert its beneficial effect on the newly formed vessels as well as on the old pannus. The ocular signs of ariboflavinosis are relatively frequent among the patients of our out-patient department who come from the poorer classes and whose diet is frequently grossly deficient.

An additional factor may play a rôle in the flare-up of a pannus in clinically cured trachoma. The corneal tissue of an eye which has undergone trachoma is rarely entirely normal and may be subject to occasional breakdowns as shown by the frequent recurrences of corneal infiltrations in some cases of inactive trachoma. An analysis by Feigenbaum* in 1921, of 3,389 cases of Koch-Weeks conjunctivitis of which about one third were also affected with trachoma, may be quoted in order to illustrate this fact. The frequency of involvement of the superficial corneal layers was 3.1 percent in patients free from trachoma, and 13.1 percent in trachomatous patients, which, according to the author, clearly points to a less favorable state of the corneal tissue in trachoma. It is conceivable that the corneal tissue of such eyes is more sensitive to a lack of riboflavin.†

* Feigenbaum, A.: Hornhautkomplikationen bei der in Palästina epidemisch vorkommenden Koch-Weeks Conjunctivitis. Klin. Monatsbl. f. Augenh., 67:436-443, 1921.

† We are indebted to the Winthrop Products, Inc., New York, and Teva, Ltd., Jerusalem, who kindly furnished the riboflavin (Ribotone and Betotal, respectively,) used in these trials.

MIKULICZ'S DISEASE AND SYNDROME*

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Mikulicz's disease and syndrome constitute problems of considerable clinical interest. Patients afflicted usually consult an ophthalmologist. The report by Haltenhoff,[1] an ophthalmologist, 1889, mentions a report by Gallasch,[2] 1874, of this syndrome in relation to leukemia. Mikulicz,[3] in 1888, presented a case at a medical meeting and first published his article in 1892. Following his description, the disease has come to bear his name. E. Fuchs,[4] 1891, published a case as lacrimal lymphosarcoma; and Zirm,[5] 1892, reported the syndrome, presumably caused by erysipelas. Following these pioneers, numerous reports have been published from all over the world.

The Mikulicz report described bilateral, painless, swollen upper eyelids associated with a nodular form of tumor of the lacrimal glands, unattached to the skin, and with a similar involvement of the parotid and submaxillary glands. There were no signs and symptoms associated with general health. The process remained local, ran a fairly long course, and regressed. Microscopic examination of sections of the glands showed masses of small round cells, lymphoid in character, fine reticulum, increase of fibrous stroma, and the remaining acini unchanged.

REPORT OF A CASE

A report of a case (WA 783,394) apparently showing a primary lesion in the lacrimal gland, the pure "Mikulicz" type, follows:

History. The patient, a Negro, aged 19 years (fig. 1), was admitted to the Receiving Hospital October 10, 1941, and was discharged November 17, 1941. For three months he had a painless and gradually increasing swelling of the left upper lid and slight protrusion of this eye. Two weeks before admission the right eye began to assume a similar appearance and course. He entered the Hospital because of disfigurement.

Eye examination. There was no diplopia. There was some reduction of tears. Examination of the left eye showed proptosis (fig. 2) and the appearance of an inward deviation. There was a fixed tumor mass, the size of a hickory nut, in the upper outer aspect of the orbit. The lacrimal gland area of the right eyelid showed swelling and a movable tumor the size of an almond. Conjunctivas and the movements of the extraocular muscles were normal. The pupils were equal and reacted to light and accommodation. There was no fever.



Fig. 1 (Heath). *WA 783,394.* Pure type of Mikulicz showing bulging of lids associated with nodular growth and the illusion of convergent squint with ptosis.

* Presented at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947. From Wayne University and Receiving Hospital, Detroit, Michigan, Departments of Pathology and Ophthalmology.



Fig. 2 (Heath). *WA 783,394.* Lateral view showing proptosis of the left eye.

Laboratory tests. O.T. (old tuberculin) test, in a dilution of 1:10,000, was negative at 48 hours. Blood Kline test negative. Hemoglobin, 14 gm.; erythrocytes, 4 M; white blood cells, 6,800; neutrophiles, 78; lymphocytes, 18; urea, 21. Urinalysis was negative, except the first specimen which showed a 3+ albumin (possibly a contamination).

X-ray examination. Orbit: October 10th and 15th, showed no orbital bone destruction. Chest: October 10th, showed no areas of infiltration. Hands: October 10th, showed no pathologic condition of the bones.

Surgery. On October 22nd, a biopsy of the left lacrimal tumor was done. On November 4th, the left lacrimal gland was removed through the conjunctiva, and on November 11th, the right gland was removed through the skin (fig. 3).

Microscopically, the sections of the tumor showed a moderate number of nests of epithelioids and lymphoid follicles with open centers, and occasional giant cells. There was no caseation and a marked fibrosis replaced reticular and acini tissue. A well-advanced lymphogranulomatosis was present in the stage of healing by sclerosis and scar formation (figs. 4 and 5).

Additional case histories

Following are some brief case histories illustrating Mikulicz's syndrome with different etiologies, namely, tuberculosis and sarcoid, syphilis, gout, and rheumatism, and giant-cell follicular hyperplasia. Other etiologies could be added, such as leukemia, lymphosarcoma, uveoparotid fever, and, relatively rare, Hodgkin's disease.

Case 1

History. R. E., a Negro, aged 21 years, was admitted on August 13, 1929, to the Receiving Hospital, and discharged on October 13, 1929. He had a progressive painless enlargement of the parotid and submaxillary glands of one year's duration, with progres-

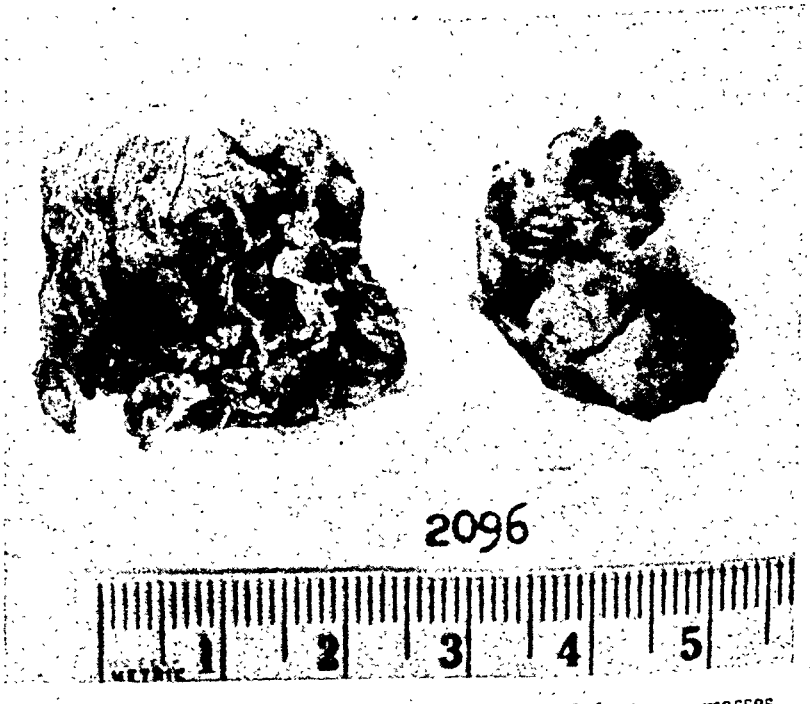


Fig. 3 (Heath). *WA 783,394.* Gross appearance of the tumor masses removed from the left orbit.

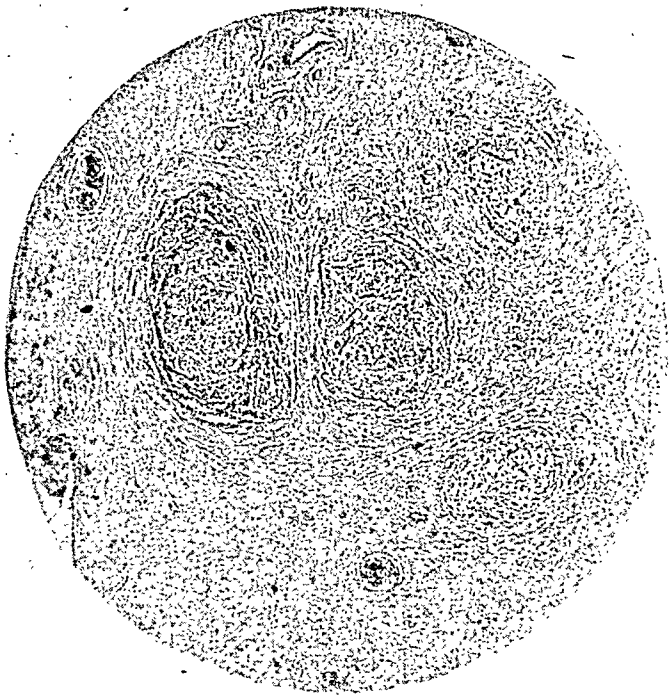


Fig. 4 (Heath). *WA 783,394.* Low-power view of tissue removed from the orbit, showing typical follicles with the exaggerated scar formation and atrophy.

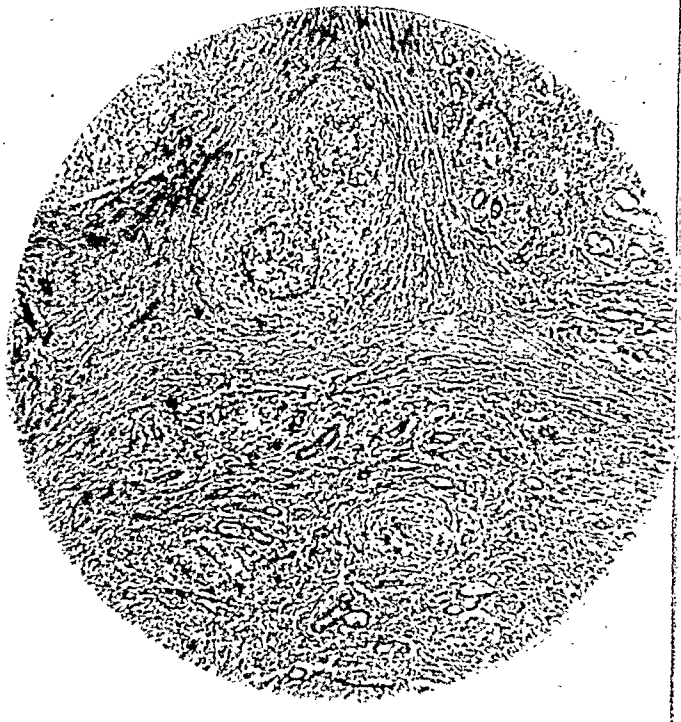


Fig. 5 (Heath). *WA 783,394.* High-power view showi nest of lymphocytes, epithelioids, occasional giant cells, granuloma, without caseation and marked fibrosis. A parently healing by sclerosis and scar.



Fig. 6 (Heath). *Case 1.* Front view showing marked enlargement of the parotid and submaxillary glands in a tuberculous lymphadenitis.



Fig. 7 (Heath). *Case 1.* Lateral view of tuberculous lymphadenitis showing preauricular and submaxillary and less obvious ocular and lacrimal gland involvement.

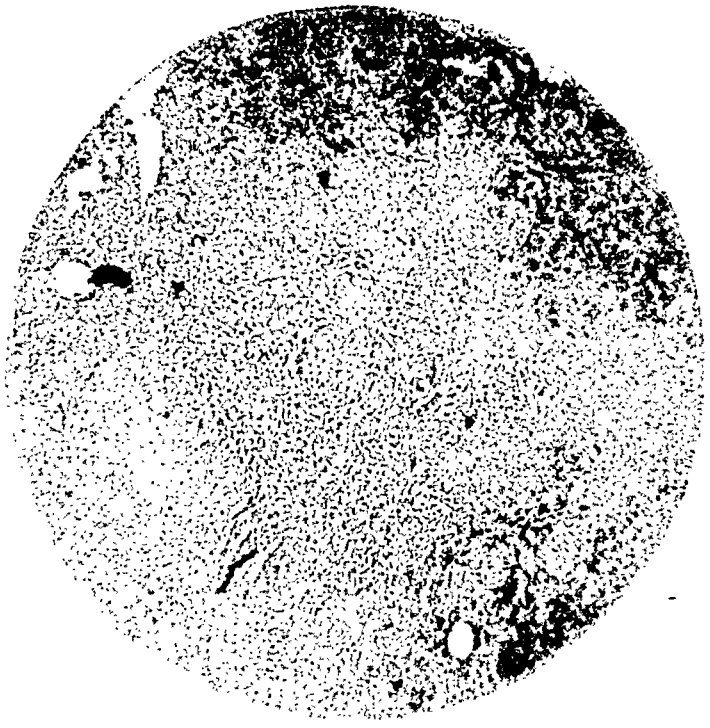


Fig. 8 (Heath). *Case 1.* Microscopic section through the biopsy material showing typical lymphadenitis, tuberculous type, with giant cells and caseation.

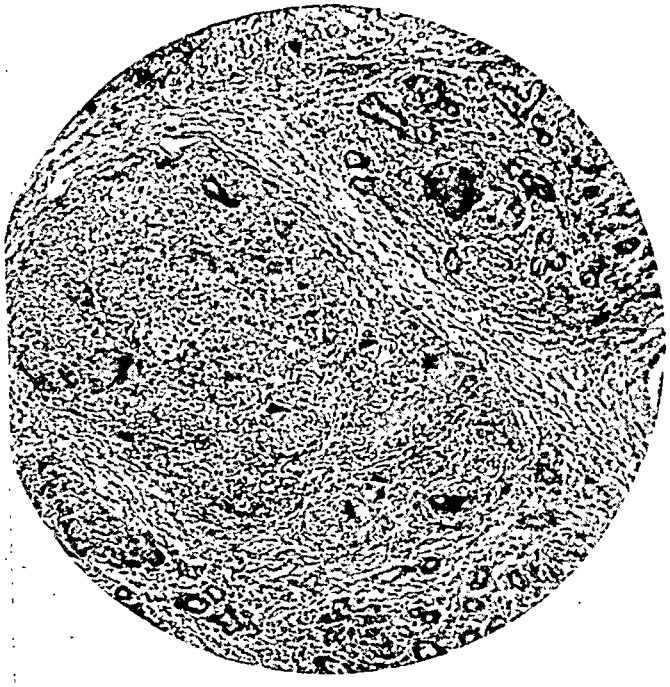


Fig. 9 (Heath). *Case 2.* Low-power view of biopsy of imal gland showing sarcoid, lymphogranulomatosis and iaumann bodies. No caseation. Moderate fibrosis and iphatic nodules

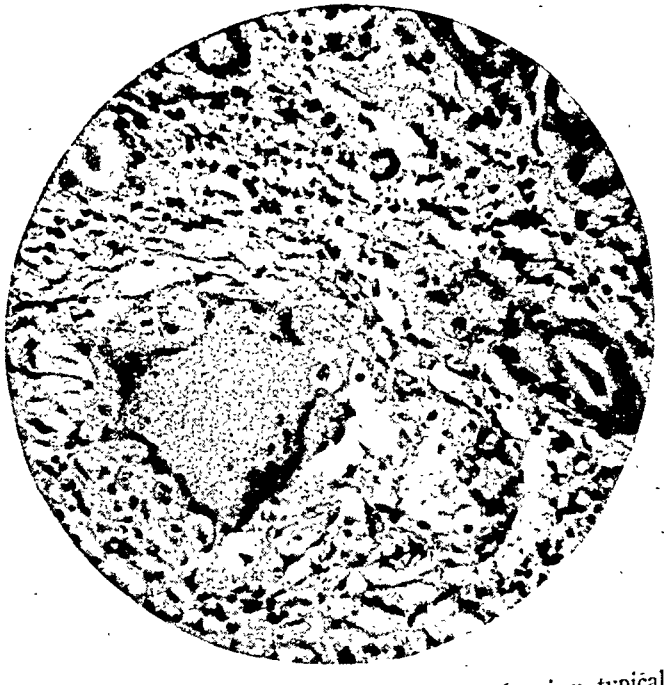


Fig. 10 (Heath). *Case 2.* High-power, showing typical structure of giant cell and follicle.

sive weakness (figs. 6 and 7). On March 22, 1929, he had been admitted to the hospital with a complaint of progressive enlargement of the neck glands over a 5-year period. There was associated redness of the eyes. Examination revealed parotid and submaxillary enlargement associated with cervical lymphadenopathy. The patient refused biopsy, and was released.

Physical examination. On August 13, 1929, there was bilateral massive enlargement of the submaxillary and parotid glands, indurated and well circumscribed, as well as edema of the upper lids (fig. 8).

X-ray examination on March 22, 1929, showed minimal infiltration of the right upper lobe of the chest. On August 13th, the films showed massive bilateral tuberculosis with cavitations.

Course. Rapidly downhill.

Autopsy. Extensive bilateral pulmonary tuberculosis with apical cavitations. Tuberculous parotitis. Cervical adenitis.

CASE 2

History. E. A., a Negro, aged 29 years, was admitted to the Receiving Hospital on September 1, 1946, and was discharged on October 7, 1946. His chief complaint was conjunctivitis, edema of the upper lid, and nasal obstructions of one month's duration. P.H. was essentially negative.

Physical examination. Temperature was 99°F.; pulse, 64; blood pressure, 112/84 mm. Hg. Examination of the eyes showed congenital nodular conjunctivitis and associated firm, bilateral enlargement of lacrimal glands—palpable, nontender. There was preauricular tenseness over the parotid region. There was granular infiltration of nasal mucosa.

Laboratory tests. W.B.C., 8,850; differential—neutrophiles, 70; lymphocytes, 20; monocytes, 8. Repeated sputum examinations were negative for acid-fast bacilli. Serology: Positive Wassermann.

Course. A biopsy of lacrimal gland was illustrative of sarcoid (figs. 9 and 10). The patient improved.

CASE 3

History. I. H., a Negro, aged 34 years, was admitted to the Receiving Hospital on March 22, 1938, and was discharged on April 11, 1938. His complaint was enlargement of the lacrimal and parotid glands and conjunctivitis, low grade.

Physical examination. There was bilateral, firm painless enlargement of the lacrimal and parotid glands with mild inflammation. The right pupil failed to react to light and accommodation. There was a perforated nasal septum and ulceration of palate.

Laboratory tests. Serology was positive.

X-ray studies. Chest negative.

Course. Antisyphilitic treatment. Rapidly improved.

CASE 4

History. E. C., a Negress, aged 15 years, was admitted to the Receiving Hospital on February 24, 1947, and was discharged on March 8, 1948. She had stiffness of joints, fatigue, anorexia, and skin rash on abdomen and left ear. She had a history of fairly typical rheumatic fever beginning January, 1944, with associated remissions and exacerbations. In January, 1946, she was admitted to the University Hospital, and after two subsequent admissions, a diagnosis of sarcoidosis was made on lymph-node biopsy. The nodes decreased in size, but three weeks prior to admission to the Receiving Hospital, the patient showed exacerbation of symptoms associated with generalized lymphadenopathy.

Physical examination. The temperature was 99.6°F.; pulse, 120; blood pressure, 106/70 mm. Hg; respiration, 24. Positive findings included: (1) Enlarged nodes of rubbery consistency, submental, cervical and pre- and postauricular and axillary positions. (2) Abdomen—Large hyperpigmented erythematosquamous eruptions with indefinite

borders. (3) Bilateral lacrimal and parotid enlargement.

Laboratory tests. Hematology: Hemoglobin, 10 gm.; W.B.C., 17,700; neutrophiles, 86; lymphocytes, 9. Toxic alteration of neutrophiles. Bone marrow negative.

X-ray examination. Bones of hands showed periarticular demineralization.

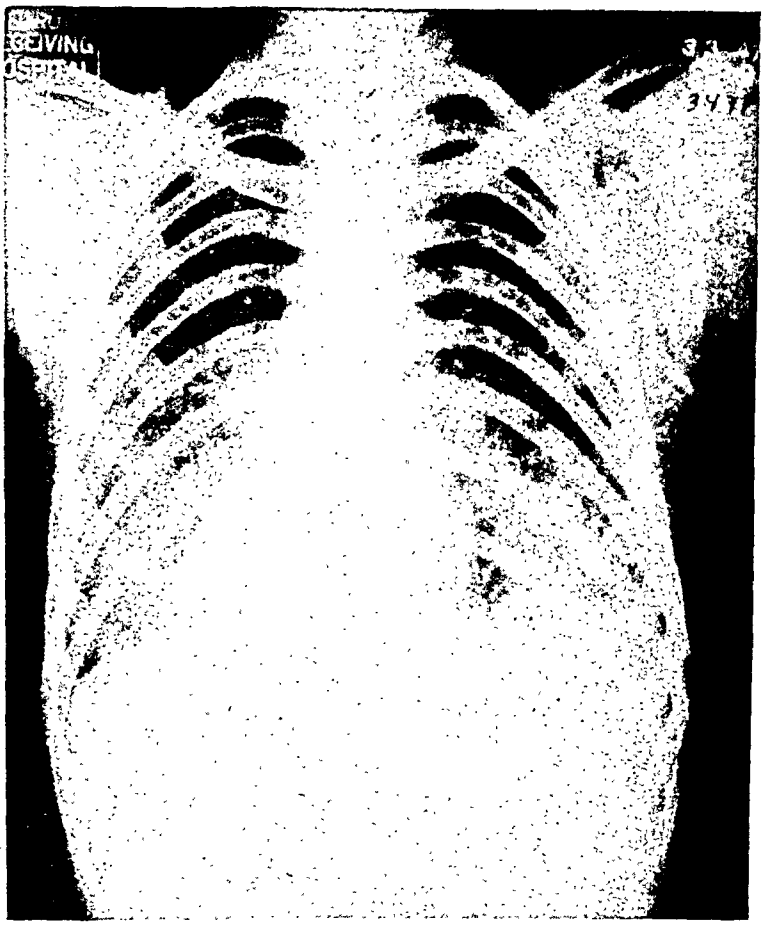


Fig. 11 (Heath). *Case 4.* Shows typical lung field and a diffuse fibrosis as seen in sarcoid.

Chest: Lung fields showed reticular pattern of opacity in all lobes, but heaviest in the bases; relatively little hilar adenopathy (fig. 11).

Lacrimal gland biopsy. Moderate interlobular and periductal fibrosis, illustrative of gout.

CASE 5

History. J. F., a Negress, aged 43 years, was admitted to the Receiving Hospital on June 15, 1946, and was discharged on July 8, 1946. She suffered from malaise and polyarthritis. There was edema of the lacrimal, parotid and salivary glands, of six weeks' duration, and conjunctivitis of one week's duration. P.H. was essentially negative.

Physical examination. Temperature, 99° F.; pulse, 88; respiration, 22; blood pressure, 140/95 mm. Hg. There was bilateral swelling of the lacrimal gland. Funduscopic examination revealed early arteriosclerotic vessel changes.

Laboratory tests. Serology was negative. Hematology and blood chemistry within normal limits. Sedimentation rate elevated.

Course. The patient refused biopsy. She was placed on salicylate.

Discharged markedly improved. Illustrative of rheumatism.

CASE 6

History. L. W., a Negro, aged 27 years, was admitted to the Receiving Hospital on December 14, 1936, and discharged on December 22, 1936. He had had progressive enlargement of the inguinal lymph nodes for one year, with parotid and submaxillary gland enlargement for three months (fig. 12).

Physical examination showed temperature, pulse, and respiration to be normal. Blood pressure was 130/90 mm. Hg. There was mild conjunctivitis and bilateral, painless, soft enlargement of parotid and submaxillary glands, as well as generalized lymphadenopathy.

Laboratory tests. W.B.C., 5,450; lymphocytes, 34. Serology negative. Sputum negative.

X-ray examination. Chest revealed advanced bilateral tuberculosis.

Course. Biopsy of epitrochlear node revealed acute noncaseating adenitis and giant-cell folliculosis. Biopsy of submaxillary gland refused. The patient was discharged on release. There was no follow-up. This case illustrates giant follicular hypertrophy.

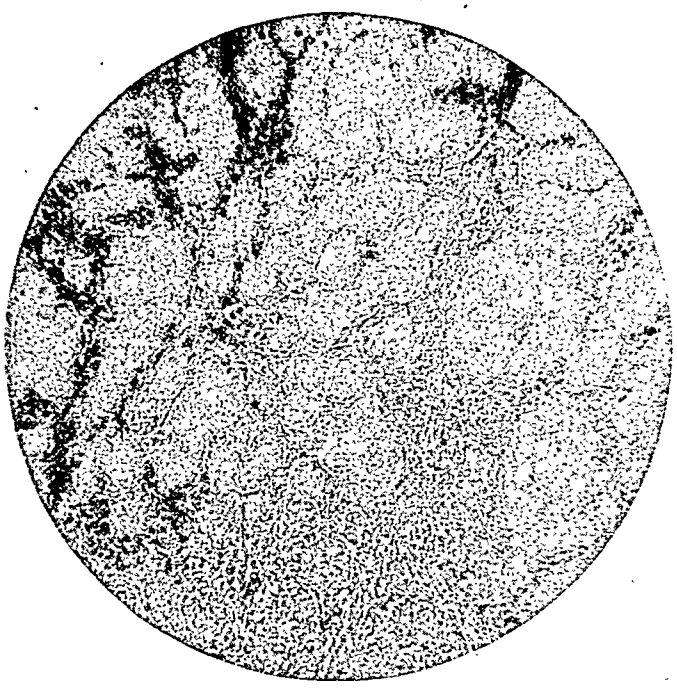


Fig. 12 (Heath). *Case 6.* Low-power view showing giant cell follicular hyperplasia.

COMMENT

Possible confusion in diagnosis is illustrated by the cases cited. There are many agencies causing physical signs of the syndrome, especially if the swelling is bilateral and includes the lacrimal, parotid, and maxillary glands (table 1).

The physiology and environment of the lacrimal gland renders it susceptible to deterioration from the edema and swelling resulting from any injurious agency. The gland has a fair blood supply and long periods of activity, a tight compact lobular structure surrounded by fibrous and lymphoid tissue. The gland is contained in a rather rigid environment between bony fossa, globe, and orbital septum, all limiting expansion, except at the price of pressure, atrophy, and fibrosis.

Microscopic studies of a biopsy material, made at only one stage sometimes, confuse unless the whole process has been followed from early through to the late stages. The structure of the gland and the lymphoid tissue present favors an inflammatory response by formation of granulomas. The structural and environmental factors mentioned above lead to early atrophy and fibrosis and the development of a lacrimal cicatrix. The clinical and morphologic findings, therefore, are often confusing.

One enters the realm of lymphomatous lesions ranging from benign simple hypertrophy and hyperplasias—transitional stages

TABLE 1

AGENCIES CAUSING LACRIMAL GLAND TUMEFACTION

Congenital hypertrophy	Infections in gland, as sarcoid, tuberculosis, syphilis, leprosy, virus (as mumps)
Simple hypertrophy (exaggerated physiology)	Rickettsia (as Q fever)
Trauma (including surgical)	Tularensis, oculoglandular fever
Foreign body	Uveoparotitis
Mechanical block (scarring and shrinking of conjunctiva, salivolithiases, calculus)	Extensions from skin as erysipelas from conjunctiva, keratoconjunctivitis
Chemicals and drugs (iodine, lead)	Leptothrix, sporothrix, blastomycosis, dachryoadenitis
Gland hypersensitivities and allergy	Neoplasms, as sarcoma, mixed cell, cylindroma, lymphoblastoma, and so forth
Metabolic diseases (gout, rheumatoid)	Leukemia
Parasitic (?trichinosis)	Hodgkin's disease
Blood dyscrasias	
Any acute xanthematous infection	

—to various forms of neoplasm. The lymphatic, hematopoietic, reticular tissues are difficult to classify.

Invasion of the gland by small lymphocytes is interpreted by some as a hyperplasia of the lymph elements and by others as a reaction of chronic inflammation. Others have noted that Mikulicz's disease in some cases is only a stage progressing from lacrimal lymphomas to ultimate concomitant, general lymphatic and hematopoietic involvement (Howard)[6]. Others present evidence against the theory of progression from Mikulicz's disease proper to pseudoleukemia to leukemia (Schaiffer and Jacobson)[7].

The evidence of a chronic, benign (over 10 to 15 years), clinical course is strong for a purely local disease. Other evidence is to be had from a study of biopsy material showing a limited lymphoid reaction and an early cicatrix, and a different, less sensitive response to radiation therapy from that of malignant lymphoma as has been pointed out by Leucutia and Price.[8]

Classification

Publications by Jackson, Parker, and Bethea,[9] and by Callender,[10] 1943, from material of the Lymphatic Tumor Division of the American Registry of Pathology give useful classifications. Gall and Mallory,[11] 1941, published a survey of "Malignant Lymphoma" offering a classification on a cellular basis, correlated with the clinical course. A general study of lymphatics, and so forth by Drinker[12] is useful. V. Brunn[13] classified with two main classes—those with and those without blood changes. Howard[6] concluded that Mikulicz's disease is not an entity. Thursfield's[14] classification provides for eight groups:

I. Congenital, familial or hereditary
II. Mikulicz's disease proper
III. Mikulicz's disease proper with involvement of lymphatic apparatus
IV. Leukemia
V. Tuberculosis
VI. Syphilis
VII. Gout
VIII. Sialodochitis fibrosa

Schaiffer and Jacobson[7] classify as follows:

I. Mikulicz's disease
A. Familial
B. Mikulicz's disease proper
II. Mikulicz's syndrome
A. Leukemia
B. Tuberculosis
C. Syphilis
D. Lymphosarcoma
E. Toxic
1. Lead
2. Iodides, and so forth
F. Gout
G. Febris uveoparotidea subchronica

Discussion

It is not the purpose of this paper to report the clinical findings related to a cellular classification of tumors of the ocular adnexa (McGavic[15]). Our purpose is to call to the attention of ophthalmologists some diseases of the lacrimal gland and related lymphadnexa. These lesions have features in common other than their location. We list in Table 1 some causes of lacrimal disease. It is clinically possible to find these causes. Lacrimal gland disease is probably more important than the frequency of its treatment suggests. Clinically, one rarely directly attacks the gland. To disentangle etiologic possibilities requires a number of studies. One may employ history, inspection, palpation, X-ray films, blood studies, examination for parasites, paper-strip studies of tears, intravital dyes, corneal studies of an associated keratitis, study of conjunctiva and smears, inspection of the lacrimal drainage apparatus, and the use of biopsies.

Tuberculosis as a rule shows caseation necrosis, loss of reticulum, smaller (Langhans) giant cells, infiltrative loss of acini, fibrosis different in character from sarcoid, and characteristic progress in the involve-

ment of other organs. The organisms may be stainable.

Sarcoid, in nearly half of the tissue sections, shows large foreign-body giant cells with inclusions (Schaumann bodies). The reticulum is present with a more normal appearing fibrosis and, as a rule, no coagulation necrosis. Other parts of the body may show sarcoid lesions—skin, viscera, lungs, bone, and so forth, and the whole process may characteristically be held in abeyance for irregular intervals.

Syphilis shows lymphocyte infiltration about vessels, the granuloma are firmer, less diffuse, and more vascular. Other over-all changes of syphilis will be present.

The clinician has to determine whether the nodule in the lacrimal gland is a self-limiting or an expanding inflammation, or neoplastic in character. Leinfelder and O'Brien[16] report the rarity of simultaneous involvement of orbits and lids in other forms of tumor.

Sarcoid and tuberculosis differentiation may be seen in Table 2. The lesions illustrated here, of the Mikulicz "pure type," are partly healed and illustrate a predominance of fibrosis and atrophy of the normal gland structure. The follicles in other patients studied late in the disease may be very rare, and giant cells still more rarely seen. The cracking phenomenon is seen hardly at all and then is only partially represented. At times a foreign body giant cell is found in the midst of, and in spite of, an extensive fibrous environment.

Early lesions show polymorphic granulomas, lymphocytes about the vessels, some

TABLE 2

DIFFERENTIATING TUBERCULOSIS AND SARCOID

Tuberculosis	Sarcoid
More of a proliferative endarteritis	A reticulo-endothelial system disease
Lesions usually move along to either healing or breakdown	Spontaneous regression common, periods of abeyance. Lesions may remain unchanged
Dissemination obvious, course relatively visible	Clinical manifestations variable, depend on organ involved
Distribution is wide; most rarely in striate muscles. Shows zonation	Descrete lesions. May occur in striate muscles
Does not enter through vessel walls. May be found on endothelial side	May enter vessel walls and go through to endothelium
Giant cells common, of Langhans type. No Schaumann bodies. More giant cells, in lymph relatively; more rare in lungs	Giant cells common, of foreign body type. Schaumann bodies common, 30 to 40 percent. Less in lymph; more common in lung
Caseation necrosis is the rule	Caseation rare
Cavity formation characteristic	In lung, cystlike spaces and emphysema
Concentric growth characteristic	Concentric growth absent
Epithelioids and eosinophiles not characteristic	Epithelioids common; eosinophiles in 10 percent
No reversal of albumin-globulin ratio	Reversal of albumin-globulin ratio
Healing is concentric, fibrous	Healing is fibrous, diffusely laid down
Reticulum lost	Reticulum present
If tuberculin test is negative, lesions may show stained organisms	If tuberculin test is negative, lesions do not show acid-fast organisms

instances of phagocytosis, red and giant cells, and sometimes eosinophiles. The acini are compressed and/or disorganized; the reticulum is compressed. Some authors distinguish two forms of lesion—lymphomatous and granulomatous. However, the characteristics of each may be found in the same tissue.

Summary

A report is given of a case of "pure" Mikulicz's disease. Similar lacrimal gland enlargements due to different agents—tuberculosis, sarcoid, gout, syphilis, and giant follicular hyperplasia—are reported. Attention is called to confusion in diagnosis. A table is supplied listing some factors and causes of tumefaction of the lacrimal gland.

Resemblances between the lesions of "pure" Mikulicz's disease and sarcoid are described. A comparison between tuberculosis and sarcoid pathology is outlined.

Conclusions

A considerable number of agents may cause tumefaction of lacrimal and accessory lacrimal glands. The differential diagnosis is made by studying the state of the general health of the patient, by following the course of the disease, and by making local ocular studies and biopsies. Confusion exists, especially between tuberculosis and sarcoid. This usually can be resolved. So-called "pure" Mikulicz's disease probably is a granulomatous response of lymphatic tissue of the reticuloendothelial system to a stimulus. This stimulus may be infectious, parasitic, or chemical. Many lacrimal gland reactions are reversible while others resolve by fibrosis to a lacrimal cicatrix. If the latter is extensive enough, the cornea inevitably suffers.

243 Charles Street (14).

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OPERATIVE FAILURES FOR CHRONIC SIMPLE GLAUCOMA*

A HISTOLOGIC STUDY

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A study of eyes removed after operative failures for chronic simple glaucoma shows that ideal surgical relief has not been devised as far as the laboratory is concerned. The examination of approximately 100 operated eyes with glaucoma at the New York Eye and Ear Infirmary showed at least three characteristics: (1) Adhesions between the iris and the cornea; (2) closure of new filtration channels with fibrosis; and (3) inflammation of the uvea.

Synechias between the anterior surface of the iris and the posterior surface of the cornea are composed of such dense connective tissue that permanent separation by operation is almost impossible. The artificial filtration channel or channels become closed by the proliferation of connective tissue, despite an iris inclusion in the operative wound. Progressive iridocyclitis usually requires enucleation.

Operations for glaucoma which illustrate the general microscopic findings of all globes sent to the laboratory for study are iridectomy, iridencleisis, and trephination. These eyes show in common the following characteristics.

1. Pathologic changes in the corneal epithelium.
2. Thinning of the cornea and sclera.
3. Inflammation at the limbus.
4. Shallowness of the anterior chamber.
5. Adhesions of the iris to the cornea and lens.
6. Inflammation of the iris and ciliary body.
7. Changes in the crystalline lens.
8. Pathologic depression of the optic nerve.
9. Atrophy of the ganglion cells of the retina.
10. Unusual findings in the vitreous body.

The object of this paper is to show the causes of failures in the usual operations performed for the relief of chronic simple glaucoma. In order to show the histologic changes in the disease, it is necessary to review briefly the microscopic anatomy of the normal globe.

THE NORMAL EYE

The eye is composed of a comparatively avascular fibrous tunic consisting of the cornea and sclera, both a millimeter or less in thickness, enclosing the uvea and the transparent contents of the globe. The



Fig. 1 (Payne). Normal globe. (A) Iris angle.

* Presented at the III Pan-American Congress of Ophthalmology, Havana, Cuba, January 4 to 10, 1948. From the Department of Pathology, New York Eye and Ear Infirmary and the New York University College of Medicine.

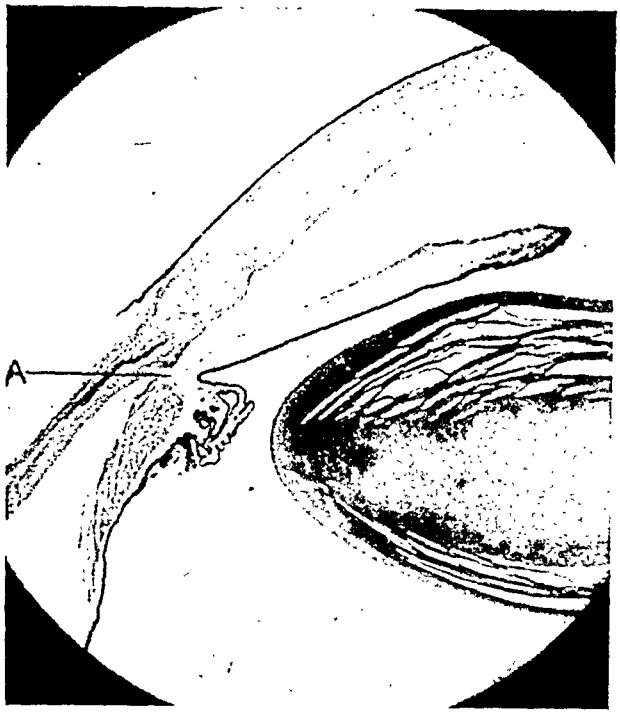


Fig. 2 (Payne). Normal angle of the iris (A) enlarged.

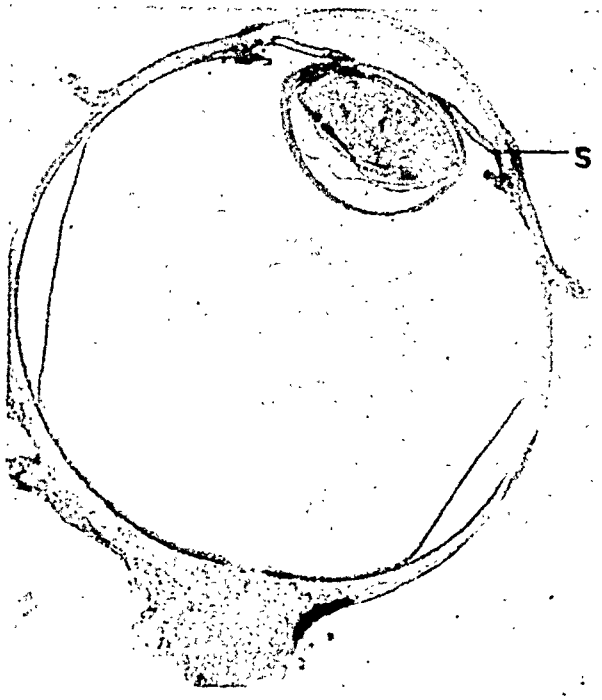


Fig. 3 (Payne). Subacute glaucoma with shallow anterior chamber and peripheral anterior synechias.

lamina cribrosa is a continuation of the sclera to form a meshwork across the optic canal.

A section of the cornea shows that it consists of five layers and from without inward they are: the epithelial layer, Bowman's membrane, the stroma, Descemet's membrane, and the endothelium. The normal cornea contains no blood vessels nor medullated nerve fibers. Corneal epithelium is unique in that it is visible throughout its five layers, including its most superficial squamous cells. Bowman's layer is a thin, homogenous, acellular layer lying immediately internal to the epithelium and serving as a basement membrane for it. It gradually fuses into the underlying stroma and becomes one of its components. The stroma consists of layers of specialized connective tissue, so interlaced that clean separation is impossible, and it forms nine tenths of the thickness of the cornea. Descemet's membrane has an inner cuticular and an outer elastic component and is quite resistant to trauma or disease. The innermost endothelial lining consists of a single layer of flattened cells which become quite thin over the pectinate processes and the anterior surface of the iris.

The limbus corneae

The limbus is a concentric segment measuring 0.75 mm. anteroposteriorly at the junction of the cornea and sclera, and containing characteristics of each. The fibrous tunic is reduced in thickness in this area by the indentation of the scleral sulcus externally and the scleral-furrow internally. The external sulcus is filled in with fine, loose aerolar connective tissue permeated by blood vessels which end in small capillary loops at the corneal margin. The surface is covered with thickened stratified squamous epithelium, which is arranged in folds and is undergoing transition to bulbar conjunctival epithelium. The scleral furrow or the internal depression of the limbus is filled in with a meridional meshwork of endothelial-covered strands known as the ligamentum pectinatum. Schlemm's canal is in close relation to the outer bounds of the furrow. Anterior ciliary veins connect with the drainage channels which transport aqueous from the anterior chamber.

The sclera

The sclera is that portion of the fibrous tunic which extends from the limbus corneae to the optic canal. It is composed of dense connective tissue and varies in thickness from 1 mm. at the posterior pole to 0.5 mm. beneath the insertions of the extraocular muscles. For descriptive purposes, the sclera has three layers: the loose, mildly vascular episcleral connective tissue; the dense, almost avascular, areolar connective tissue forming the middle and greater thickness of the structure; and the inner or "lamina fusca" which is only differentiated from the middle layer by chromatophores in its interspaces.

The lamina cribrosa is a weblike continuation of scleral fibers across the optic canal. It contains collagenous and elastic fibers intermingled with glial components. Normal horizontal sections through the optic nerve show that there is continuity in curvature of the cribriform plate corresponding to that of the sclera. It is evident that it is the weakest portion of the fibrous tunic and will be first to become distended by pressure from within the globe.

The uvea

The uvea consists of the choroid ciliary body and iris. The choroid may be described as the vascular layer lying just internal to the lamina fusca of the sclera. It is composed of three ill-defined series of blood vessels as follows: An outer layer of large-sized blood vessels, a middle layer of intermediate-sized vessels, and an internal layer composed of a single row of capillaries adjacent to the lamina vitrea of the choroid. Interspersed between these various layers of blood vessels are chromatophores and a fine reticulum of connective tissue and endothelial elements.

The ciliary body is composed essentially of the same layers as the choroid, but differs in that the ciliary muscle is interposed. The ciliary muscle is made up of three parts; an inner circular series of fibers connected with outer meridional fibers by a series of radiating fibers. The ciliary muscle gives size and shape to the ciliary body. Internal to the muscle layers are the continuations of the vascular choroidal layers with the exception of the choriocapillaris. The pigment epithelium is a continuation of the pigment epithelium of the retina and the ciliary epithelium is the same as the retina reduced to a single layer of the nonpigmented cells.

The principal blood and nerve supply is from the long posterior ciliary vessels and nerves.

The iris may be divided into an anterior or mesodermal portion and a posterior or ectodermal derivative. The former consists of three ill-defined layers: the endothelium, the anterior border layer, and the vessel layer. The posterior portion of the iris is composed of a dilator pupillae and the pigment epithelium of the iris. The anterior endothelium is peculiar in that its surface is abruptly broken at the margins of the crypts and aqueous is permitted to come into direct contact with the stroma. The anterior border layer is characterized by a slight condensation of the fibrous tissue beneath the endothelium. The number of chromatophores contained in this layer determines the color of the iris, the more chromatophores, the darker the iris. The vessel layer of the stroma of the iris is composed of delicate, loose connective tissue supporting numerous blood vessels, which appear to have thickened walls. No elastic fibers are found in the iris except in the walls of the blood vessels and at its union with the ciliary body. The constrictor and dilator pupillae muscles are derivative of the pigment epithelium and the latter forms the outer lead or the ectodermal portion of the iris. The constrictor is easily seen in most preparations but the dilator is thin and obscured by the pigment epithelium or the inner leaf of the iris. The circulation is through the radicals from the greater arterial circle, which lies in the anterior part of the ciliary

body and is supplied by the long posterior and anterior ciliary vessels.

The retina

The retina is a thin transparent structure composed of nine layers, the outermost being the rods and cones and the innermost being the internal limiting membrane. It lies in apposition but not attached to the pigment epithelium, a single layer of cells separating it from the choroid. The retina is anchored only at the ora serrata and around the margin of the optic disc. It has a dual blood supply, the inner five layers receiving nutrition from the central artery and accompanying vein. The outer four layers are supplied by the choriocapillaris. The optic nerve begins with the papilla, a flat round projection just inside the globe measuring 1.5 mm. in diameter. It lies 1 mm. below and 3 mm. nasally to the posterior pole of the eye and corresponds to the intraocular portion of the nerve. The elevation is caused by an accumulation of nonmedullated nerve fibers from the ganglion cells of the retina. A central depression lies on the surface. It is in this depression that the central retinal vessels emerge. The fibers arrange themselves in the interstices of the cribriform plate and just posterior to it they assume medullation and become arranged into bundles. Posterior to the globe, the nerve is covered by the pial and dural sheaths, with the arachnoid lying between. At approximately 15 mm. posterior to the globe, the central retinal vessels enter the nerve at right angles and proceed forward in its center to appear in the depression of the papilla. The bundles are so arranged that regular rows of nuclei from the septa follow a course parallel to the long axis of the nerve. The blood supply is from the vessels of the sheaths, the central vessels, and the circle of Zinn.

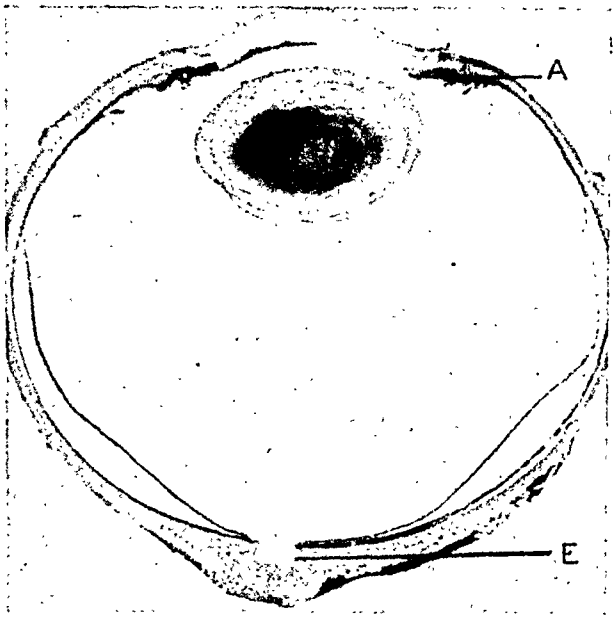


Fig. 4 (Payne). Iridectomy operation (A) shows stump of iris extending toward apex of cornea, adhesions remain.

Contents of the normal globe

The contents of the globe are aqueous humor, the crystalline lens, and the vitreous body. Under normal conditions, the aqueous does not appear in sections. The lens is often distorted in the process of fixation and staining. The vitreous may be displaced or compressed. In the presence of glaucoma, all three of these elements may show definite findings which contribute to the pathologic picture. The aqueous may show albuminous changes with cells and fibrin in suspension, the lens may be pushed forward and swollen, and the vitreous may contain fragments of pigment and other evidences of degeneration.

Iridectomy operations

An eye (fig. 4) demonstrating most of the usual microscopic findings after unsuccessful iridectomy operations shows generalized thinning of the fibrous tunic with edema and absence of the corneal epithelium. The operative wound is closed by dense connective tissue in which some of the iris pigment remains. The stump of the iris extends toward the center of the cornea and is adherent to it, showing that the synechia is just as extensive as it was before the operation was performed. In other words, the normal iris angle is not restored

and the adhesions are not relieved.

Further study of the specimen shows considerable edema and round-cell infiltration at the limbus which extends into the operative wound. The cornea is somewhat thinner than normal and the epithelium is undermined in the periphery, swollen and absent over the center. Bowman's membrane is intact except in the region of the limbus, where pannus is beginning to form. A membrane is forming on the anterior surface of the iris, and the endothelium is covered with a thin layer of round cells, fibrin, and pigment particles. The sclera is thinner than normal and shows little of importance. The iris is characterized by atrophy, broad anterior peripheral synechias, and chronic inflammation. The iris stump extends far anterior to the filtration angle which has been closed by adhesions. The membrane forming on the anterior surface of the iris, and contributing to the adhesions, has firmly sealed any possible connection with the normal drainage spaces. The ciliary body shows atrophic and inflammatory changes, and the choroid is flattened to a mere line by pressure and fixation. The retina shows destruction of the ganglion cells, edema, and cystic degeneration. The crystalline lens has been removed but its enlarged and forward displaced capsule remains. A fragment of iris lies on the anterior surface of the lens. Careful study of this specimen indicates that the iridectomy failed to create a new drainage channel and the synechias were undisturbed. The presence of inflammation contributed to the loss of the eye.



Fig. 5 (Payne). Iris inclusion (A) in operative wound; (L) crystalline lens; (S) anterior synechias.

Iridencleisis operation

An eye (fig. 5) removed after an unsuccessful iris inclusion operation shows atrophic uveal tissue in the operative wound, a shallow anterior chamber, and definite lens changes.

The fibrous tunic is distended and thinner than normal. The epithelium shows signs of edema and bullouslike formation near the operative wound.

A more intensive examination of the sections shows that the iris is included in the bleb and that filtration is possible. There is sufficient space between the conjunctival flap

and the iris for aqueous drainage. Unfortunately, the iris shows signs of chronic inflammation and firm diagonal adhesions, which unite the root of the iris to the base of the flap. Instead of acting as a filtration "wick," the iris forms a firm band which dams the aqueous behind it. There is no relief from increased intraocular pressure, which accounts for distention of the globe and formation of bullae on the cornea.

vessels with extravasations into the loose connective tissue. A small hemorrhage lies adjacent to the ciliary body. Diffuse lymphocytic infiltration and fibrotic changes complete the picture. The iris on the side opposite is drawn taut by its adhesion to the displaced lens. It is atrophic and diffusely infiltrated with lymphocytes. The ciliary body shares in the atrophic changes just mentioned.

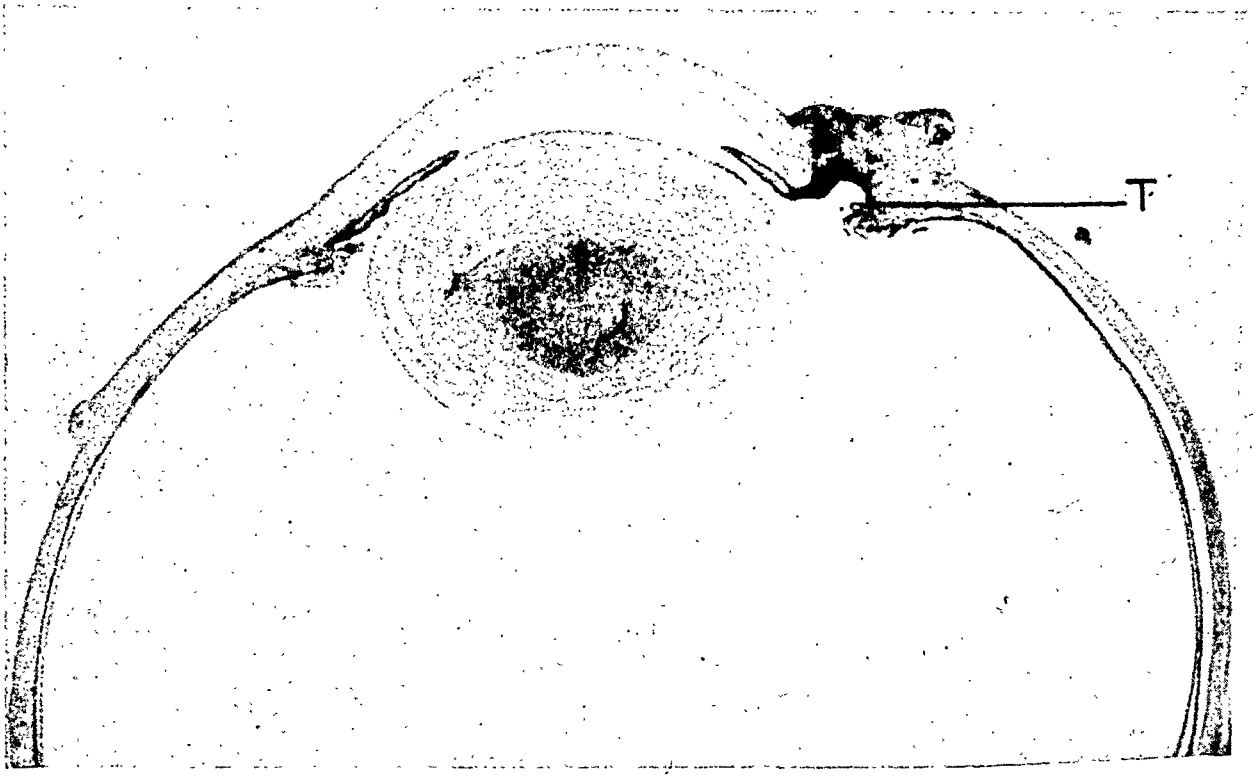


Fig. 6 (Payne). Unsuccessful trephining operation showing (T) operative wound.

The crystalline lens has moved in the direction of the filtration cicatrix. It is saved from complete dislocation by a firm adhesion of the pupillary area of the iris to its anterior capsule. The iris itself is almost diamond shaped in cross section and shows evidence of nuclear sclerosis. Some of the contraction of the lens cortex is due to hardening agents. Displacement of the lens is a fairly common finding after operations for glaucoma.

Most of the inflammatory changes in this specimen are in the vicinity of the operative wound. There is congestion of the blood

The eventual loss of this eye was due to the bandlike adhesion of the iris across the mouth of the operative wound, displacement of the lens, distention of the globe, and bullous keratitis.

Trephinations

Eyes (figs. 6 and 7) enucleated after unsuccessful trephinations may be illustrated by the description of a typical "failure."

The specimen shows that the anterior chamber is shallow, the crystalline lens is swollen, and the operative wound is closed by fibrous tissue. The cornea is irregular in

thickness. The epithelium is slightly undermined by new blood vessels and connective tissue at the limbus. The stroma is moderately infiltrated in the periphery. Descemet's membrane is curled in itself near the operative wound, and the endothelium is covered with a thin layer of fibrin. The operative wound is closed by dense connective tissue containing fragments of pigment, lymphocytes, and new blood vessels. The filtering cicatrix contains fresh hemorrhage. The iris is atrophic and is closely adherent to the cornea and lens on the unoperated side. An iridotomy has been performed as is shown by a part of the iris lying in the wound. The ciliary body and the choroid show atrophic changes with congestion of the blood vessels. The retina is undergoing degenerative changes with diffuse hemorrhage in its innermost layers. The crystalline lens shows cortical cataractous changes with nuclear sclerosis. The lens is in close relation to the filtration wound. The loss of the eye was due to fibrotic changes in the wound and close approximation of the lens.

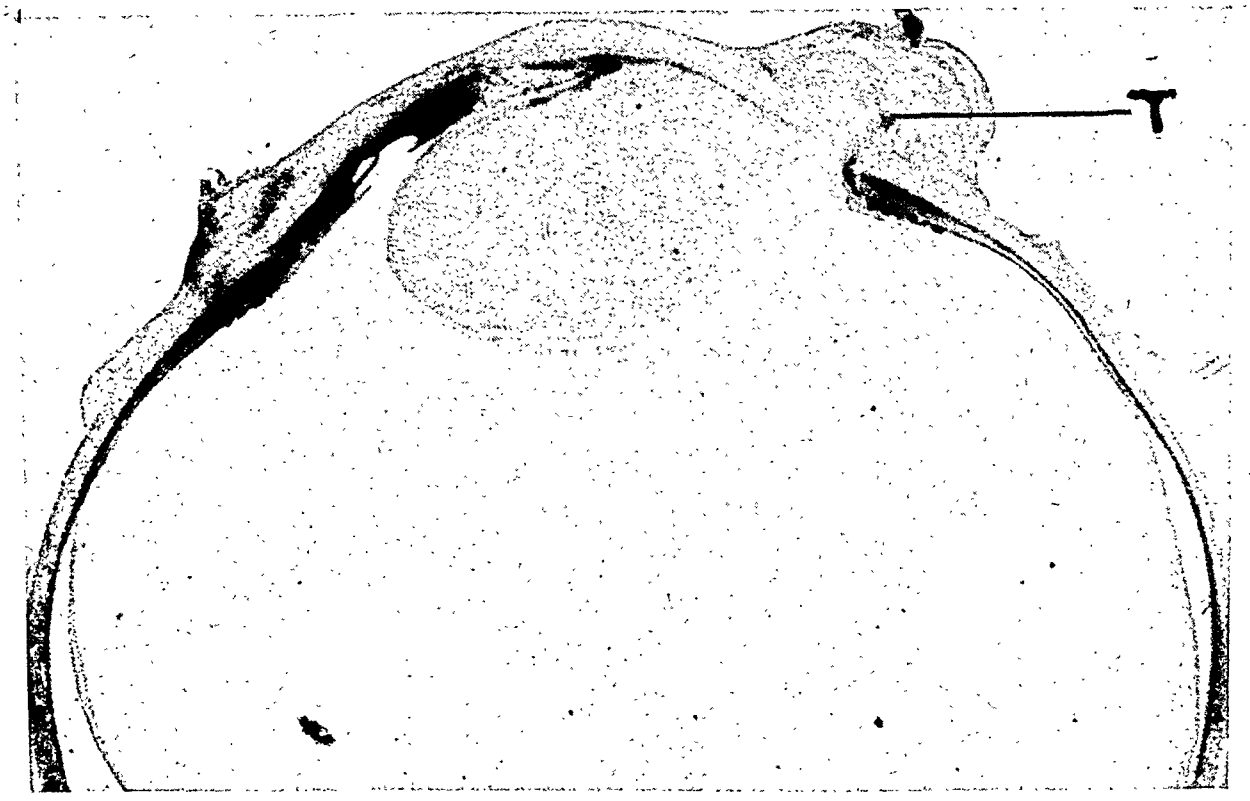


Fig. 7 (Payne). Operative failure after trephining operation, (T) showing herniation of crystalline lens.

Conclusions

1. Common pathologic changes are present in eyes removed after operative failures for chronic simple glaucoma.

2. Comparing the histology of normal eyes with that in chronic simple glaucoma may show the causes of operative failures.

3. Failure of the iridectomy operation may be due to persistence of synechias and not removing the iris at its roots.

4. Iris-inclusion operations may be closed by the iris itself.

5. Trephinations may become closed by fibrotic and inflammatory changes.

6. Specimens reviewed in the laboratory are operative failures.

7. Successful operations for glaucoma are not reviewed in the laboratory and far exceed the "failures."

17 East 72nd Street (21).

A TECHNIQUE FOR MUSCLE RESECTION WITHOUT THE USE OF THE PRINCE FORCEPS*

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It has often been my feeling when performing or observing ocular muscle resections in which various types of forceps, such as the Prince, Reese, or Worth, were used that the surgeon was being inconvenienced considerably by the forceps, in spite of the fact that the muscle was being held securely. Frequently, the forceps are awkward and in the way, especially when working on the relatively small eye muscle of a child where space is at a premium. With corrective strabismus surgery being performed more and more frequently in young children, this annoyance with the use of muscle forceps assumes greater importance.

Over a period of time I began to question the concept that the Prince forceps† furnished the ophthalmic surgeon a secure and certain fixation on the muscle. The concept was challenged with caution, since the Prince type of forceps is almost universally accepted and used. Certain specific experiences and observations in muscle resection surgery, however, cause me to doubt that the forceps are always safe and certain in their action.

In some instances, the forceps slip a small amount after being locked, and the final amount of resection obtained is less than anticipated. When the forceps are used to pull the distal end of the muscle toward the site of insertion in order to place sutures and later to tie them securely, there is tension on the muscle and the forceps are apt to slip, especially if the teeth are worn or do not approximate accurately. It may be argued that this is a fault in the instrument rather than with the technique. Nevertheless, the procedure is essentially dependent on the instruments.

An argument in favor of the Prince type of forceps is the accuracy with which the amount of resection can be determined. If a 10-mm. resection is desired, then the instrument is placed the necessary distance from the insertion. Here, too, the concept of accuracy has to be questioned. Although in theory the instrument is placed at the required distance planned for the muscle resection, actually there results a certain amount of stretching and pulling on the muscle while inserting the forceps. This is especially true in large resections, even though the muscle and its adjacent tissues are thoroughly cleaned. Thus the final resection is less than planned even if measuring instruments have been used.

The forceps create further annoyance by engaging a large part of the surgical field which is necessarily limited by the relatively small structure of the extraocular muscle. The surgeon is frequently working around the instrument, especially during the placing and fastening of the sutures, at which time diligent care has to be exercised in order to avoid tying the forceps to the muscle.

Finally, another moment of awkwardness is usually encountered when the forceps are removed. The teeth of the forceps may be so strongly entrenched in the muscle fibers that the surgeon has to exert his full care and delicacy in extricating the instrument. The sutures are already tied, and excessive tension in this region may loosen or even damage the sutures.

Although the use of muscle-resection forceps has shortcomings and limitations, nevertheless these instruments will continue to be employed unless another procedure

* From the Department of Ophthalmology, Worcester City Hospital. Service of Dr. A. Eugene Messier.

† Since this particular type of forceps is widely used, the term "Prince forceps" will be used as generally referring to all types of resection forceps of similar principle.

can be devised which will eliminate or lessen the faults of the forceps. With this in mind the following procedure was initiated and developed. To date 29 muscle resections have been performed by this technique with increasing confidence in its value.

Surgical procedure

The conjunctival incision is made 6 mm. above the superior border of the muscle to be resected rather than over the muscle (fig. 1). In this way the small blood vessels about the muscle are avoided and all bleeding is eliminated. The original incision includes Tenon's capsule and extends down to the sclera. Following the exposure of the sclera and gentle dissection of the episcleral tissues with blunt-pointed conjunctival scissors, all cutting instruments are placed aside. The isolation and cleaning of the muscle is completed entirely with the use of strabismus hooks and ordinary eye forceps, and it is usual to accomplish this in a completely bloodless field.

A double-armed, 3-0 catgut suture is placed through the muscle insertion from beneath (fig. 2), each arm of the suture being about 2 mm. from the muscle margin. The assistant now gently raises the distal end of the muscle from the sclera and each arm of the suture is placed through the muscle at the desired distance from the insertion depending upon the amount of resection planned (fig. 3). The suture is not pulled up but a loop of each arm is left loose both above and below the muscle to avoid severing the sutures where the muscle is cut. All suturing is performed before the muscle is sectioned. The muscle is now cut about 2 mm. from the insertion (dotted line in fig. 3) while the assistant holds up the muscle with a hook. The sutures must be observed carefully to avoid injury to them. When the muscle is severed, the assistant grasps the cut distal end with a Graefe forceps and pulls the muscle toward the insertion until the new site of attachment is over the original insertion (fig. 4). The sutures are securely tied and the excess muscle trimmed. In this way the distal end of

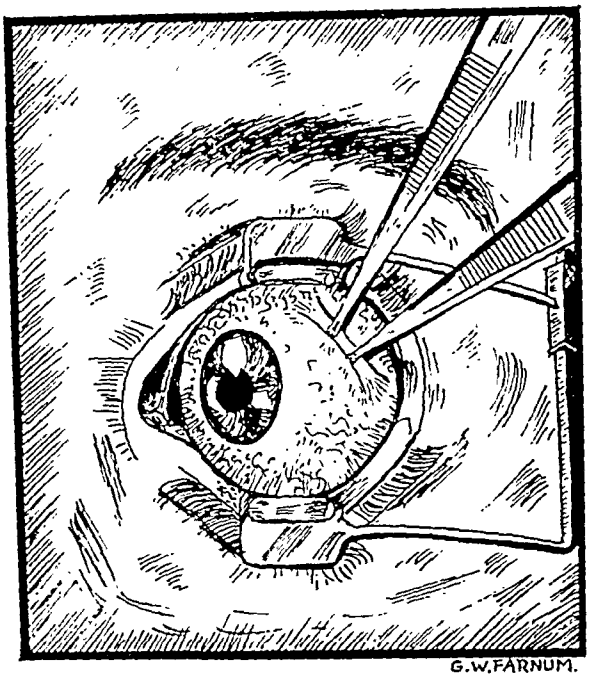


Fig. 1 (Yasuna). The conjunctival incision is made 6 mm. above the superior border of the muscle to be resected rather than over the muscle.

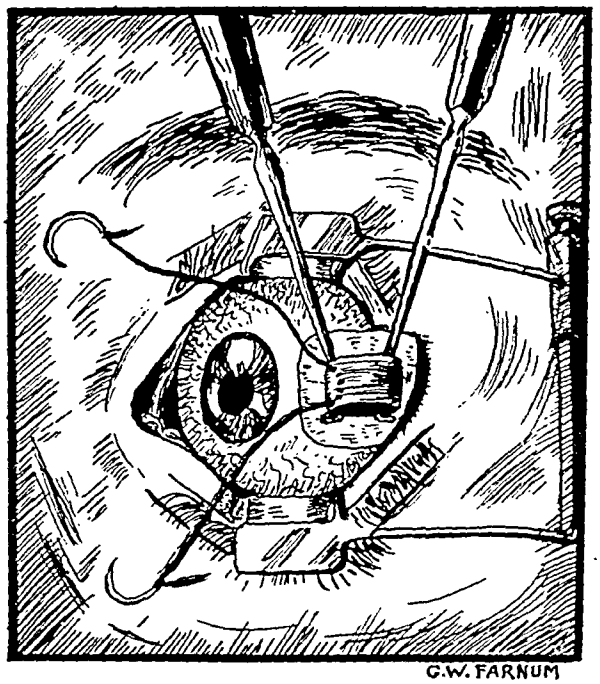


Fig. 2 (Yasuna). The suture is placed through the muscle insertion beneath, each arm of the suture being about 2 mm. from the muscle margin.

the muscle overlaps the insertion and places muscle over muscle which will result in a firmer union. The conjunctiva is closed with a continuous 6-0 black silk suture.

The above method is simple and the surgical field is never obscured with instruments. The amount of muscle to be resected is measured with the muscle in its normal anatomic position and no stretching is caused, as with the Prince forceps. When desired, larger resections have been possible with this method than with forceps. No vertical error is caused since the sutures are placed before the muscle is cut.

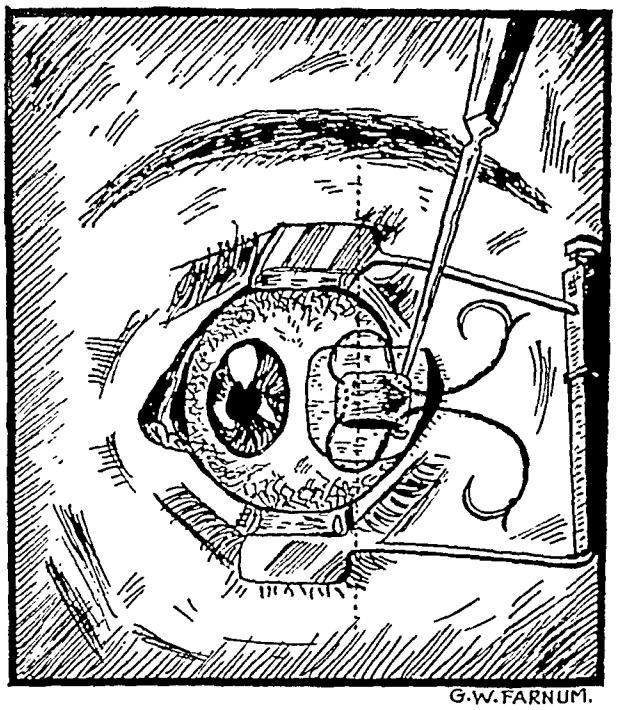


Fig. 3 (Yasuna). Each arm of the suture is placed through the muscle at the desired distance from the insertion, depending upon the amount of resection planned.

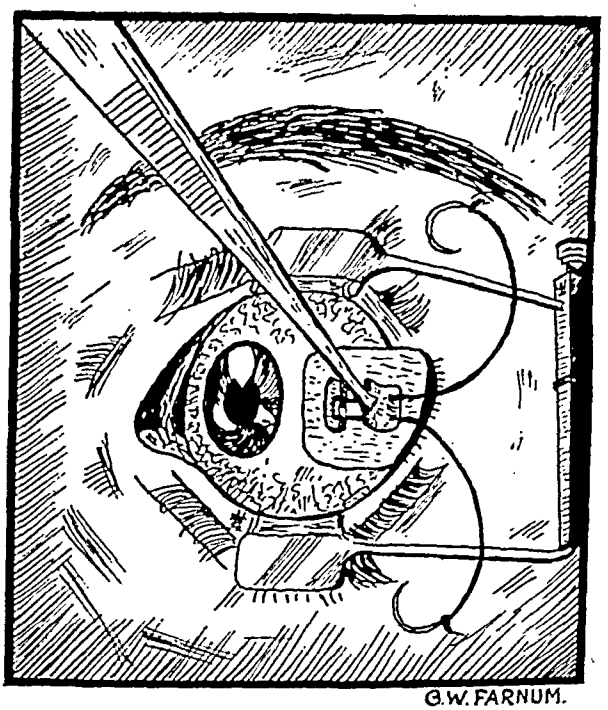


Fig. 4 (Yasuna). The severed muscle is pulled toward the insertion until the new site of attachment is over the original insertion.

The present standard textbooks on ophthalmic surgery[1, 2] do not describe a procedure for muscle resection without the use of forceps. On searching back among older ophthalmic surgical texts, however, a description is found in Török and Grout[3] of a resection method by Schweigger in which no forceps are used.

Conclusions

1. The use of resection forceps, such as the Prince, is not always secure, safe, and accurate. The instrument is awkward and obscures part of the surgical field.

2. A simple method of muscle resection without the use of forceps is described.

3. This method allows greater accuracy in determining the amount of resection, larger amounts of resection when necessary, and avoidance of vertical displacement.

44 Pearl Street.

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2. Spaeth: Principles and Practice of Ophthalmic Surgery. Philadelphia, Lea & Febiger, 1944.
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A MODIFICATION OF ELLIOT'S OPERATION AND ITS APPLICATION TO HIGH TREPHINATION

A PRELIMINARY REPORT

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Although Elliot's trephining operation is in general use and is much easier than the Lagrange operation, many surgeons prefer cyclodialysis or simple iridectomy because they sometimes encounter difficulties both in the technique of the operation itself and in the postoperative results.

DIFFICULTIES IN TECHNIQUE

As for the technique of Elliot's operation, two points cause certain difficulties. (1) It is sometimes difficult to separate the conjunctival flap beyond the margin of the cornea without tearing. (2) Trephination of the sclera requires the use of a sharp instrument, much training, and great caution if the ciliary body is not to be injured.

It occurred to me that the introduction of a metal plate between the sclera and the ciliary body, before the sclera is buttonholed, would greatly facilitate the performance of the operation. It would give a firm support to the trephine when the sclera is punctured; it would protect the deeper parts of the eye from trauma; it would permit the surgeon to use an exceedingly sharp trephine which makes for better end results. (According to Meller[1] when a dull or blunt trephine is used, the scleral wound generally overgrows.)

MODIFICATION OF OPERATION

With these difficulties in mind, I modified the operation in the following manner (fig. 1).

TECHNIQUE

The conjunctiva is incised with scissors 1 cm. above the superior limbus of the cornea and is then separated up to its margin. An incision of the sclera is made as for a superior cyclodialysis; that is, on the vertical meridian, 5 to 6 mm. from the limbus. The cyclodialysis spatula, or the iris repositor, is introduced between the sclera and the ciliary body which is not broadly separated from the sclera. The spatula is left in place to act as a support for the trephine.

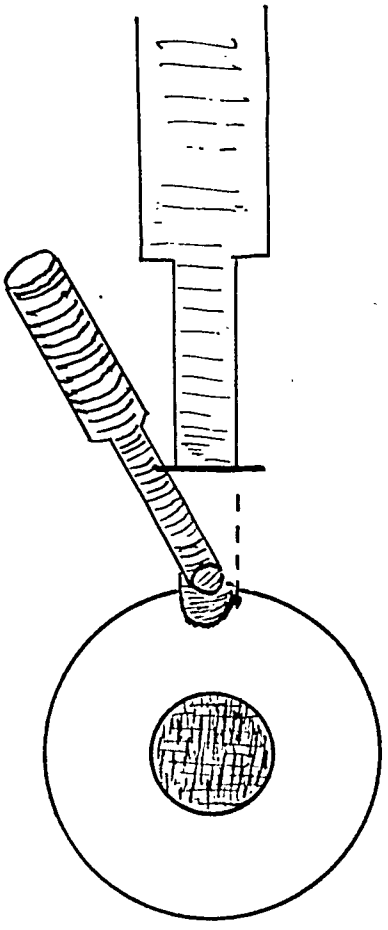


Fig. 1 (Arkin). A modification of Elliot's trephining operation.

Holding the spatula in the left hand, I use the *right hand* to perform the trephination in the corneoscleral margin at the meridian,

as is customary, while the sclera is lifted by the spatula. (The end of the spatula is visible across the cornea.) To avoid any slipping of the trephine, a wider spatula (3 mm. in width) may be used, or the spatula and trephine can be combined into one instrument (fig. 2).

Combining the operations of cyclodialysis and trephination, even with the broader

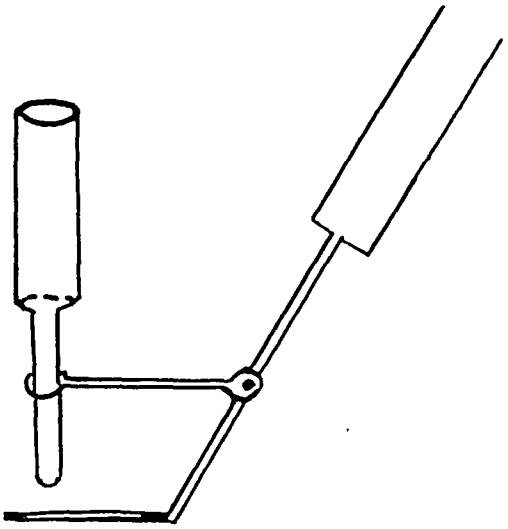


Fig. 2 (Arkin). The spatula and trephine can be combined into one instrument.

separation of the ciliary body, does not alter the final result. Cyclodialysis has for a long time been used with other operations for the relief of glaucoma in order to reinforce their action. No complications have resulted. Statistics show that, in cases of long standing, iridectomy is not effective in lowering the intraocular pressure but gives only temporary relief from an acute attack and that, in the end, a second operation (cyclodialysis) is indispensable.

Discussion

It would seem wise, therefore, to avoid two operations, when both procedures can be performed jointly. A majority of surgeons separate the ciliary body by means of a corneoscleral incision either before or after the iris is excised. Such a performance may be termed "cyclodialysis inferior" or "cyclodialysis superior," depending upon the technique used. I have come to the conclusion that it is much easier to execute the "cyclodialysis superior" first and then to perform a classical iridectomy immediately.

If cyclodialysis does not include a broad separation of the ciliary body, it does not cause an inflammatory reaction, and that is why it does not put an additional burden upon the eye if it is performed jointly with other operations for the relief of glaucoma. Indeed, cyclodialysis has one advantage in that it liberates the angle of filtration and thereby enables one to perform a correct trephination.

When the angle of filtration has trabecular and sclera-iris adhesions, the fact that the trephine on its way across the iris pricks through the iris tissue may be the reason that the aqueous does not leak away after the corneoscleral puncture is made.

When a trephination is performed as described, it is executed with greater safety because injury of the underlying tissues is impossible. The operator need not concentrate upon the sharpness of the trephine and, since there is support for the trephine, an even corneoscleral puncture can be made with a blunter instrument.

If a narrow spatula is used, the liquid flows out slowly, and the iris inserts itself on the sides. (It suffices then to withdraw the spatula and the iris prolapses only on removing the instrument.) It is important to remove the spatula slowly so that the liquid does not flow out too rapidly, causing dislocation of the lens or hemorrhage.

The chief disadvantage of this modification of Elliot's trephining operation is the possibility of a late infection being caused by the inclusion of corneal epithelium in the covering of the corneoscleral wound. Since the inferior part of the wound is only just covered with the corneal tissue which can easily be impaired, a secondary infection may follow. There is less danger of late infection after the Lagrange type of

operation because, when this procedure is used, the wound lies obliquely almost beyond the cornea.

Report of a case

While using a 2-mm. trephine to operate a case of glaucoma simplex, the instrument slid upward. Since it was too late to correct the instrument's position, I was compelled to finish the trephination with great care, striving not to injure the ciliary body.

In order to accomplish this, I maneuvered the upper part of the scleral disc close to the sclera and cut only the lower part with the trephine. When the instrument was taken away, I lifted the lower part of the disc with the forceps and cut away the upper part very carefully with the Graefe knife. Only when the spatula was introduced through the puncture in the anterior chamber did the aqueous flow.

As the spatula was introduced, I felt some resistance that indicated the presence of trabecular or scleral iris adhesions. Black tissue (the ciliary body) was visible in the superior portion of the wound and below the base of the iris which could be recognized by its different color. The iris did not prolapse because the wound lay almost totally on the ciliary body.

For fear of injuring the ciliary body, I did not try to draw out the iris but finished the operation and covered the wound with the customary conjunctival flap.

On the second postoperative day, the eye was quiet, and there were no signs of inflammation. There was good filtration and the intraocular pressure was reduced. Postoperative progress was normal, intraocular pressure became lower, and filtration persisted.

Comment

An analysis of this case made me conclude that performing a trephination in this manner (it could be named *superior trephination*) has some advantages. (1) The wound is covered completely with conjunctiva which facilitates separation of the flap from the corneal epithelium. Since the conjunctival flap is thicker, it is seldom perforated which is a certain safeguard against secondary infection. (2) Conjunctiva, more easily permeated by aqueous than corneal epithelium, completely covers the wound—not just half of it, as in the original Elliot's trephining operation. (3) When this modified method is used, the iris does not prolapse and obstruct the wound. Since the wound is bounded by the ciliary body, an iridectomy can be avoided. This latter circumstance necessitates an explanation.

Discussion

In executing the Elliot trephining operation in the traditional manner, it is almost always necessary to perform an iridectomy because the iris either prolapses or obstructs the wound. Because of the pressure of aqueous from behind, it is almost impossible to replace the iris since it is too frail to hold back this pressure.

The question may well be asked if iridectomy is not essential to the relief of high intraocular pressure. It would seem that the existence of free filtration is sufficient to reduce the pressure. I have found that a high ocular tension resulting from iritis (iritis glaucomatosa) can be controlled more quickly by trephination without iridectomy.

Since this technique is confined to sclerectomy, not only the iris, but the entire eye, is protected from injury, and the possibility of obstructing the wound with remnants of excised iris is eliminated.

One disadvantage of this technique lies in the possibility of injuring the ciliary body. For this reason, the modification in technique herein described is best suited to high trephination. This protects the ciliary body from damage and, at the same time, produces separation of trabecular adhesions.

Any fear that the ciliary body will fill

the wound may be dismissed. Even when a 2-mm. trephine is used, the ciliary body is too thick to obstruct the wound. Such a complication usually occurs after iridectomy or sclerectomy in which the wound is wider.

On the other hand, the iris is so delicate that its fold can obstruct even such a small incision as a buttonhole of the sclera. The higher in the sclera the incision is made, the less is the possibility of the iris prolapsing. However, it is important not to make an incision too high in the sclera for then the ciliary body would obstruct the wound completely and there would be no free filtration of aqueous.

In order to guarantee free filtration, a certain portion of the wound should be unobstructed and should open either directly into the chamber or, at least, touch its border.

In a survey of the available literature I found a paper by Schultz[2] with a discussion by Schieck. Assuming that a wound covered only with conjunctiva protects the eye against infection, Schultz used high trephination. In his discussion, Schieck said that high trephination injured the ciliary body and maintained that great caution was necessary to avoid this complication.

My method by which a spatula is used as a safeguard against the possibility of injuring the ciliary body would seem to be an answer to this criticism.

Summary*

1. A new method of trephination is described. It consists of introducing a spatula between the sclera and ciliary body as for cyclodialysis. The protection of the metal plate makes trephination easier and safer.

2. Cyclodialysis without great separation of the ciliary body does not detract from the end results, but on the contrary has certain advantages.

3. The so-called "superior trephination" has advantages over the classical or "inferior trephination." It is only considered more dangerous because there is fear that the ciliary body may be injured. This seldom occurs.

4. The use of a spatula between the sclera and ciliary body as protection in high trephination eliminates the possibility of injuring the ciliary body.

Targowa Street, W. 15

* This paper must be regarded as a preliminary report, since all my notes and case records were destroyed during the war.

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A NOTE ON METHODOLOGICAL EVALUATION OF SELECTED VISUAL TESTS*

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INTRODUCTION

In evaluating any method from the point of view of its usefulness in laboratory investigations on man one should ask at least three questions: (1) Is it affected by practice? (2) Does it yield, on successive applications, consistent results? (3) Is it sensitive to the experimental variables the effect of which it is used to test?

Too frequently the first two questions are neglected or decided impressionistically. Yet there is little doubt that the quantitative and impersonal approach should not stop at the stage of obtaining raw measurements but should be carried into the stage of evaluation as well. In the present paper we shall discuss from this standpoint a number of visual functions measured in connection with investigations on the effect of illumination on performance and fatigue. The work task, experimental design of the series, and the statistical concepts and computational formulas were presented in detail elsewhere.[1, 2] The reader may refer especially to a paper on ophthalmological functions, published in the JOURNAL,[3] for a more detailed discussion of the fundamental issues and statistical methodology.

SUBJECTS

The subjects were six young men with normal vision and ocular structures who participated in nutritional studies carried out at the laboratory during the year preceding the visual investigations. They were coöperative and conscientious, and were well adapted to experimental work.

* From the Laboratory of Physiological Hygiene, University of Minnesota. This work was supported in part by a grant from the Verd-A-Ray Corporation, Toledo, Ohio.

METHODS

The following functions will be discussed in this paper: recognition time for threshold stimuli, brightness discrimination, flicker fusion frequency, and blinking rate. The first three functions were measured before and after two hours of standardized visual work which reproduced, in a miniature job situation, the operation of conveyor inspection.[1] The blinking rate was determined during the course of visual work. These functions were a part of a large battery of tests applied in our studies on the effect of illumination intensity[4] and the spectral quality of light.[5]

RECOGNITION TIME FOR STIMULI OF THRESHOLD SIZE

The test of visual acuity consisted in designating the location of dots in white squares, 1.5 by 2.5 inches. The stimuli of different size were presented in random order. The distance between the test patch and the subject was kept at 18 feet, and the illumination remained constant. The time from the moment the stimulus was presented to the instant of recognition was determined. The recognition time for the smallest dot which was correctly located was taken as the test score.

BRIGHTNESS DISCRIMINATION

One half of the visual field in the Pulfrich photometer manufactured by Zeiss was set at a brightness level which served as a standard throughout the experimental series. The brightness level in the other half of the visual field was set at zero (darkness) and the subjects' task was to increase the brightness until it matched the standard. The deviation, expressed in arbitrary units, above or

below the correct value, served as a score. Both a red and a green filter were used. The score for each testing is based on five repeated determinations made with each filter.

Flicker fusion frequency

The flicker was produced by interrupting a beam of light by means of a rotating, perforated disc. The opening in the opal glass on which the light fell was about 1 cm. in diameter, with the distance from the light stimulus from the eyes fixed at 40 cm. The number of flickers per second was increased at a standard rate from a coarse flicker to the point of an apparent fusion. Three successive measurements were made at each testing and averaged.

Blinking rate

The blinking rate was determined by counting the number of blinks for five minutes. The count was taken at the start, at the midpoint, and toward the end of a 2-hour work period. Both the initial reading and the average value were considered, expressed as the number of blinks per minute.

Effects of practice

In experiments requiring testing repeated over a period of days (or months, as is the case in nutritional studies) it is desirable to reach a stable performance plateau before the start of the experimental work. The information on changes resulting simply for a repeated administration of a test and due to the complex of factors summed up in the term "practice" is essential for the planning of experimental work yet the data on this point are scarce. The initial test scores obtained under standard conditions before or at the start of the work test on the first 6 testing days, separated by 2 or 3 days during which the subjects worked as clerical or technical assistants in the laboratory, provide a useful material for a study on the effects of practice.

The men were well acquainted with the experimental procedures and were tested twice before the start of the experimental work proper. On inspection there was little change in the scores obtained on these two occasions. On the basis of theoretical considerations, as well as previous experience with some of the tests used in this series, no marked practice changes were expected. The presence of practice trends was tested by comparing the mean of the different functions for the first 3 testing sessions with the mean of the 4th, 5th, and 6th testing sessions. The data (table 1) indicate that the actual mean changes were small and reached the 5-percent level of statistical significance only in the case of flicker fusion frequency. This was somewhat surprising, since in our previous work no statistically significant effects of practice were observed when a group of 8 men was tested on 15 consecutive days.[6] Simonson and others found little change in the fusion level in 11 subjects who were tested repeatedly at least once a week up to 13 weeks.[7]

Probably the main factor which produced the apparent lowering of the fusion level in the present series was a better coördination of the perception of fusion by the subject and giving the signal to the experimenter, thus shortening the lag between occurrence of the fusion and reading of the dial. The second factor of potential importance in long-term experiments is the possible change in the criterion of "fusion." These factors are minimized if separate, repeated trials are made with definite rates of flicker. As indicated above, in this series the readings were made during the ascending, automatically increasing rate of flicker. However, the alternative procedure is more time consuming.

The actual "practice" change in the average flicker fusion-frequency score was small. In terms of the "fitness," the change was in the biologic direction of "deterioration": the higher the fusion score, the greater the capacity of the retinocortical system to perceive successive flashes as discrete stimuli and, therefore, by definition, the "better"

TABLE 1

THE DIFFERENCES BETWEEN THE MEAN SCORES AND THE F-TESTS OF THEIR STATISTICAL SIGNIFICANCE FOR THE FIRST AND SECOND SET OF THREE SUCCESSIVE TESTING SESSIONS

Function	Units	Mean Differences	Biological Direction of Change†	F-Values
Recognition time	sec.	−1.2	+	0.94
Brightness discrim., red	arbitrary	+0.1	(−)	0.41
Brightness discrim., green	arbitrary	−0.4	+	2.09
Flicker fusion frequency	flickers per second	−0.6	−	6.39*
Blinking rate, initial	blinks per minute	−1.6	+	1.78
Blinking rate, average	blinks per minute	−1.2	+	0.10

* For 1 and (18−1) = 17 degrees of freedom, the value of the F ratio at the 5% level of significance is 4.45, at 1% level it is 8.40.

† The plus sign indicates an "improvement," the minus sign a "deterioration."

the score. In the majority of the other functions, the changes were in the direction of "improvement" but remained well within the limits of chance variation.

CONSISTENCY OF REPEATED MEASUREMENTS

The data analyzed from the point of view of the consistency of the measurements were obtained in the 13th to 18th session of the series. The rows in Table 2 represent data obtained for each individual in the course of six testing sessions, separated by 2 to 3 days; the arithmetical averages of the rows indicate *individual means.* The columns represent testing sessions; averages of the columns may be referred to as *"daily means."*

TABLE 2

MEASUREMENTS OBTAINED IN A SERIES OF SIX REPEATED TESTING SESSIONS

A. Recognition Time

	Trial 1	2	3	4	5	6	$\bar{Y}_I$
H	4.0	1.5	1.5	4.0	3.5	2.0	2.8
R	4.0	7.0	2.5	10.0	6.5	14.0	7.3
O	13.0	6.0	13.0	6.0	17.0	7.0	10.3
P	6.0	3.0	9.5	7.0	7.5	7.0	6.7
B	5.0	8.0	4.0	2.5	2.5	6.0	4.5
V	3.5	3.0	1.5	2.0	6.5	2.0	3.1
$\bar{Y}_D$	5.9	4.8	5.3	5.2	7.2	6.2	

B. Brightness Discrimination (Red)

	Trial 1	2	3	4	5	6	$\bar{Y}_I$
H	1.4	1.2	1.3	1.3	1.7	2.4	1.6
R	2.2	2.8	1.8	2.2	2.1	2.6	2.3
O	4.6	4.1	3.3	4.0	4.2	3.2	3.9
P	3.1	3.5	2.0	3.3	3.6	2.7	3.0
B	2.3	2.5	2.6	2.7	2.3	2.2	2.4
V	2.7	2.4	2.5	2.2	2.0	2.8	2.4
$\bar{Y}_D$	2.7	2.8	2.2	2.6	2.6	2.6	

C. Brightness Discrimination (Green)

	Trial 1	2	3	4	5	6	$\bar{Y}_I$
H	2.1	2.4	1.6	2.1	1.9	3.0	2.2
R	2.4	2.5	2.3	3.0	1.9	2.1	2.4
O	3.6	3.1	2.8	3.0	2.9	3.1	3.1
P	3.1	3.4	2.7	3.2	3.1	2.8	3.0
B	2.4	2.9	2.7	2.4	2.5	2.8	2.6
V	2.6	3.1	2.8	2.9	2.6	2.9	2.8
$\bar{Y}_D$	2.7	2.9	2.5	2.8	2.5	2.8	

D. Flicker Fusion Frequency

	Trial 1	2	3	4	5	6	$\bar{Y}_I$
H	47.2	47.8	48.4	46.5	46.2	48.5	47.4
R	46.1	44.4	46.0	46.8	46.9	44.0	45.7
O	45.5	43.4	45.5	45.8	43.7	44.9	44.8
P	45.6	45.1	45.6	44.3	45.3	44.6	45.1
B	45.1	46.4	48.0	47.6	46.5	44.3	46.3
V	47.1	46.6	46.5	47.3	46.4	46.6	46.8
$\bar{Y}_D$	46.1	45.6	46.7	46.4	45.8	45.5	

E. Blinking Rate, Average

	Trial 1	2	3	4	5	6	$\bar{Y}_I$
H	8.9	8.8	10.8	10.8	9.3	9.1	9.6
R	2.6	2.8	2.8	2.3	2.9	3.8	2.9
O	3.0	3.8	3.8	3.8	3.0	3.3	3.4
P	8.0	6.0	12.1	9.6	7.0	9.1	8.6
B	7.6	8.3	5.9	5.7	5.2	4.3	6.2
V	5.0	4.0	5.7	3.0	4.2	2.7	4.1
$\bar{Y}_D$	5.8	5.6	6.8	5.9	5.3	5.4	

F. Blinking Rate, Initial

	Trial 1	2	3	4	5	6	$\bar{Y}_I$
H	7.0	9.0	10.7	8.7	7.3	7.0	8.3
R	3.3	3.0	2.0	2.3	3.7	6.7	3.3
O	3.0	3.0	5.0	3.0	2.0	4.3	3.4
P	3.3	3.7	13.3	7.3	8.7	10.0	7.7
B	5.0	8.3	5.3	6.7	3.3	4.0	5.4
V	5.3	4.7	4.7	2.3	5.0	2.7	4.1
$\bar{Y}_D$	4.5	5.3	6.8	5.0	5.0	5.6	

In a 2-way table we may compute three types of variation, characterized statistically in terms of variances:

1. Variation within the rows; this may be designated as "variance within individuals," V_{wI}.

2. Variation within the columns, expressed as "variance within days," V_{wD}.

3. The discrepancy between the scores predicted on the basis of the mean values for a given individual and a given day, and the actual measurements; this type of variability is expressed as the "random variance," V_R.

When there are no significant trends in the scores obtained in consecutive testing trials and when the ratio V_{wI}/V_R approaches one, the consistency of a test may be characterized in terms of the *intraindividual* variation (V_{wI}). This indicates the amount of inconsistency in the scores obtained on different days under standard conditions. In evaluating the magnitude of this "experimental error" we shall compare it with the *interindividual* variation (variance within days, V_{wD}). Ideally, we should know the population value of this characteristic; when we are working with small samples of highly homogeneous subjects, the V_{wD} is likely to be a gross underestimate of the population value. The comparison of V_R and V_{wI} with V_{wD} can be obtained in the form of a simple percentage

$$\left(\%\ V_R = \frac{100V_R}{V_{wD}}, \quad \%\ V_{wI} = \frac{100V_{wI}}{V_{wD}}\right)$$

or in a form of a coefficient of day-to-day consistency

$$\left(r_C = 1 - \frac{V_R}{V_{wD}}, \quad r'_C = 1 - \frac{V_{wI}}{V_{wD}}\right).$$

TABLE 3

STATISTICAL DATA CHARACTERIZING THE CONSISTENCY OF REPEATED MEASUREMENTS OF SELECTED VISUAL FUNCTIONS

Function	Mean Score	Variances			
		V_R	V_{wI}	V_{wD}	V_{wI}/V_R
Recognition time	5.8 sec.	9.6	8.7	16.4	0.91
Brightness discrim., red	2.6 units	0.18	0.19	0.78	1.06
Brightness discrim., green	2.7 units	0.09	0.10	0.20	1.11
Flicker fusion frequency	46.0 flickers	0.9	1.0	1.8	1.11
Blinking rate, initial	5.4 blinks	4.2	4.1	8.2	0.98
Blinking rate, average	5.8 blinks	1.5	1.6	9.2	1.07

Function	$\frac{100V_R}{V_{wD}}$	$1-\frac{V_R}{V_{wD}}$	$\frac{100V_{wI}}{V_{wD}}$	$1-\frac{V_{wI}}{V_{wD}}$
Recognition time	59%	0.41	53%	0.47
Brightness discrim., red	23%	0.77	24%	0.76
Brightness discrim., green	42%	0.58	50%	0.50
Flicker fusion frequency	50%	0.50	56%	0.44
Blinking rate, initial	51%	0.49	50%	0.50
Blinking rate, average	16%	0.84	17%	0.83

As indicated in Table 3, the average intraindividual (V_{wI}) and the random (V_R) variance are of about the same magnitude, their ratio being for all the visual functions tested very close to 1.00; consequently, both can serve as an indicator of the "chance variation" in scores obtained on repeated testing. When we express the "error variances" (V_R and V_{wI}) as percentage of the average interindividual variance (variance "within days," V_{wD}), the figures run from 16 percent for the blinking rate average to 59 percent for the recognition time, and the coefficients of consistency range from 0.84 to 0.41. In view of the high homogeneity of the sample, we may be certain that the average interindividual variance (V_{wD}) used as the criterion for the evaluation of the "ex-

perimental error" is too small and, consequently, the tests appear to have low consistency. Elsewhere[2] tentative limits for the evaluation of consistency coefficients have been set as follows: for very high consistency $0.91 \leqq r_c \leqq 1.00$, for high consistency $0.81 \leqq r_c \leqq 0.90$, and for low consistency $r_c \leqq 0.70$.

We have an empirical check on the effects of the homogeneity of the sample for the flicker fusion frequency, which was tested by the same instrument in a larger group of subjects; both groups were drawn from the same population. For the larger sample ($N = 36$) the interindividual variance was 19.40. Using this as an estimate of the population value, the percentage error ($100\ V_{wI}/V_{wD}$) is reduced from 56 percent to 5.2 percent, and the coefficient of consistency increases from 0.44 to 0.948 which is a very respectable figure. This value is close to the product-moment correlation of 0.981 obtained by correlating two sets of flicker fusion determinations made a week apart on the 36 men in the age range from 20 to 30 years.

For the other functions no such correction can be made because values for larger samples are not available but one may be certain that the consistency of the tests which at present appear low and in some cases very low would improve markedly if adequate estimates of the interindividual variability were available.

Sensitivity to stress

No attempt will be made to investigate this question systematically. The type of stress will be limited to visual work and the data will serve only as an illustrative example. The visual work used as the experimental "stress" involved recognition of moving letters, exposed for a fraction of a second, and has been described in detail.[1] The set of experiments considered in this context involved 2 hours of work at the illuminative level of 5 foot-candles. This represented a fairly severe strain and should be a reasonable criterion for testing the possible use of these functions for laboratory studies of visual fatigue.

TABLE 4

CHANGES IN THE VISUAL FUNCTIONS TESTED BEFORE AND AFTER TWO HOURS OF VISUAL WORK INVOLVING RECOGNITION OF LETTERS (VISUAL ANGLE OF TEN MINUTES) AT FIVE FOOT-CANDLES

Function	Mean Differences	F-Values	Biologic Direction of the Change†
Recognition time	+3.7 sec.	16.55*	−
Brightness discrim., red	+0.2 units	2.69	−
Brightness discrim., green	−0.05 units	0.15	+
Flicker fusion frequency	−0.9 flickers per sec.	18.33*	−
Blinking rate (initial-terminal)	+0.8 blinks per min.	1.01	−

* For 1 and $(36-1)=35$ degrees of freedom, $F_{0.05}=7.42$, $F_{0.01}=4.12$.
† The plus sign indicates an "improvement," and the minus sign a "deterioration."

The differences between the mean values of 36 individual determinations made before and after the 2-hour spell of intensive work or, in the case of the blinking rate, at the start and end of the visual work, are given in Table 4.

The change was in 4 out of 5 functions in the direction of deterioration but only the recognition time and the fusion frequency of flicker were affected significantly. In terms of biologic significance, as distinguished from statistical significance, the change in the flicker fusion frequency was small. The increase in the recognition time attained a value which would be relevant from the practical point of view.

The different behavior of the functions measured may in part reflect a true

differential sensitivity, in part it may be due to the fact that the determinations of brightness discrimination were made last in the series of tests with a delay of about 15 minutes as compared with the determinations of the recognition time and flicker fusion frequency which were measured immediately at the end of the work.

The change in the rate of blinking at intervals measured during work is not sensitive to the visual stress and can not serve as an "index of fatigue." This is in conformity with the experience of Tinker and other investigators (see ref. 8, esp. p. 440 ff.).

Summary and Conclusions

1. An attempt was made to evaluate a number of visual characteristics from the point of their usefulness in laboratory investigations of "fitness" and "fatigue."

2. The functions studied included recognition time for threshold stimuli, brightness discrimination, flicker fusion frequency, and blinking rate.

3. As a result of practice in taking the tests, there was a small but statistically significant drop in the fusion frequency of flicker. The decrease in the rate of blinking and in the amount of error made in matching a standard level of brightness (green filter) was not significant.

4. The consistency of the scores repeated on six different occasions under standard conditions appears to be low, due to a very high homogeneity of the sample. When, in the case of the fusion frequency of flicker, more valid estimates of the interindividual variation for the population were substituted for the estimates obtained on the given sample of subjects, the consistency criteria assumed satisfactory values.

5. When the functions were measured before and after 2 hours of strenuous visual work under 5 foot-candles, the difference between initial and terminal scores was in direction of biologic deterioration in all of the functions studied, except the brightness discrimination (green filter). The change was statistically significant only in the case of the recognition time and the flicker fusion frequency.

Stadium South Tower (14).

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SOME EXPERIMENTS WITH GREEN SPECTACLES PRESCRIBED TO GLAUCOMATOUS PATIENTS*

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In our preceding work† it was shown that the illumination of the one eye with green light resulted in the lowering of the intraocular pressure in the other eye, this effect being especially pronounced in glaucomatous eyes. It seemed natural, therefore, to test the use of green spectacles, as a means tending to reduce intraocular pressure. The present paper contains a description of the attempts made by us in this direction.

Experiments involving the use of green spectacles by glaucomatous patients were carried out on 19 subjects with various forms of the disease.

The period of observation was 12 to 15 days for in-patients (11 cases), and 30, 50, and more days for out-patients (8 cases).

METHOD

The pressure was determined with the aid of the Schiøtz tonometer three times a day: at 7 a.m. when the patients were still in bed; at 1 p.m., and between 7 and 8 p.m., at the moments of a maximum or minimum intraocular pressure..

The patients were withheld from any medication during a whole day, or even two days, if the status of their eyes made it permissible. By the end of the second day, in most cases, the patient received green spectacles which he was asked to wear throughout the period of examination.

The spectacles were manufactured from green glass of a hue corresponding 511 mμ and with daylight transparency equal to about 21 percent.

In certain cases the use of green spectacles was combined with a greatly reduced dose of pilocarpine. The combination of green glasses with the instillation of several drops of adrenalin (1:1,000) was also made to test Kravkov's statement that the instillation of adrenalin at this concentration may increase the eye's sensitivity to the green light.

The effect of the use of green spectacles under the given conditions was evaluated by us from the run of the diurnal curve of intraocular pressure.

RESULTS

From an analysis of the curves obtained from testing patients, it may be seen that, notwithstanding the total suspension of pilocarpine medication, the intraocular pressure showed a pronounced tendency to decrease in patients wearing green spectacles; the range of fluctuations of intraocular pressure during the day was likewise found to decrease. (Degenerative alterations of these eyes were not advanced, nor was the level of tension excessively high.)

An appreciable effect was obtained when the use of green spectacles was combined with the administration of a very small dose of pilocarpine (0.5-percent solution twice a day).

In 20 of 25 diurnal curves, we were able to observe a clearly expressed decrease in intraocular pressure, as well as a reduction of the range in fluctuation, as compared to the records taken at the period when the administration of pilocarpine was entirely suspended. The decrease in tension was a fairly appreciable one—6.0 mm. Hg in 8 cases; 6.0 to 10 mm. Hg in 9 cases; 10 mm. Hg and more in 3 cases.

The decrease in intraocular pressure was much more striking, however, in certain

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† Am. J. Ophth., 31:721 (June) 1948.

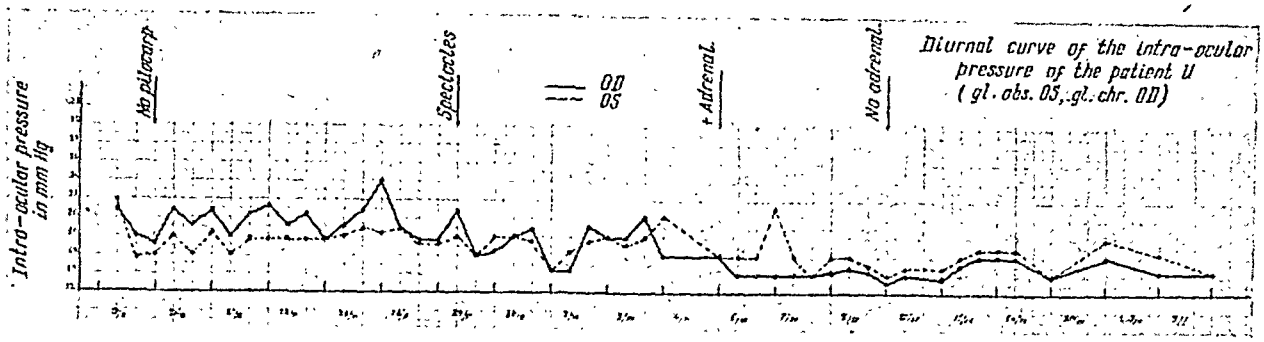


Fig. 1 (Zaretskaya). *Case 1.* Absolute glaucoma of the left eye; chronic glaucoma of the right eye.

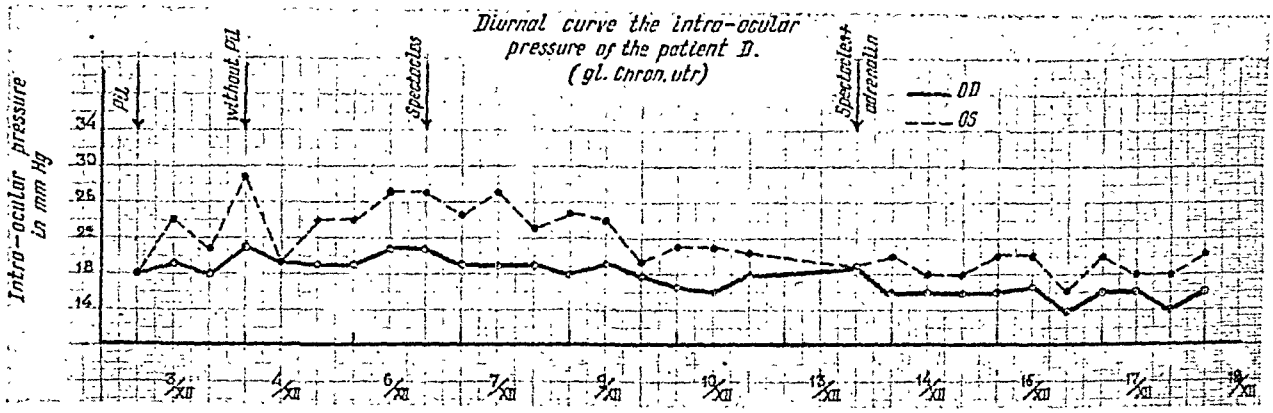


Fig. 2 (Zaretskaya). *Case 2.* Chronic glaucoma of both eyes.

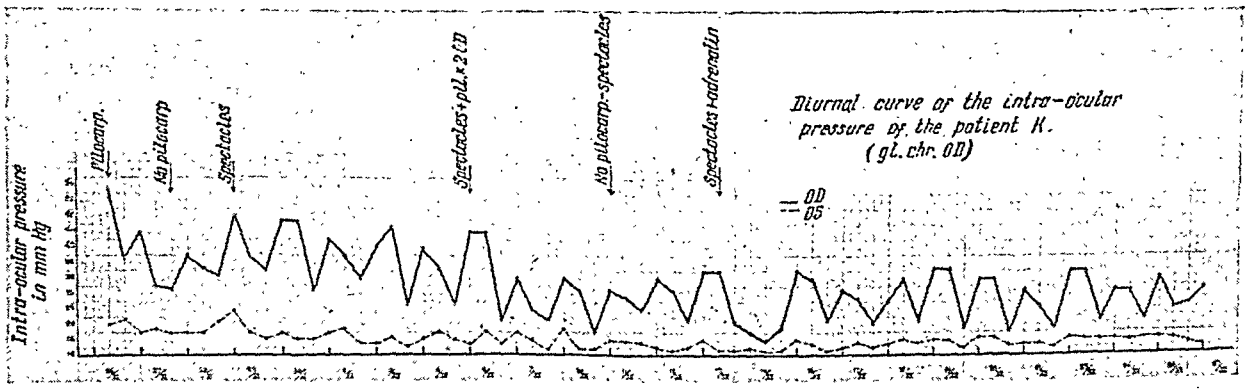


Fig. 3 (Zaretskaya). *Case 3.* Chronic inflammatory glaucoma of the right eye. The left eye was normal.

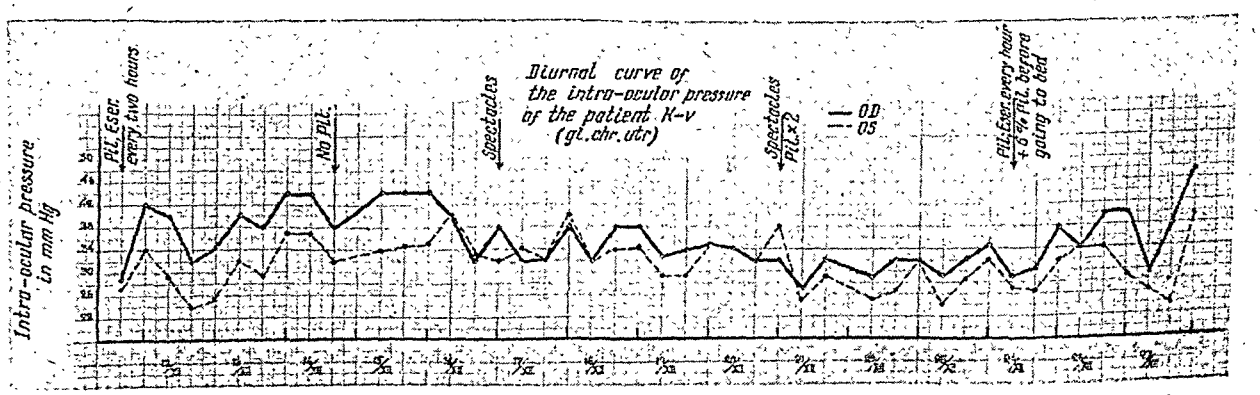


Fig. 4 (Zaretskaya). *Case 4.* Chronic glaucoma of both eyes.

cases in which the use of green spectacles was combined with small doses of adrenalin.

The 24-hour curves reproduced in Figures 1 to 4 were plotted for some of the patients investigated by us and may well illustrate all that has been said.

Report of cases

Case 1 (fig. 1). The patient, a woman, 75 years of age, suffered from chronic glaucoma of the right eye and nearly absolute glaucoma of the left eye.

The eyes were quiet, corneas transparent, and the pupils were the size of a pinhead. The crystalline lens was sclerotic. Visual acuity of the right eye was 0.9; that of the left eye, light projection irregular. The visual field of the right eye showed a concentric contraction for the white, and a sharp contraction for the other colors. The fundus of the right eye showed a deep glaucomatous excavation of the papilla of the optic nerve; this was somewhat less profound in the left eye.

The tension as measured according to Sobansky in the arterial center of the retinas of the two eyes was 45 mm. Hg.

The patient has now been wearing her green spectacles for more than a year without receiving any supplementary medication.

No undesirable phenomena on the part of the patient's eyes have been recorded within this period during which she was under our continuous observation.

Case 2 (fig. 2). The patient, a man, aged 61 years, had chronic glaucoma of both eyes. He complained of a mist swimming before the eyes, iridescent halos when looking at the lamp, reduced visual acuity, but no pain. He had been treated since 1937 with instillation of 1-percent pilocarpine solution, without feeling any better. At the first examination, the patient was much annoyed by the continuous dimness in both eyes.

The pupils were extremely narrow (miosis medicam). Visual acuity was: R.E., 0.4 to 0.5, with a 0.5D. sph., 1.0; L.E., 0.4, with a 0.75D. sph., 1.0.

Green spectacles were prescribed and, as may be seen from Figure 2, the general level of the diurnal curve of tension for both eyes became lower. The patient enjoys his spectacles and feels more comfortable.

However, since the intraocular pressure in the left eye was occasionally found to fluctuate above the normal level, an attempt was made to combine the use of green spectacles with instillation of adrenalin solution (1:1,000). As seen from Figure 2, both the level of tension and its fluctuation range soon became quite normal.

Case 3 (fig. 3). Patient K, a man, 62 years old, had chronic inflammatory glaucoma of the right eye. The left eye was normal. He had been ill since 1938 when he suddenly became aware of reduced visual acuity, of iridescent halos, and mist before his right eye.

Visual acuity was O.U., 0.02, without correction; O.U., 1.0, with correction.

The fundus of the right eye showed a glaucomatous excavation of the papilla of the optic nerve, although not sharply pronounced. The papilla was hyperemic, the veins extended.

The visual field was somewhat concentrically restricted for the white, and somewhat more for colored lights. The left eye was within the normal.

On November 29th the patient was asked to wear green spectacles. Diurnal curves were analyzed for five days. During this period, the intraocular pressure persistently showed a wide range of fluctuation, although at a somewhat lower level. The patient felt well, and he was less annoyed by the feeling of mist swimming before his eyes. He liked to wear his spectacles which make him feel more at rest; he was becoming much less irritable.

On December 6th, a 1-percent pilocarpine solution was prescribed in addition to the

use of green glasses. This was to be instilled twice a day into his right eye.

Under these conditions intraocular pressure showed a marked decrease, although on separate days of the period of examination its level attained 44 mm. Hg.

The best effect was attained, however, by substituting a 1:1,000 solution of adrenalin, twice a day, for the pilocarpine. The patient was observed for 11 days. Without entirely normalizing the tension, the combination of green spectacles with adrenalin prevented the maximum tension from exceeding 34 mm. during these days.

It should be pointed out in this place that, during the course of our experiment, we often observed that the instillation of pilocarpine at shorter intervals caused the intraocular pressure to persist at a higher level than when less frequent doses, or no pilocarpine at all, were given.

Case 4. (fig. 4). At this juncture it is of interest to cite the case of Ku., aged 65 years, who suffered from chronic glaucoma of the two eyes. The diurnal curve of this patient, after he had refused to wear green spectacles combined with small doses of pilocarpine, and after pilocarpine and eserine every hour had been prescribed as a preoperational treatment, shows that there was a sharp increase in tension and that the level, in general, was much higher than during the preceding days. The range of fluctuation of tension, which had been 6.0 mm. or less, rose to 10 to 16 mm. during these days.

Comment

In addition to these successful results, cases were also encountered where the patients derived no benefit whatever from the use of green spectacles. Some even showed a slight increase in intraocular pressure, although this increase was observed in individual cases only, in patients whose intraocular pressure had for the most part been stabilized at a high level.

The questions arise: What is the clinical value of our investigations? And what is their practical application?

The encouraging results of our experiments make us believe that the use of green spectacles may, in certain forms of glaucoma, prove a helpful therapeutic procedure, especially if prescribed along with small doses of adrenalin or pilocarpine.

Discussion

The mechanism of the action of indirect stimuli upon the intraocular pressure is rather obscure and so is, although to a lesser degree, the mechanism responsible for the appearance of hypertension in the case of glaucoma.

Unquestionable, however, is the fact that green light, while acting upon the color receptor of our vision, produces a definite rearrangement in the vegetative nervous system, thus affecting also the neurovascular apparatus of the eye.

It may be assumed that the amounts of acetylcholine and sympathin in the eye are different, according to whether the eye is exposed to green or to red light: this may possibly be the cause of the opposite reaction of the intraocular pressure for the red or the green stimulus revealed by us.*

Conclusions

1. Preliminary tests have shown that the use of green spectacles prescribed along with a total withdrawal of pilocarpine medication produces in glaucomatous patients a well-pronounced tendency toward a decrease in their intraocular pressure. The beneficial effect observed was at its maximum in patients showing a medium level of intraocular pressure accompanied with no sharply expressed disturbances in the function of the sight.

2. The intraocular pressure in glaucomatous patients has been found to be most reduced when the use of green spectacles

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*Am. J. Ophth. 31:721-727 (June) 1948.

was reinforced by the administration of small doses of adrenalin.

3. The mechanism of action of the green-light stimulus upon intraocular pressure still remains obscure. It is very probable however, that by acting upon the color receptor of the human eye, the green light brings about a definite rearrangement in the autonomous nervous system and thus affects the neurovascular apparatus of the eye.

Sadovaya-Chernogryazskaya Street. (14/19).

RUBEOSIS IRIDIS DIABETICA

JACK V. LISMAN, M.D.
New York

The association of new capillary formation on the iris with glaucoma in diabetic patients was first noticed by Salus[1] in 1928. He proposed the term rubeosis irides diabetica and called the associated glaucoma the true diabetic glaucoma in contradistinction to the usual primary glaucoma in the ordinary diabetic patient. Since his report of 3 cases, 37 more cases have appeared in the literature and have been reviewed by Fralick.[2] Two of the 5 cases reported by Fralick occurred in the absence of diabetes. The rarity of this condition is indicated in its absence in a series of 2002 diabetics in whom rubeosis was searched for, studied by Waite and others.[3]

The original description of Salus and his conclusions have been somewhat modified by the report of subsequent cases. As originally described, the surface of the iris is transformed by the appearance of new, light-red, capillary nets superimposed on an otherwise normal appearing iris tissue. These new vessels are in the region of the lesser circle of the iris, placed closely together and interlinked, and give this portion of the iris a reddish hue.

Other larger vessels run radially from the lesser circle toward the ciliary part where they disappear in the angle of the anterior chamber. The vessels never extend into the pupillary area itself.

The rubeosis is not related to the severity nor to the duration of the diabetes. Kurz[4] presents one case in a man, aged 29 years, with diabetes of only three years' duration. The rapidity with which glaucoma follows the rubeosis is quite variable and may appear concomitantly or may be delayed as long as five years, as in one case of Salus. One third of the cases have an associated essential hypertension. Hemorrhagic and proliferating retinopathy is frequently associated.

Wegner[5] reports one case of rubeosis associated with diabetic retinopathy that was successfully operated on for cataract by intracapsular extraction. In view of the inevitable glaucoma in all other cases and the interval of five years between the appearance of rubeosis and the glaucoma in the case of Salus, the cataract extraction was probably followed by glaucoma after a long interval.

Glaucoma is a sequel to the capillary formation and invariably appears if the cases are followed long enough. The glaucoma is associated with hemorrhage in the anterior chamber and does not respond to miotics; surgical intervention is always followed by disastrous consequences.

Gonioscopic examination of the angle was described by Kurz[4] who found large radially running vessels breaking up into many branches connecting directly with Schlemm's canal. The angle at first was bridged by numerous synechias between which ran many fine vessels; the angle was almost completely obliterated as the pathologic process advanced. Schlemm's canal was filled with

blood on gonioscopic examination. The histologic examination by Kurz revealed that the new vessels were not associated with inflammation and were not part of a new membrane but lay in and upon iris tissue itself.

These eyes respond not at all to treatment and because of the pain may have to be enucleated. In the stage of absolute glaucoma, the neocapillary formation disappears from view as the iris stroma undergoes atrophy and no evidence of the antecedent rubeosis is present. Kurz presents this fact as evidence that the new vessel formation is not part of an inflammatory membrane but part of the iris tissue and shares its fate when it atrophies. The characteristics of the associated glaucoma is that it is of the hemorrhagic type. There is always a deep anterior chamber.

Sugar,[6] in his classification of glaucoma, places hemorrhagic glaucoma in a separate category. This form of glaucoma may be seen in patients with diabetic rubeosis and also in thrombosis of the central vein of the retina and, clinically, the two types are not distinguishable. Sugar believes that the rubeosis occurs only when there are repeated large intraocular hemorrhages and that the neocapillary formation is a toxic effect due to the disintegrating blood; if the toxic effect of the disintegrating blood is less marked, the rubeosis may antedate the glaucoma by a long time.

Etiologically, the two types of glaucoma are the same, both being associated with massive intraocular hemorrhage and with severe angiosclerotic changes. The presence of albuminous material and extensive vascular membranes in the angle of the anterior chamber in thrombosis of the central vein has been well shown by Samuels, in 1933.[7] He states that the glaucoma "could be caused by a change in the metabolism of the eye, produced by toxic substances derived from the disintegration of red blood cells and a degeneration of the stroma of the vitreous."

The rupture of the thin-walled vessels when the tension if the eyeball is suddenly reduced by surgical procedures, is the reason the eye fails to respond to antiglaucoma operations.

Hemorrhagic glaucoma differs from simple glaucoma in its acute malignant onset with vascular congestion, and from true acute congestive glaucoma in that the anterior chamber is of normal depth rather than shallow.

Report of a case

History. F. W., a 53-year-old white woman, was seen on the eye service of the Morrisania City Hospital in December, 1944, complaining of a red, painful right eye of one week's duration. Examination in 1941 had revealed a corrected visual acuity of 20/40 in each eye; diabetic retinopathy and incipient cataractous changes were present in both eyes at that time.

The patient was a diabetic of 30 years' standing and had been taking insulin for the preceding 12 years. The diabetes was always easily controlled on 15 to 18 units of Protamine Insulin. There had been one episode of pyelitis. There had been 10 pregnancies with 4 miscarriages.

General examination revealed an obese woman with some evidence of weight loss. The heart was moderately enlarged. The blood pressure was 210/100 mm. Hg. The urine contained 4+ sugar but no acetone; 20 W.B.C. per H/p/F. The diabetes was easily controlled.

Examination revealed a visual acuity of 5/200 in each eye, not correctable by lenses. The right eye was markedly tender to palpation and there was minimal edema of the upper lid. There was marked ciliary injection. The pupil measured 5 mm. in diameter, and was fixed to light and for near. The pupillary border was irregular; two fine posterior synechias were seen below. The pupillary portion of the iris was light red in color and contrasted markedly from the brown ciliary portion. The color of the iris was due to the presence of numerous new capillaries, so small and so closely packed

together that even with the aid of the corneal microscope they were barely distinguishable individually. These vessels ran to the pupillary border and disappeared from view; they occupied the surface of the inner third of the iris and from this capillary net larger vessels ran radially into the angle of the anterior chamber where they could not be followed.

The cornea was steamy and the angle could not be examined gonioscopically because of the corneal edema. An aqueous flare was present but there were no precipitates on Descemet's membrane.

The surface of the iris not covered by the capillary net showed the normal pattern differentiation and no filling in of the crypts by newly formed tissue. The vessels appeared to run on the surface of the iris. Incipient cataractous changes were present and the fundus could not be visualized. Tension measured over 90 mm. Hg (Schiøtz). Transillumination was normal.

The pupillary responses in the left eye were physiological and the iris itself showed no abnormalities. Incipient cataractous changes were present, and the fundus could not be visualized. Transillumination was normal.

Treatment. After repeated instillations of atropine into the conjunctival sac of the right eye, the pupil dilated easily with the exception of the area anchored by the posterior synechias below. Tension dropped to 45 mm. Hg (Schiøtz) and the patient felt relieved of her pain. The corneal edema cleared somewhat, and the neocapillary formation on the iris appeared less prominent. The patient refused surgery and during the following six weeks vision fell to light perception.

Ocular tension during this interval was never controlled; it was observed that under miotics the tension would rise and would fall with mydriatics. The patient was most comfortable when the pupil was dilated. The patient finally consented to operation and a paracentesis of the anterior chamber was performed; as the aqueous escaped, the vessels on the surface of the iris dilated rapidly and ruptured. The anterior chamber was completely filled with blood.

Following operation, the ocular tension always remained over 90 mm. with considerable pain which was relieved somewhat by atropine. A hyphemia, measuring about 3 to 5 mm. in height, was continuously present. The rubeosis did not change in appearance. This eye was enucleated four months after operation.

Course. In February, 1945, three months after the onset of rubeosis of the right eye, the left eye became red and inflamed and presented the picture of rubeosis iridis similar to that previously observed. The vision had fallen to hand movements and the tension was over 90 mm. Hg. The tension was reduced to 45 mm. by the use of miotics. On attempting to inject novocain and adrenalin retrobulbarly, a retrobulbar hemorrhage was encountered, the eyeball became proptosed, and the tension rose again to over 90 mm.

The patient consented to operation, and a posterior scleral trephination was performed. At operation, the ocular tension was decreased slowly by expression of vitreous, with clearing of the corneal edema and relief of pain. There was no rupture of the capillaries on the iris. Tension was reduced to 20 mm.

The day after operation, the tension rose to 45 mm. Hg, and a large gelatinous exudate was present in the anterior chamber. The pupil was dilated rapidly with atropine, the patient was given sulfadiazine orally and within 24 hours, the gelatinous exudate disappeared. A small hyphemia had appeared and the rubeosis was not prominent.

During the next two weeks, tension was always moderately elevated but could always be massaged down to normal. The time then came when the elevated tension could not be massaged down and a Lagrange sclerectomy was performed with very little associated bleeding in the anterior chamber. The

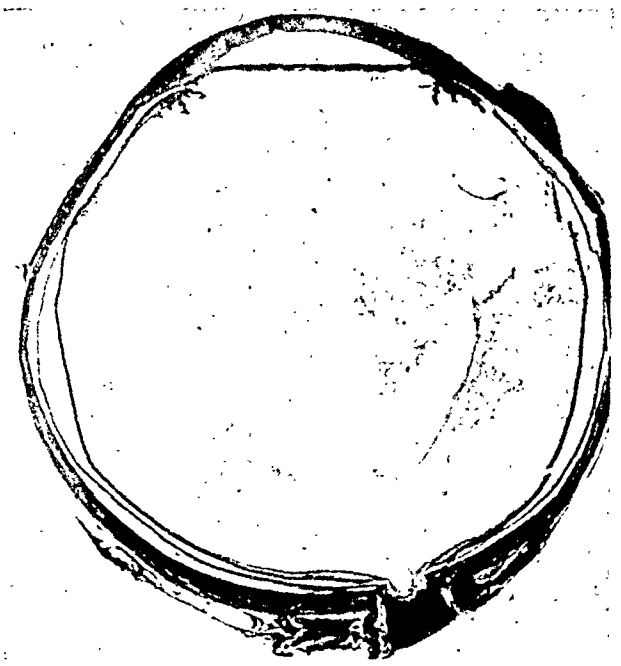


Fig. 1 (Lisman). Section demonstrating broad anterior peripheral synechia and deep glaucomatous cupping.

tension remained normal for two weeks postoperatively and then there were repeated hemorrhages into the anterior chamber and marked elevation of tension and loss of normal light projection.

Over a period of 10 months, the iris gradually became atrophic and the rubeosis almost obliterated. At one stage, the vessels crossed over the pupillary border onto the surface of the cataractous lens; even these vessels in time disappeared.

Histologic examination. (Dr. S. Gartner)

"There is an extensive infiltration of small round cells and hyperemia at the limbus. The anterior chamber contains a fibrinous exudate, some of which is adherent to the corneal endothelium. The angle of the anterior chamber is blocked by broad anterior peripheral synechias.

The iris is extensively attached to the periphery of the cornea (fig. 1). The anterior surface of the iris, especially in the part not adherent to the cornea has an additional layer of newly formed connective tissue which is vascularized with many small and medium-sized vessels and characterized by very thin walls. The older iris

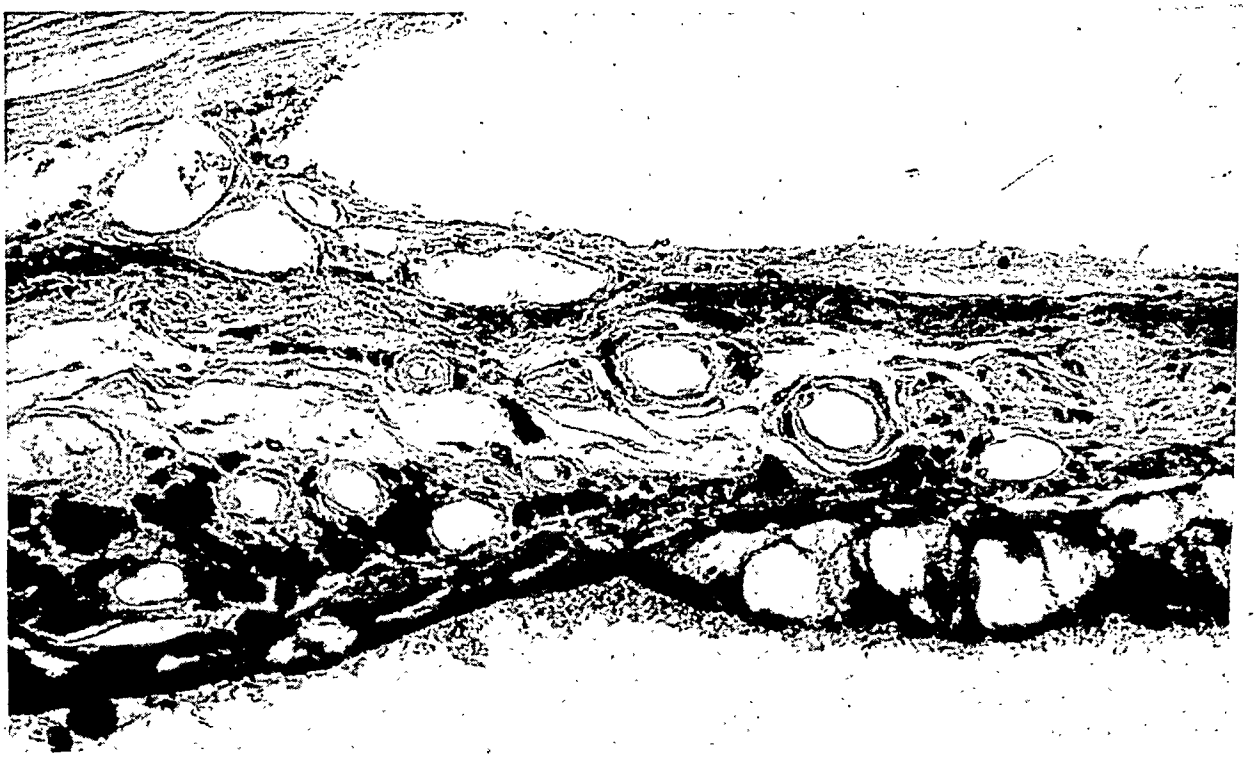


Fig. 2 (Lisman). Section showing layer of connective tissue and blood vessels on the iris surface and extending into the angle. The thin-walled vessels in this layer contrast markedly with the older iris vessels with characteristic thick adventitial coats.

vessels have the characteristic thick adventitial coat (figs. 2 and 3).

The pigment epithelial layer has been transformed into a thicker and irregular



Fig. 3 (Lisman). Layer on the iris surface.

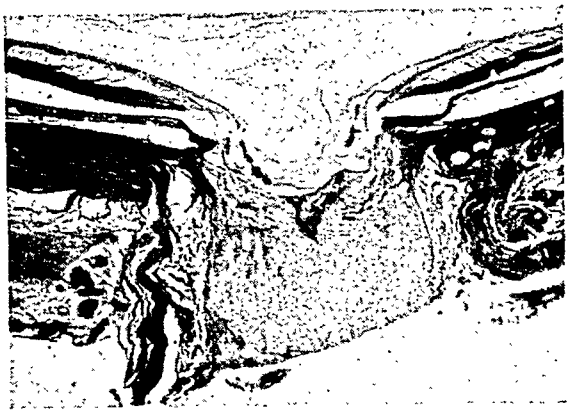


Fig. 5 (Lisman). Section showing atrophic cupping of the optic disc and newly formed connective tissue obstructing the central retinal artery.

layer honeycombed with cystic spaces. Some of the pigment epithelium has migrated into the iris stroma, which is thinned and atrophic (fig. 4). The ciliary body is normal.

The retina shows scant changes in the periphery and considerable at the posterior pole, where there is a paucity of ganglion cells, cystic spaces in the internal plexiform and internal nuclear layers. These cystic spaces may be the signs left by lipoid exudates which dissolved in the preparation of the section.

The external plexiform layer contains

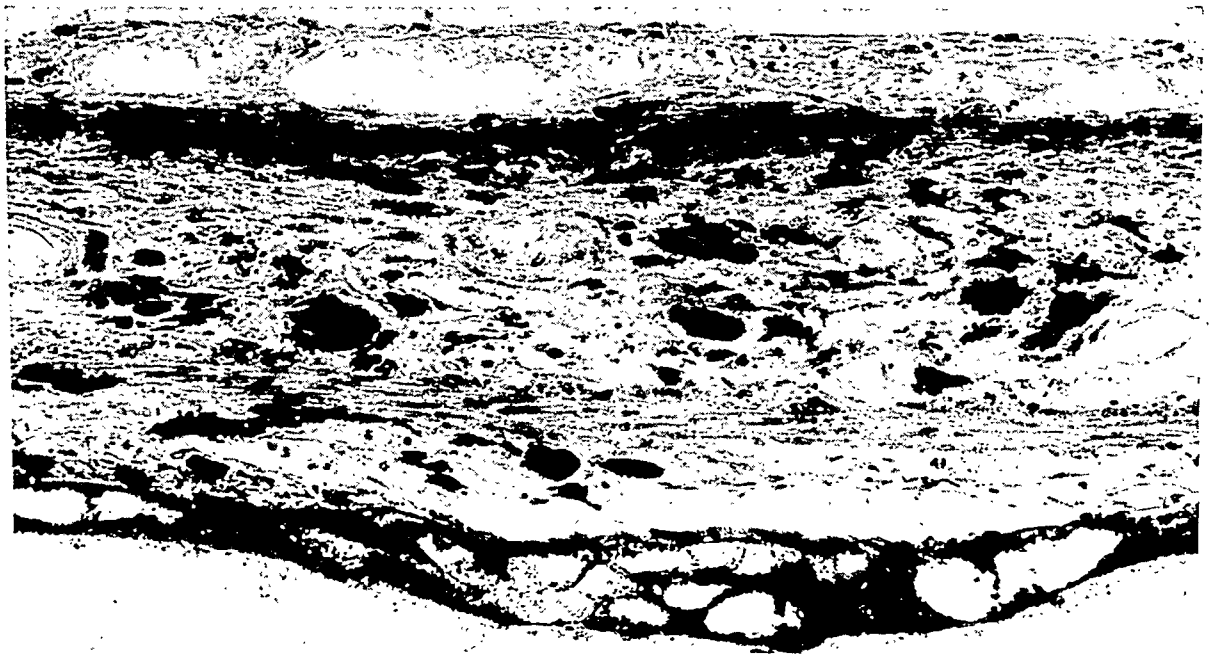


Fig. 4 (Lisman). Section demonstrating the cystic transformation of the pigment epithelium characteristic of diabetes.

some lipoid exudates. The optic nerve is atrophic. There is deep glaucomatous cupping of the disc (fig. 1). The central retinal artery at the nervehead has newly formed connective tissue in its lumen which almost obstructs it (fig. 5).

Diagnosis. Rubeosis iridis, peripheral anterior synechias, pigment epithelium cysts, optic atrophy, diabetic retinopathy, central retinal artery endarteritis, and secondary glaucoma.

Conclusion

The glaucoma associated with rubeosis iridis is an inverse glaucoma, since the ocular tension is more easily controlled by myd-

riatics. This is probably due to a mechanical squeezing out of blood from the vascular bed on the iris as the vessels are compressed in a dilated pupil. A scleral trephination can reduce tension slowly without danger of rupture of the capillaries on the iris; however, the tension is not controlled for long.

Summary

A case of rubeosis iridis in a diabetic is reported. Medical and surgical treatment was of no avail and blindness resulted. One eye was enucleated and histologic examination was possible.

654 Madison Avenue (19).

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Historical Miniature

Diabetic cataract, as an etiologic entity, was first recognized by T. W. G. Benedikt in 1842. He was educated at Leipzig and Vienna. In 1812, at the age of 27 years, he was made professor of surgery and ophthalmology at the University of Breslau, and remained there until 1856. He died at Breslau in 1862.

Hirschberg, *Graefe-Saemisch Handbuch.*

NOTES, CASES, INSTRUMENTS

REFRACTION CLINIC*

DISCUSSION BY
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Boston, Massachusetts

A 17-year-old student was unhappy with her present glasses which had been prescribed one year previously. She had no headaches, but stated that when she read, the print would run together. These symptoms of near difficulty were made worse by the wearing of the glasses, but were also present when she wore none. She found the glasses helpful at the movies, since they made her see a bit more clearly. Her visual acuity without glasses was 20/50 in the right eye, and 20/70 in the left eye. Retinoscopy (corrected) without drops was: +4.5D. sph. ⊂ −1.5D. cyl. ax. 180°; +5.0D. sph. ⊂ −2.5D. cyl. ax. 180°; revealed presence of a relatively high hyperopic error associated with astigmatism. Wearing: O.D., −1.0D sph. ⊂ −1.25D. cyl. ax. 180°; O.S., −1.25D. sph. ⊂ −2.0D cyl. ax. 180°. Subjective fog test revealed the following prescription:

O.D., 20/50 with a +3.25D. sph. ⊂ −1.25D. cyl. ax. 180° = 20/50
O.S., 20/70 with a +4.0D. sph. ⊂ −2.5D. cyl. ax. 180° = 20/50
→ 20/30, O.U.

Muscle balance was tested and found to be within normal limits. A 2-percent solution of homatropine was instilled over a period of an hour, along with two drops of paredrine and, another hour after that, refraction was again measured. At that time, she accepted, with drops, the retinoscopy (corrected) findings: +5.0D. sph. ⊂ −1.5D. cyl. ax. 180° = 20/40; +5.75D. sph. ⊂ −2.0D. cyl. ax. 180° = 20/50.

DISCUSSION

Discussion will bring out a number of questions.

1. "How is it possible that such an obviously gross error in refraction could be made?"

2. "How is it that the patient was able to tolerate the glasses at all?"

If we analyze her symptoms, she appeared to enjoy her glasses for distance, since she wore them at the movies, and they annoyed her only at near.

One possibility is that in writing the prescription, the ophthalmologist wrote "minus" instead of "plus" for the sphere, in which case, one would assume that the refraction was measured acceptably and undercorrection was purposely prescribed so that the person might get used to her glasses with a minimum of difficulty. This person is young, has an ample amount of accommodation, and is most helped by the astigmatic correction, and could well enjoy the glasses if such a sphere had been written as a "plus." The moral of this observation would be, "Always check the prescription when it is made up." In other words, "Check up on the optician as well as yourself."

A second possibility is that the optician made an error in the signs, and the same moral would apply.

3. It is possible that the examiner did not do a retinoscopy, and, therefore, any spherical lens he placed before the eye, did not improve vision appreciably. We are all aware of the fact that when minus lenses are placed before a young person who has a great deal of accommodation, the patient will observe that the print looks blacker and more distinct, but smaller and not necessarily more readable. So, it may well be that the person prescribed the minus sphere because

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† Director of Department of Refraction.

the patient stated that she saw blacker and more distinctly with them, even though she could read no more.

4. The patient may have had a pseudomyopia produced through a spasm of accommodation. The patient may not have been fogged properly, or may not have responded to a fog effectively, but if retinoscopy were done, this would easily have been discovered.

The second question that arose was "How was it that the patient could tolerate these glasses as long as she did?"

If you will examine the prescription carefully, you will notice that the astigmatism was corrected fairly accurately both as to amount of cylinder and particularly the axis. It is more than likely that the correction of the astigmatism which changed her basic refractive error from that of a compound hyperopic astigmatism to a simple hyperopia without astigmatism, was enough to eliminate some of her visual difficulty. Thus, the remaining amount of spherical error could be compensated for by her accommodation, and the elimination of the astigmatism was enough to make the patient feel better.

At this time, it would be well just to mention some of the ways in which spasm of accommodation can be recognized.

1. When the retinoscopy reveals a much higher hyperopic error than the subjective test; or when the opposite occurs—when a greater error is found by subjective testing than will be elicited by retinoscopy.

2. In the first case, the accommodation is stimulated to a spastic state by trying to read letters or trying to see. Whereas, in the second case, the spasm of accommodation is precipitated by the light flashing into the eye.

3. When near vision produces most of the symptoms, spasm may exist.

4. When during your subjective test, visual acuity fluctuates with a given lens, spasm is present. The best procedure in such cases is to heed the visual acuity report when the vision is at its clearest. For example, you might place before the eyes a strong convex sphere, and the person is able to read 20/40, but then says, "Now everything is all blurred out," or "now it blurs" to 20/70. The 20/40 reading would be the more accurate. For this reason, it is advisable to have the patient close her eyes each time you change a lens, so that you do not excite accommodation from this procedure. Another way of recognizing spasm is when retinoscopy is carried out both with fixation at distance, and fixation at near (using accommodation), and there is a great discrepancy between the two sets of findings. This procedure in itself is not entirely without discrepancy.

Solution

The surest way to have solved this case was by the use of cyclopegia, because then the procedure would have been fool proof. One cannot usually prescribe the full correction as found under cyclopegia without producing complaints in most people of this age who have a refractive error of this magnitude, and have not worn proper glasses before.

I believe one should correct all of the astigmatism that one could be sure of in this case, and then as much of the spherical portion of the hyperopia as the patient will comfortably accept. In most cases, I would say about one third to one half of the spherical portion. In this way, enough improvement in her vision would occur so that she could enjoy her glasses for distance, as well as at near, and still allow her to use some of her accommodation which apparently she has *no objections to doing.*

I would tell the patient that I am purposely not giving the full strength glass; that it is better to prescribe in graded steps. I would recheck her again in six months, at which time I would give her a fuller correction if accepted, and if her symptoms warranted.

The first prescription that I would prob-

ably give her would be: O.D., +3.25D. sph. ⊂ −1.25D. cyl. ax. 180°; O.S., +4.0D. sph. ⊂ −2.0D. cyl. ax. 180°.

QUESTIONS

House Officer: When you say you would correct as much of the error as she would accept, do you mean to bring her down to 20/20 or 20/15?

Dr. Sloane: Get the best possible visual acuity, whatever it be, 20/30 or 20/70.

House Officer: When the patient returns after six months, as requested, and has no symptoms and is satisfied with her glasses, what do you prescribe?

Dr. Sloane: I personally would make no change in the glass because the more fully one corrects the error, the more dependent will the patient become on her glasses. Since her muscle balance is not adversely affected by the lack of correction of the refraction, the patient can well go along. The patient has a good deal to gain through not becoming entirely dependent upon glasses, particularly a girl, aged 17 years.

House Officer: What are some of the defects in the application of findings from dynamic retinoscopy?

Dr. Sloane: The entire system of retinoscopy with accommodation at play is based upon the fact that convergence and accommodation work on a one-to-one ratio: That is, a diopter of accommodation will stimulate one meter angle of convergence and vice versa. This is not a hard and fast situation.

The exercise of convergence will also act as a check on the excessive use of accommodation. For example, looking at one-third meter, the person will use 3-meter angles of convergence. Therefore, he will only be able to use, according to this theory, 3 diopters of accommodation—the convergence holding the accommodation in check. Thus, if you retinoscope at a near distance, the amount of convergence employed will only allow the necessary amount of accommodation for that same distance to be employed. Thus, the movement that you would find with your retinoscope at that distance would be due to the refractive error itself. An allowance for lag of accommodation must then be made. Too many variables are present.

243 Charles Street (14).

ACUTE GLAUCOMA IN AN ADOLESCENT

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Kampala, Uganda, East Africa

Dr. H. Saul Sugar (1947), describing a case of acute glaucoma in a young man, aged 27 years, states "This is probably the youngest case of true acute glaucoma on record, having started with prodomata at the age of 17 years." In view of this statement it seems worth while to place on record the following case.

REPORT OF A CASE

The patient is an Indian girl, aged 17 years, who is exceptionally intelligent, speaks perfect English, and until her recent incapacity attended to the bookkeeping in her father's business. Her past medical history is insignificant apart from an operation for "tonsils and adenoids" three years ago. She was brought to me on May 29, 1947, and gave this account.

History. Her trouble started five weeks previously with a severe headache which lasted for five days and was accompanied by progressive loss of sight. The eyes were not red at the outset but became so after a few days (mother's evidence). Her doctor gave drops for the eyes but she does not know what they were. She claimed emphatically that prior to this episode her eyes had always been perfect.

Physical examination showed a well-developed girl in sound general health but obviously blind. She insisted that she could see

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light, although when asked to point at the window, through which bright tropical sunlight was entering, her projection was most inaccurate. Vision was recorded as barely light perception. There was no pain. Apart from some turgescence of the anterior ciliary vessels, suggestive of a caput medusae, the eyes were white. The pupils were widely dilated and inactive. Moderate corneal edema obscured the fundi. The tension in each eye was stone hard to digital palpation. I had unfortunately left my tonometer at another hospital and so missed the opportunity of recording the actual tension. Eserine (1 percent) was immediately instilled and repeated at half-hour intervals.

The patient was seen again two hours later, by which time I had recovered my tonometer. The pupils had contracted considerably but were not small. The edema was receding and a blurred view of the fundi could be seen. The anterior chambers were very shallow. The eyes felt appreciably softer to the fingers, and the tonometric reading was: O.D., 37 mm. Hg (Schiøtz); O.S., 40 mm. An operation was decided upon.

Surgical procedure. Under pentothal-sodium anesthesia, each eye was trephined and a peripheral basal iridectomy performed. The fistulizing operation was chosen because it seemed not improbable that peripheral anterior synechias might be firmly established.

Course. The postoperative course was uneventful with very little reaction, the eyes soon becoming white and the anterior chambers being reformed by the fifth day. The tension, however, was not satisfactorily lowered in spite of apparently good filtering blebs, although it could be reduced by massage. Atropine was used daily till the chambers reformed when eserine ointment (Cusi) was substituted.

Postoperative examination. During this period, the pupils were widely dilated and a clear view of the fundi could be obtained. The discs were seen to be deeply cupped. Vision was now hand movements. The response to eserine was surprisingly rapid, the pupils becoming moderately small by the following day. On the ninth day it was evident that the tension in the right eye was increasing, the tonometric reading was 37 mm. Hg (Schiøtz). A cyclodialysis was performed on this eye, again under pentothal anesthesia. It was observed that the effect of adrenalin drops (before the pentothal injection) was to cause wide dilatation of the pupil despite the thorough antecedent eserinization.

Course. The patient left on the 14th day. She had been having pilocarpine (1 percent) for the previous three days. The pupils were now small, satisfactory peripheral colobomas could be seen, and the Schiøtz reading was: O.D., 28 mm. Hg; O.S., 25 mm. Vision was still barely hand movements.

It should be added that a routine Kahn test was negative, and that in deference to her mother's wishes the patient had a course of sulfadiazine while in hospital.

Discussion

Apart from the age of the patient, the case presents features of unusual interest. The simultaneous onset of acute glaucoma in both eyes of a young girl otherwise in excellent health is alone remarkable. The development of deep cupping of the discs in the short period of six weeks is no less unusual, unless one postulates an antecedent physiologic cup of abnormal degree. Also illustrated is the validity of Sugar's contention that congestion is not necessarily an early concomitant of acute glaucoma. According to the evidence in the case herein presented, the eyes were not red for the first few days during which vision was lost and the tension must have been very high.

Etiologically, the bilateral onset suggests a common systemic cause. But what this might be remains a matter for speculation. A sudden allergic imbalance of the vegetative nervous system, expressed as an angioneurotic edema of the uveal tissue, is an explanation as difficult to accept as to reject

(Vanysek, 1946). The patient is at an age when hormonal control might be unstable, but there is nothing in her physical or psychic make-up to suggest that she is other than a perfectly normal girl. Moreover, if this were a significant factor, surely one would not find acute glaucoma in young adults the rarity it undoubtedly is.

The history of tonsillectomy prompted consideration of proliferative jugular endophlebitis as an etiologic factor (Meyer 1946). But it seemed to be beyond the limit of probability that both jugular veins could follow identical pathologic courses leading to simultaneous crises in both eyes.

Epidemic dropsy was considered, only to be ruled out.

Comment

For how long can an eye tolerate a very high tension without being irreparably damaged? Duke-Elder (1940) advises that, if medical methods fail to convert an acute attack into a chronic congestive phase within 24 to 48 hours, operation should not be delayed. Gradle (1936) would allow 48 to 72 hours for a trial of nonsurgical treatment. The late T. Harrison Butler (1943) cites a case of his own of violently acute glaucoma. "Both eyes had been treated, I think, for a fortnight with atropine; both were stone-hard with widely dilated pupils, and perception of light was abolished—a truly desperate case. I trephined both eyes and the result was incredible. The eyes became soft and lost all inflammation, and eventually both recovered, with a final acuity of 6/12."

Despite the small ray of hope afforded by this experience it was felt from the outset that the present case was beyond recovery, and that five weeks of gross hypertension was more than any eye could stand. The outcome has borne out this gloomy prognosis.

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CARCINOMA OF THE INNER CANTHUS AND FOREHEAD

Max Hirschfelder, M.D., and Jack Frost, M.D.
Centralia, Illinois

Slowly advancing epitheliomas of the lid margin or of the canthi are frequently observed in elderly people. They usually are basal-cell carcinomas which demand either excision with plastic repair or treatment by X ray or radium. The following case of a tumor was one of the less common types and, although it seemed to originate in the region of the inner canthus, extended to a much wider area and behaved differently from clinical and pathologic standpoints.

Case report

History. An 85-year-old man, who otherwise was in surprisingly good health, had noted a swelling below the inner right eyebrow for a year previous to medical consultation. During the past few months this swelling had enlarged and extended to the forehead. Subsequently the right upper lid began to swell and to occlude the right eye.

Examination revealed a hard tumor, of the size of a large plum, which was firmly attached to its base. The skin was firmly



Fig. 1 (Hirschfelder and Frost). (Left) Appearance of the right eye on April 8, 1947, before radium therapy was instituted. (Center) Two months after radium treatment. (Right) Final result on October 15, 1947, six months after treatment with radium and one week after excision of edematous lid.

attached in the region of the inner canthus, where it was drawn in like a little navel. Over the rest of the tumor region it seemed to be movable. The skin over the forehead was smooth. The right upper lid looked like a tumor mass, but on examination was found to be composed of soft, edematous tissue, a sort of elephantiasis created by blockage of the lymph channels through the tumor. The right eyeball seemed displaced downward and slightly proptosed. Movements were limited in all directions. The bulbar conjunctiva showed venous hyperemia and edema. Media were clear and the fundus seemed normal. The regional glands were not enlarged.

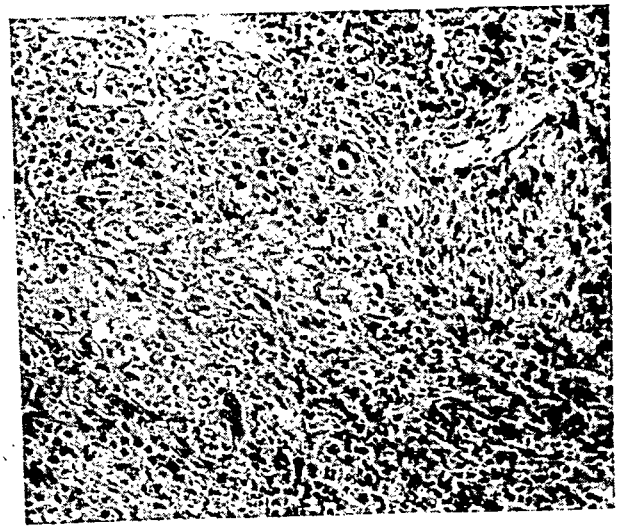


Fig. 2 (Hirschfelder and Frost). A microscopic section of the tumor.

Diagnosis. The X ray did not reveal a definite origin of the mass. There was a certain cloudiness in the right frontal sinus. A biopsy was taken and diagnosed as a squamous-cell carcinoma (H. C. Allen).

Treatment. While there was a definite possibility that this tumor originated from a paranasal (probably frontal) sinus and while the proptosis could have been caused by more than just an orbital edema, it was thought best to avoid extensive surgery in a man, aged 85 years. Radium therapy seemed to provide the best chance for success and, on counsel of Dr. H. Swanberg, Quincy, Illinois, 12 needles containing 15 mg. radium altogether were plunged into the tumor mass under local anesthesia. The needles contained radium ranging from 1.3 mg. to 2.6 mg. They were left in the tumor for a period of one week.

Result. The tumor softened perceptibly during this first week (April, 1947) and disappeared completely during the next two months. On a reëxamination six months after the radium treatment, it was found that the site of the tumor was flat and smooth and no recurrence was noted.

The lid itself was still markedly edematous and a portion, 10-mm. broad and 20-mm. long, was excised together with the underlying tissue. No sign of tumor was found by the pathologist in this tissue.

The eyeball showed a slight downward

displacement, but the engorgement of the conjunctiva had completely disappeared. Movements of the eye were considerably better, even though its position could not be called normal. It was assumed that there was an orbital edema similar to the one of the lid, although remnants of an orbital tumor could not be definitely excluded. The vision was the same in both eyes (20/70, uncorrected) and no radium damage was apparent. No double vision was noted by the patient and he was extremely satisfied with being able to see out of the right eye.

No recurrence of the growth was observed as late as May, 1948.

Comment

The case is presented because of its unusual features. We realize that it is uncertain that our radium treatment effected a permanent cure, and only continued observation and, if needed, another series of radium implants will promise a continued satisfactory result. It can well be argued that a more radical procedure would be better and more certain. There is, however, no doubt that the method used in this case was the easiest on the patient and the least disfiguring. For a man past the age of 80 years, it seemed to us the method of choice.

408 West Second Street.

A DEPENDABLE TYING FORCEPS FOR FINE SUTURES*

Warren D. Horner, M.D.
San Francisco, California

We now have finer eye sutures than we have forceps for tying them. This lack of a suitable forceps led me to experiment with various types of epilating forceps, since they are designed for grasping minute strands.

By micrometer measurement, I found the diameter of eye lashes to vary between 0.0015 and 0.003 inches, with an average of 0.0025 inches (0.0063 mm.). The diameter of 7-0 silk cataract sutures varied less, averaging 0.0026 inches. A cilium, therefore, is just a bit smaller than a cataract suture, a fact which makes a forceps properly designed for grasping the one efficient in grasping the other.

Some cilia forceps are too short to handle well, but the Beupre model is very adaptable and handy for suture tying. This forceps is an old favorite and has been listed in instrument catalogues for the past 20 years. It is of spring-grip construction, and has tapering and closely fitting smooth jaws set at an angle of 30 degrees. The instrument has a total length of about 4½ inches (11.4 cm.) and handles well. The jaws hinge smoothly and present no projections apt to catch the suture in tying an ordinary single or double hemostat knot. A 7-0 suture can be grasped anywhere along the jaws from the tip to the base, a distance of a full centimeter. The jaws open to a width of 4 mm., which makes it easy to pick up a thread.

A canvass of the instrument companies showed that the Beupre forceps was out of production for the present, but it is probable that there is a considerable number of old models about our offices.

The Paton needleholder is a delicate model closely resembling the Beaupre forceps, except that its jaws are slightly wider and heavier, and are straight instead of angular, which is an added advantage. By a little honing, the serrated jaws can be sufficiently smoothed down to grasp a 7-0 suture securely. This model is available† and after the modification just mentioned makes an ideal tying forceps. Most other needleholders either lack the precise bite necessary for tying fine silk or do not open widely enough to facilitate picking up a thread.

490 Post Street (2).

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* From the Division of Ophthalmology, University of California Medical School.

† E. B. Meyrowitz, New York.

MECHANICAL FACTORS IN OCULAR PATHOLOGY

Reciprocal relations of injury and disease

Percy Fridenberg, M.D.
Rockville Center, New York

The practical significance of the factors mentioned in this paper appears most striking when related to definite clinical entities in which they play a role—actual, "traditional," or/and recognized, claimed and contested—as not infrequently happens, in criminal and civil courts or before compensation boards. Among these clinical entities, we may mention retinal detachment, glaucoma, interstitial keratitis, and sympathetic ophthalmia.

Before these topics can be intelligently presented, however, it is necessary and worth while to consider, in their general characteristics and manifestations, the role and the nature of the mechanical factors active in the basic processes of ocular physiology, such as circulation of blood and other intraocular fluids, tissue development, metabolism, and intraocular pressure. It is also of equal importance to consider such pathologic changes as atrophy, various forms of cellular degeneration (colloid, amyloid, fatty, and so forth), and the equally varied forms of inflammation—hemorrhagic or specific.

Mechanical factors

There are two categories of mechanical factors: (1) The external, and (2) the local ocular.

External factors

Gravity, barometric pressure, radiant energy, heat, and cold are constantly acting forces in that very close environment, the telluric atmosphere, and have determining and contolling influences on the life manifestations of the individual and the race.

In accordance with their cosmic nature and massive scope, these forces affect the entire body including the eye, although this organ by its position and structure is vulnerable to much less intense and persistent violence.

Local mechanical forces

There is, however, another group of mechanically acting forces that contrasts most strikingly with the environmental agencies. These local mechanical factors act on a smaller scale of intensity and dimensional spread, although the resulting pathologic processes often produce disturbances of function which would seem to be out of proportion to the causal factors.

Resulting pathologic processes

Among these processes we note expanding lesions associated with neoplastic formations, malignant or benign, of a more or less solid nature (callus, dense connective tissue) or semifluid nature (fatty, lipoid, dystrophic), fluid effusions of blood, lymph, and pathologically altered intraocular fluids (vitreous, aqueous).

The modus operandi may consist in pressure atrophy of delicate structures of functional importance, lowered viability and vitality by way of connective-tissue infiltration or scar contraction, actual solution of continuity (a tear or break), and alterations of volume and spatial relations to other structures—conditions almost equally sinister in their implications for so delicately adjusted an organ as the eyeball. Incidentally, these local pathologic changes may result in what clinically constitute actual traumatic lesions.

Indirect complications

Gravity acting upon a sound and healthy eye causes no definite pathologic change and only transient discomfort when an unusual body posture results in a gravitational rush of blood to the head. This observation also

applies to the centrifugal force and communicated motion of intraocular contents. Pathologic changes in intraocular fluids and semifluids may, however, intensify the effect of these processes. The dramatic example is the danger associated with such motions, even within the normal range of extent and intensity, in the presence of fluid vitreous. Under such a circumstance, their agency in causing retinal tear or detachment or in nullifying the effect of an operative procedure for reattachment is well known.

Similar implications apply to the possibility of pathologic changes which are larval, inactive, but potentially hazardous in the reaction of the eye, which harbors them, to some slight trauma or to some other forms of eye disease. For example, a potentially virulent spirochaetae may be quiescent in the cornea or optic nerve but may flare into action if that tissue is subjected to some insult, however trivial.

Circulatory disturbances

It is not at all improbable and may well be assumed that, aside from actual tissue lesions, circulatory disturbances and functional anomalies may form intraocular "fifth columns" and act as clinical conspirators with traumatic violence below the usual levels of causal significance.

In glaucoma, the pupillographic studies of Lowenstein, Schoenberg, and others have shown quite clearly that increased fatigability of the reflex miosis, a latent hazard of pupillary exhaustion, is a definite clinical sign of incipient or prodromal increase of intraocular pressure.

Studies of early signs of disease

Such studies of very early signs of actual eye disease and/or of a definite predisposition thereto must be taken into account in the interpretation of the reciprocal relations between ocular pathologic processes and trauma.

Evaluation of chronology will depend for accuracy on our definite knowledge of a starting point for the eye affection in question. With this knowledge we can reach a definite conclusion as to the rate of progress of the disease. A correct decision as to this is of obvious importance in the matter of lenticular opacities, but there are other conditions in which it is of practical importance to reach a correct decision as to the starting point of the disease.

Previously sound eye

This brings one to a discussion of the "previously sound eye," a concept that logically must be taken into consideration in any attempt to decide whether or not a given injury is antecedent to the existing pathologic condition of the eye.

The assumption that an eye was "sound" at the time of injury is generally made on the absence of evidence, clinical or otherwise, of previous eye disease and on a similar lack of record to that effect. Signs of disease, like those of injury, are often evanescent, or so slight as to be overlooked, ignored through carelessness or failure to use all the finer methods of examination for their detection.

This negates the validity of any decision except one based on previous, periodic eye examinations. Thus, the halos of increased intraocular pressure, the presence of foreign bodies, peripheral lens opacities, slight but pathognomonic lesions at the ora serrata, incipient atrophy, even tears may not be discovered until after an injury to the eye has been sustained and a careful study of ocular conditions brings these changes to light. It is then that definite knowledge replaces assumption.

311 Rockaway Avenue.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

October 6, 1947

DR. DANIEL KRAVITZ, *president*

SYMPATHETIC OPHTHALMIA OR PHACO-ANAPHYLAXIS?

DR. DANIEL KRAVITZ said that the possibility of sympathetic ophthalmia has caused the removal of many eyes, probably in some cases unnecessarily. On the other hand, procrastination has resulted in a nightmare to many an ophthalmologist.

The case reported by Dr. Kravitz was of a man, aged 70 years, who was examined on November 4, 1946, with a history of sudden loss of vision in both eyes, severe headaches, and vomiting for over 24 hours. For many years he had been treated at the out-patient department of the Kings County Hospital for chronic glaucoma of the left eye. His vision, taken on examination by another ophthalmologist in September, 1946, was 20/200 in the right eye, improved to 20/100 with a −0.75D. sph. Both eyes presented all the classical signs of acute glaucoma and both eyes were stony hard. He was placed on a mixture of eserine, pilocarpine, and cocaine with no appreciable effects, and the following day he was entered at the Brooklyn Hospital where a basal iridectomy was done on the right eye and a modified Lagrange operation on the left eye. Convalescence was uneventful and he was discharged on November 11th. On November 13th, the tension was: O.D., 22 mm. Hg and O.S. 20 mm. (Schiøtz) and, it was noted that there were diffuse lens changes in both eyes. He was able to find his way around with difficulty. Because of his poor general condition, he was unable to return until December 12, 1946. Tension in both eyes had remained the same and he saw just enough to get around. At his next visit, January 9, 1947, tension in the right eye had increased to 2 plus, the eye was considerably inflamed, and there were many deposits on the posterior corneal surface.

His next visit was on January 29, 1947, at which time his eye was stony hard and very painful. He presented the picture of a severe plastic iridocyclitis. In the 3-week interval between the last two visits, he had seen several ophthalmologists, most of whom advised enucleation. The left eye was white and free of any signs of inflammation. Removal of the right eye was urged, and the following day it was enucleated at the Brooklyn Eye and Ear Hospital. He was discharged two days later.

On February 5, 1947, seven days after removal of the right eye, the left eye was white, there were no signs of inflammation and he was able to grope his way around. Tension was 20 mm. Hg (Schiøtz).

He was unable to return until February 18, 1947, at which time the tension in the remaining eye was 2 plus. It was red and painful and there were many large deposits on the posterior cornea. He was placed on salicylates, penicillin, hot compresses, and atropine. The patient did not return for further treatment but subsequently entered the New York Hospital, on the service of Dr. MacLean. The further course of the patient is unknown.

SYMPATHETIC OPHTHALMIA VS. PHACO-ANAPHYLAXIS

DR. J. ARNOLD DE VEER discussed the histopathologic interpretation of sections of the enucleated right eye of the case presented by

Dr. Kravitz. While the clinical course suggested sympathetic ophthalmia, the picture found in the enucleated eye was that of endophthalmitis phaco-anaphylactica. The following alternative interpretations of the case were suggested and discussed:

1. That a bilateral phaco-allergic reaction may have occurred, such a phenomenon representing a type of sympathetic ophthalmia.

2. That the phaco-allergic postoperative inflammation had been the precursor of sensitization to uveal pigment and that sympathetic ophthalmia had supervened, although not yet identifiable histologically at the time of enucleation of the exciting eye.

Because the patient had passed from their supervision prior to the sectioning of the enucleated eye, no immunologic studies were made by the reporters of this case.

Clinical aspects of sympathetic ophthalmia

Dr. Harold H. Joy said that the foremost predisposing cause of sympathetic ophthalmia is a perforating wound involving the ciliary body or the root of the iris, particularly if there is incarceration of uveal tissue or lens material. As a rule, the exciting eye undergoes a prolonged low-grade uveitis with occasional exacerbations and a tendency to phthisis. However, the clinical picture is not characteristic, and sympathetic ophthalmia may follow a violent acute traumatic uveitis or it may occur in the presence of glaucoma or even panophthalmitis.

The incubation period is extremely variable, but usually 1 to 3 months after injury a mild serous iridocyclitis appears in the fellow eye. Less frequently the inflammation originates posteriorly in the choroid. In either case, the process develops into a chronic plastic uveitis characterized by massive cellular reaction, and subject to exacerbations and recurrences. In spite of comparatively mild inflammation, exudation is profuse, and there is early and persistent development of posterior synechias, and gradual secondary involvement of all the ocular tissues. Cataract and glaucoma are frequent complications and, if the latter is not checked, phthisis bulbi ensues.

The only means of making a positive diagnosis is by histologic examination of uveal tissue. However, a presumptive diagnosis may be made if the case fulfills the following conditions: (1) The presence of uveal inflammation in the injured eye caused by exogenous infection. (2) A reasonable interval between the injury and the onset of uveitis in the fellow eye. (3) The presence in the fellow eye of the rather characteristic plastic uveitis. (4) Proof that this inflammation is not due to some other cause.

Sympathetic ophthalmia is much easier prevented than cured, and this can usually be accomplished by removal of the exciting eye before the process has extended to its fellow. Hence, the shorter the interval between injury and enucleation the greater the prophylactic value. Removal of the exciting eye within two weeks after injury always prevents sympathetic involvement, but further delay nullifies, or at least markedly lessens the favorable effect. Evisceration is not as effective a preventive procedure due probably to the occasional retention of uveal tissues. Prophylactic enucleation is contraindicated if there is reasonable hope of retaining or regaining useful vision. If sympathetic uveitis does not follow within two weeks after enucleation of the exciting eye, the chance of it occurring is slight, and it almost never appears after one month.

It is essential that treatment begin early and be thorough. It is quite generally agreed that enucleation of the exciting eye has little or no favorable effect after sympathetic uveitis is once established. However, until this has been proved, prompt enucleation of a blind exciting eye is indicated, at least in early cases. Practically all that can be done in treating the sympathizing eye is to attempt the establishment of maximum mydriasis. Secondary glaucoma can frequently be controlled by repeated corneal paracenteses. Any

surgical measure involving the uvea should be postponed if possible for at least one year after subsidence of inflammation, and should be preceded by desensitization.

No form of systemic treatment has been proved entirely adequate. The use of massive doses of salicylates and nonspecific foreign-protein therapy appear to be the most effective, particularly if supplemented by desensitization therapy through uveal pigment. The sulfonamides and penicillin have, on the whole, been disappointing and it is too early to assess the value of streptomycin.

The prognosis is always uncertain, due chiefly to variation in degree of severity, the reasons for which are unknown. The most important prognostic factor of which we have control is the early institution of proper and thorough treatment. In such patients a favorable prognosis may be expected in two-thirds of the cases. Unfortunately a great many patients are not seen until the disease is well advanced, and these are apt to result badly in spite of all treatment.

Discussion

General discussion of these three papers followed.

Dr. Andrew J. Rados said that the only possible treatment is the prophylactic enucleation of the exciting eye. An interesting study was made by Dimmer, who stated that during the first World War no case of sympathetic ophthalmia occurred in the armies of the central powers; the English and French army reports were also of similar nature. Dimmer compared these results with the high incidence of sympathetic ophthalmia in the relatively short Franco-Prussian War of 1870-71, and came to the conclusion that the disappearance of sympathetic involvement was due to the timely enucleation of the offending eyes.

The anaphylactic theory of the sympathetic ophthalmia was based on the theory of Elschnig-Bail, that the uveal pigment has an organ-specific quality and leads to hypersensitiveness of the uvea of the fellow eye. My own research of uveal-pigment specificity with complement fixation tests contradicted the organ-specific results of Elschnig, disproving the anaphylactic origin due to uveal pigment. Later on von Szily, one of the best known research workers in the domain of anaphylaxis, came to a similar conclusion; namely, that sympathetic ophthalmia cannot be explained theoretically as anaphylaxis due to pigment antigen. The negative outcome of his experiments led him to search for other possibilities, like neurotropic viral infection.

Sympathetic ophthalmia after enucleation usually occurs only in the first 14 days, and is extremely rare after this period, which would not be the case if it were due to pigment anaphylaxis. Once the organism is sensitized the so-called anaphylactic reaction would hardly be so promptly prevented by removal of the offending eye. The second very important objection is the fact that sympathetic ophthalmia never appears in the form of an acute uveitis in the second eye but frequently is seen in the form of neuroretinitis. If one would accept pigment anaphylaxis as the explanation of sympathetic ophthalmia, then the cases of sympathetic neuroretinitis are unexplainable, because the pigment anaphylaxis could establish itself only in such pigment-bearing tissues as the uvea.

Verhoeff and Lemoine conceived the idea of phaco-anaphylaxis in order to explain the postoperative inflammatory reaction of the eyes with extracapsular extraction. The followers of their theory never tried to explain the involvement of the other eye on the basis of phaco-anaphylaxis. If one accepts the idea of phaco-anaphylaxis of the first eye, then the intracapsular removal of the lens of the other eye would eliminate the possibility of the lens anaphylaxis because the lens antigen could act only on the lens of the other eye, but not on the uveal tissues. The clinical observation that the discission of juvenile cataract of one eye (where the

entire lens masses remain for spontaneous absorption) is rarely the cause of a postoperative uveitis of the operated eye and never results in a uveitis of the fellow eye contradict the possibility of phaco-anaphylaxis as the basis of sympathetic ophthalmia of the second eye. Finally it should be mentioned that the histologic picture of sympathetic inflammation differs greatly from that of anaphylactic inflammation.

Dr. Isadore Givner said that he agreed with Dr. Rados that sympathetic ophthalmia and endophthalmitis phaco-anaphylactica are two distinct entities. He cited a case, which he felt did not bear out Dr. Rados's contention that, in endophthalmitis phaco-anaphylactica, it is necessary to have the lens of the second eye opened before changes can occur in the second eye.

The patient, a woman aged 74 years, had bilateral cataracts, a history of asthma, and her blood pressure was about 200/100. On May 7, 1946, a combined extracapsular extraction was performed in the right eye. The operation was uneventful and, except for the fact that a small quantity of lens cortex was left in the anterior chamber after irrigation, the eye looked and did well.

On June 3rd, a few keratic precipitates were noted in this eye. These were large and connected with fibrin strands, the type of keratic precipitates that are seen as an allergic response to lens material and not infection. The eye remained white and except for a secondary membrane was in excellent condition at the end of July.

On August 1st, the left eye developed a secondary glaucoma with keratic precipitates and a tension of 90 mm. Hg (Schiøtz). Positive transfer showed a 4-plus reaction to lens antigen. An iridencleisis with sclerectomy was performed, which controlled the tension. After a discission of the secondary membrane, vision of 20/20 was obtained in the right eye; the left eye went on to phthisis bulbi.

Dr. Posner concluded that this case suggested that enucleation of the first eye is not indicated in endophthalmitis phaco-anaphylactica and, therefore, the clinical differentiation from sympathetic ophthalmia is important.

Occlusion of the central retinal artery

Dr. Abraham L. Kornzweig presented a case with sudden loss of vision of the right eye in a woman aged 72 years. Examination of the fundus revealed a partial occlusion of the central retinal artery, and edema of the macula. The vision of the left eye was 20/30. The patient was observed for two years, during which time there was no improvement in the vision. The arteries of the retina of both eyes showed marked hypertensive changes, such as tortuosity, increased light reflex, and compression of the veins.

This patient died, and both eyes were obtained. The right eye was sectioned serially in order to determine the condition of the arteries which had become occluded. The important serial sections of the eye were shown. The artery was traced from a distance of about one-half inch from the optic disc through the lamina cribrosa and on to the dics. The central retinal artery was narrowed but patent. Several sections that were stained with the Weigert-Elastica stain showed evidence of fibrous bands in the lumen of the artery. The artery was distinctly narrowed, almost to the point of obliteration, as it passed through the lamina cribrosa. On the disc, one vessel showed marked narrowing and what looked like recanalization. The retina showed atrophy of the internal layers up to the internal nuclear layer, which was thinned down to one row of Müller's nuclei. The macula was also seen and it was considerably atrophic.

Because of the absence of complete occlusion of the central retinal artery by embolus, thrombus, or endarteritis, a spasm of the artery was considered as contributing to the closure of the vessel.

Bernard Kronenberg,
Secretary.

LOS ANGELES OPHTHALMOLOGICAL SOCIETY

October 21, 1947

DR. ORWYN H. ELLIS, *chairman*

CLINICAL RADIUM AND ROENTGEN THERAPY

DR. IAN MACDONALD (by invitation) presented the action of the different rays and their effect on living tissue. The alpha rays are extremely caustic and produce flash burns. In beta radiation the electrons are travelling at high speed, and filters are used to produce emanations of 95 to 98 percent. Gamma rays are produced by electromagnetic radiation, are extremely penetrating, and require 25 centimeters of lead to filter completely.

The essentials for determining the radiologic effect are quality, intensity, and quantity. In inflammatory states, before the pyogenic stage, irradiation may produce resolution without suppuration. Chronic inflammatory states, such as tuberculosis of the lids, will respond quickly to irradiation. For eyelid conditions, beta radiation is usually advised. Basal-cell carcinoma responds to low voltage X rays, with the eye shielded. The deep penetrations of retinoblastoma usually respond well to therapy. Since nerve tissue is practically unaffected by X ray, extremely high doses can be given.

Radium salts in monel metal capsules are the most practical for short beta radiation treatment. In the treatment of inflammatory conditions, it is important that the cells are not destroyed, that the changes are reversible so that the cells can return to normal. In the treatment of neoplasms the destructive change is desired, so that the cell changes are irreversible.

CHEMISTRY AND BIOCHEMISTRY OF THE VITREOUS

DR. RICHARD WINSLER (Department of Chemistry, University of Southern California, by invitation) presented a detailed technical discussion. The vitreous is a collagen gel, or a series of alveolar sheets. The fibers seen on pathologic preparations are artefacts in fixation products, and the evidence for membrane existence is poorly substantiated. The osmotic pressure is in equilibrium with the aqueous and serum, and cannot be responsible for swelling in pathologic conditions. Swelling of the vitreous can be varied by changes in the pH, but not in the physiologic range. The fractionation of proteins and the composition were reviewed, and it was pointed out that the vitreous has mucoprotein and residual protein not present in aqueous and serum. Glucosamine plus glucuronic acid produces hyularonic acid, the latter is probably primarily responsible for the viscosity of the vitreous. The relative metabolism of the vitreous is very low, and there is doubt as to whether there is any oxygen consumption at all. Dr. Winsler closed this interesting evening with the challenge that the mysteries of the vitreous were still mostly unexplored. At least part of the etiology of glaucoma might be uncovered.

Daniel B. Esterly,
Secretary.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

October 23, 1947

DR. BURTON CHANCE, *chairman*

RETINOBLASTOMA CURED BY RADON

DR. JOSEPH WALDMAN AND DR. CHARLES E. G. SHANNON presented a proved case of retinoblastoma (microscopic and gross study of the enucleated eye) that had been treated and observed for 12 years. Retinoblastoma in the remaining eye had been treated and cured for a period of nine years (1938).

Enucleation of the left eye was performed in 1935 when the patient was aged 10 months. The optic nerve was microscopically free of tumor cells.

Roentgenotherapy to the right eye was given. It will be noted that the total of 3,404R units given was far below the dose advised by the fractionated method of Martin and Reese. In November, 1938, 2½ millicuries of radon were applied in dental compound and sewed to the overlying sclera. Following this, 1 application of 2½ millicuries, 3 applications of 5 millicures, and 1 application if 7½ millicuries of radon were used in a previously described holder (Waldman, J.: Arch. Ophth., 24: (Jan.) 1940) from March, 1939, to May, 1942. The patient was 10 months old when treatment was instituted, and is 13½ years old at this time.

Typical irradiation cataract and fundus changes, probably incident to radon therapy, were described. Visual acuity was 6/60. The patient attends a sight-saving school.

The lens changes and perhaps the macular changes, too, may become more marked. In retrospect, the areas thought to be new growths in April, 1942, may quite possibly have been a late reaction to the radon applied previously. This condition has been noted and described by Martin and Reese in their large series treated by fractionated roentgenotherapy.

Conclusions. We can do no better than to endorse the procedure of Martin and Reese in the treatment of retinoblastoma:

1. *Unilateral* ocular involvement—prompt enucleation. Bimonthly ophthalmoscopic examination of remaining eye for one year; trimonthly in 2nd year; every 4 months in 3rd year; every 4 months in 4th year; every 6 months in 5th year.

2. *Bilateral* involvement—prompt enucleation of the more diseased eye and irradiation therapy with idea of saving life and conserving vision in remaining eye, if the growth is not too far advanced.

For ocular and intracranial involvement of relatively easily accessible areas, craniotomy and excision of growths with enucleation are recommended.

The local use of radon by the method described (Arch. of Ophth., 24: (Jan.) 1940) is recommended as another form of treatment of this malignant disease, particularly where the exact and careful technique of fractionated roentgenotherapy described by Martin and Reese is not available.

Discussion. Dr. Charles E. G. Shannon: I would like first to congratulate Dr. Waldman on his excellent paper. I can speak freely as I am in no way responsible for its production. It is entirely Dr. Waldman's.

Unquestionably with an advanced gliomatous growth in one eye, and a beginning growth in the other, enucleation of the more severely involved eye should be carried out at once and irradiation by radium or fractionated roentgen rays in the other eye should be instituted. We are all familiar with the extraordinary success with which Martin and Reese have carried out the fractionated or divided principle of roentgen radiation. However we felt it to be more practical to irradiate the remaining eye in the patient with radon seeds. Our first attempt to implant the seeds on the sclera opposite the site of the growth according to the technique of Stallard was a bit harrowing and, therefore, a different technique seemed necessary. It was at this point that Dr. Waldman solved the problem by the development of what he has termed a "pliable silver-band applicator." It was a most ingenious device, and it proved its value by reason of the comparative ease with which the implantation could now be carried out. Six applications over a period of four years (1938-1942) finally witnessed the complete elimination of the growth.

Dr. William Zentmayer: There are two features in this case that interest me very much. The first is the appearance of circinate degeneration of the retina, inasmuch as it has been observed in other cases. In the *Transactions of the Ophthalmological Society of the United Kingdom,* volume 64, there is a case reported by S. Philips, strikingly similar to Dr. Waldman's, treated with radium. In this case, the circinate lesions appeared just as they did in Dr. Waldman's

so there is evidently some relation between the radium application and the appearance of degenerative changes. Perhaps something similar to what occurs in the lens.

I feel that in the area where the radium was applied, the changes seen are not only destruction of the choroid, but that there is superimposed connective tissue, the result of the action of the radium. This also has been noted in other cases, and particularly in the case I mentioned above. So marked was this, that it was taken by the surgeon to be a recurrence of the growth, and he reapplied radium. He later came to the conclusion that he was mistaken, and what he took to be a recurrence of the growth was the formation of fibrous tissue.

I might say that six years ago I had the opportunity to do an interstitial implantation of a radon seed in a case of retinoblastoma. A child was sent up from Florida who had had the left eye removed for glioma. This diagnosis was confirmed by Dr. Verhoeff. In the eye that remained, the growth was very extensive. It extended from the lower margin of the disc almost to the equator in the inferior quadrant of fundus, the vessels were exceedingly large and tortuous. Through the coöperation of Dr. Pendergrass, I secured some radon needles, and inserted them into the tumor itself. Unfortunately, the child developed whooping cough, and had to be taken from the hospital and was taken home to Florida so there was no observation beyond a period of about a month, but unquestionably, there was already shrinking of the mass. I was told that the child improved so that she could see to go about. Death resulted from spinal metastasis.

Dr. I. S. Tassman: I should like to ask as a matter of information when are you justified in considering a case of this kind cured clinically?

Dr. Edmund B. Spaeth: Just one difference of opinion with Dr. Waldman which is not tremendously important. He spoke of the irradiation cataract changes as due to the radon. I doubt it very much. The extent of dissemination of beta emanations is so short that the position of the radon seeds could not affect the lens. I believe his patient's irradiation cataract is undoubtedly due to the earlier X-ray therapy which was used. I am rather unwilling to have the radon blamed for the radiation cataracts when they probably did not occur from that.

Dr. Zentmayer: It appeared in the case reported in the *Transactions of the Ophthalmological Society of the United Kingdom,* volume 64, 1944.

Dr. Edmund B. Spaeth: Without roentgen therapy?

Dr. William Zentmayer: Yes.

Dr. Edmund B. Spaeth: It is rather interesting.

Dr. Joseph Waldman: Thank you very much, Dr. Shannon, for your comment.

In answer to Dr. Spaeth's remark about the course of X ray (3104R) causing the cataract, rather than the radon, I believe it is a possibility. On the other hand, repeated exposure to radon has been reported as causing the same disturbance. I think that H. L. Hine, F. Moore, H. B. Stallard, and J. G. Milner in the *Transactions of the Ophthalmological Society of the United Kingdom* have reported such cases. (To Dr. William Zentmayer) Is that the reference you have in mind, sir?

Dr. Zentmayer: I think the author is Philips.

Dr. Joseph Waldman: Yes, sir, that is in the same journal—S. Philips.

In answer to Dr. Tassman, I do not know actually when you are justified, but it has been the custom, I believe, pathologically so to speak, to consider a five-year cure. Now, whether you can say cure without adding five years I do not know, so if you want to be exact, I suppose we can say this is a nine-year cure.

Ptosis operation: Friedenwald technique

Dr. Edmund B. Spaeth presented a film

showing operative procedure for the correction of ptosis, according to the Friedenwald technique.

Attention was called briefly to the history of the use of nonabsorbable sutures in ophthalmology. The indications for the utilization of the occipital frontalis in correcting ptosis by this technique were stressed. The technique lends itself best to correcting high degrees of ptosis in young children, as an interim operation, and for the correction of ptosis with flaccid lids in the presence of a completely paralyzed levator.

Discussion. Dr. Francis Heed Adler: The majority of these children with congenital ptosis have marked epicanthus. I have always felt that any operation designed to correct the ptosis was doomed to failure unless the epicanthus was first taken care of, and this generally should not be done before the child is 5 or 6 years of age. This operation looks very simple and effective, and I am wondering whether Dr. Spaeth finds that it corrects the deformity adequately without doing anything for the epicanthus.

Dr. Edmund B. Spaeth: Dr. Adler asked the question about epicanthus and its relationship to ptosis in very young children. It is a most pertinent question. I feel that epicanthus should not be surgically corrected until the child's face has reached an adult size. Most of these youngsters have a very shallow bridge of the nose or none at all. The configuration of the nose of the father or the mother will aid one in forming an opinion of what might occur in these children, as the bridge of the nose develops and elevates. Of course, children do not always develop similar to their parents. Epicanthus frequently continues and needs corrections in spite of the development of a normal bridge. Some rather unpleasant instances have come to my attention of epicanthus, and its correction in the very young years of life by plastic surgeons who were not ophthalmologists. When the time is proper for correction of epicanthus, it is not always a problem of surgery at the inner canthus alone. Frequently the external canthus also needs adjustment because of dissimilar lengths of the lid margins.

Any type of levator surgery which can be done will modify but little the degree of epicanthus present. Some logical ptosis operations will actually augment the epicanthus at that time; namely, such a procedure as the Hunt-Tansley. On the other hand, the Machek and Gifford operations do modify favorably epicanthus if present at the time the ptosis is being corrected by these techniques. They probably are the only two ptosis operations which do help to correct epicanthus. Unfortunately they have limitations as to their use. Under such circumstances, it again appears that the proper time to correct epicanthus is not when the patients are still in early childhood, but in the later years of child life, or in early adult life. Then that which is still residual, in spite of more mature development, must be corrected. It would seem at the 14th or 15th year of life is perhaps the best time for that surgery.

Severe papilledema in diffuse infections of the nervous system

Dr. Joseph C. Yaskin, Dr. Robert A. Groff, and Dr. Henry A. Shenkin, Philadelphia,* (by invitation) presented this subject.

In most instances a frank bilateral papilledema presents few diagnostic problems since the history of the case, the evidences of focal brain disease, or the presence of acute infection makes the etiologic diagnosis fairly evident. Most cases of papilledema are eventually traceable to space-taking lesions, such as tumor, abscess, subdural hematoma, and less frequently to arachnoiditis, and frank infectious processes of the temporal bone and paranasal sinuses (otitic hydrocephalus, nonsuppurative encephalitis).

* From the Departments of Neurology and Neurosurgery, Graduate School of Medicine, University of Pennsylvania.

We have encountered a number of patients with bilateral papilledema in whom the etiologic diagnosis was difficult but important since some of those patients required operative intervention to save eyesight. It is the purpose of this presentation to report 12 patients in all of whom bilateral papilledema was present, but could not be accounted for on the basis of any of the causes mentioned above.

The 12 cases (average age, 24 years) showed bilateral papilledema and other less marked evidences of increased intracranial pressure. Although no definite etiologic factors could be established, it was felt that the process was probably infectious in nature, but did not fall into the category of arachnoiditis, pseudotumor, otitic hydrocephalus, or localized, nonsuppurative encephalitis of known etiology.

The papilledema varied from 2 to 10 diopters, it was accompanied by hemorrhages and exudates and lacked the characteristics of papillitis. The visual acuity was only slightly impaired, excepting in those patients who had marked papilledema.

The study of the spinal fluid was not helpful in establishing a diagnosis. Ventriculography was performed in 10 cases and ruled out an intracranial mass lesion.

The average duration of papilledema was 3½ months with a range between 1½ and 6 months. Focal brain signs were absent in the majority of patients, and were only confusing in the six patients who presented them.

In addition to symptomatic treatment, some patients were benefited by ventricular drainage; two required a subtemporal decompression, and two were subjected to a suboccipital exploration. Of the 12 patients, 2 died, 5 made a complete recovery, and the remaining developed some degree of secondary optic atrophy and diminution of visual acuity.

The problem of bilateral papilledema of undetermined etiology is not new, and has been discussed previously by a number of investigators. In the course of time, especially with the advent of air studies, more frequent exploratory procedures, and painstaking autopsy material study, new etiologic factors have been ascertained leading to the concepts of arachnoiditis, otitic hydrocephalus, pseudotumor, and nonsuppurative encephalitis. We believe that our series of cases are not included in the above categories, although there must be some overlapping of concepts relating to the etiology and pathogenesis.

In attempting to arrive at an etiologic diagnosis in our cases, it is evident that the increased intracranial pressure was not due to any obstructive lesion. Nor was it likely to be due to any marked edema of the brain since all our patients were alert throughout their clinical course.

It would seem reasonable to assume, therefore, that the increased pressure was due to some factor which either increased the output of spinal fluid or interfered with its absorption. We suggest the presence of some infectious process, reasoning largely by analogy to similar conditions produced by infections of the temporal bone and paranasal sinuses. We cannot exclude toxic or allied factors, especially since the spinal fluids were singularly free from elements of an inflammatory nature. Thus, the absence of pleocytosis would justify the conclusion that the principal mechanism in our cases is one of fluid exchange such as one sees in other parts of the body in allergic or similar reactions.

It is suggested that future ultraspectrophotographic studies of the spinal fluid such as are now being carried on by Dr. Adolph Spiegal in Philadelphia may give us more information on the etiology and pathogenesis of these cases. Such information may help to explain why small lesions on the surface of the cerebrum may give rise to marked increase in intracranial pressure; whereas, large lesions in the vicinity of the ventricles, as, for example, the gliomas of the brain stem, give rise to no papilledema

until late in the course of the disease.

Irrespective of etiology and pathogenesis, these patients present practical problems in diagnosis and treatment. Every case of papilledema with or without other evidences of increased intracranial pressure should be suspected from the start as harboring an intracranial space-taking lesion until proved otherwise. In all patients in whom there is no clear etiologic factor, such as infection of the temporal bone and paranasal sinus, syphilis, system infections or intoxication (lead), or hypertensive encephalopathy, and, unless the patient progresses rapidly toward recovery, there should be an air study. In our experience ventriculography is the procedure of choice since it is safer, causes less discomfort to the patient, and, in most instances, provides the necessary information to exclude a space-taking lesion.

Even more important is the consideration of the management of these patients. In the absence of any known etiologic factor the treatment is largely symptomatic. Several of our patients were probably benefited by repeated ventricular drainages. Five of the 10 surviving patients developed a secondary optic atrophy of varying degrees. We feel reasonably certain that two of our patients owe whatever vision remains to a subtemporal decompression. Considering the seriousness of diminished visual acuity and the relative simplicity of subtemporal decompression, it is our feeling that a decompression should be done more frequently in an attempt to prevent visual impairment. The question of more extensive exploratory procedure must be left to the judgment of the mature clinician and his evaluation of the individual case.

Conclusions. 1. There are patients who have papilledema and other evidences of intracranial pressure probably due to alterations of the cerebrospinal fluid circulation and/or chemical composition of the fluid, the nature of which is unknown. It is suggested that in these cases routine spinal-fluid studies should be augmented by ultraspectrophotographic studies.

2. Unless the progress in these obscure cases is satisfactory from the standpoint of ocular findings, ventriculography should be employed, in that an intracranial mass lesion cannot be definitely excluded without its aid.

3. Operative intervention in the interest of preserving vision should be seriously considered in those cases whose progress is unsatisfactory, despite the inability to demonstrate an intracranial mass lesion.

Discussion. Dr. Francis Heed Adler: The one thing these cases all have in common is a papilledema of unknown origin. I did not hear Dr. Shenkin mention polycythemia vera. I presume that this was ruled out in all of these cases. We have had three patients at the University Hospital which Dr. Shenkin probably knows about in which this was the final diagnosis. All three had choked discs.

Dr. Robert H. Trueman: Mr. Chairman, I would like to add a few words of comment on one of the cases presented by Dr. Shenkin, in that Dr. Spaeth and I had the opportunity to reëxamine her only a few days ago. She was the young girl that had the very high degree of papilledema.

The first time that Dr. Spaeth and I saw the case, in consultation, she had between 4 and 5 diopters of papilledema in each eye with vision of 6/15, bilaterally. We saw the case daily with Dr. Yaskin and Dr. Groff and watched a rapid increase in the papilledema, and a decrease in the visual acuity in each eye. Under conservative therapy, the patient's general condition deteriorated, and the papilledema increased to 10 diopters in the right eye and 8 diopters in the left eye with a decrease in vision to light perception, bilaterally. It was at that time that it was felt that operative intervention was absolutely imperative. Isn't that correct, Dr. Yaskin?

Dr. Joseph C. Yaskin: Yes.

Dr. Robert H. Trueman: It was at that

time that Dr. Groff did the subtemporal decompression. Immediately thereafter the papilledema began to recede, and the visual acuity to improve. At the time of her discharge from the hospital, her papilledema had receded between 2 to 3 diopters in each eye.

At the time of her reëxamination several days ago, we found an optic atrophy secondary to the papilledema, but the remarkable thing we felt, was the fact that in the eye that had had the 10 diopters of papilledema, her vision was now 6/22, while in the eye that had had the 8 diopters of papilledema, her vision was now 6/7.5. Her visual fields showed a moderate concentric contraction for form and color.

I feel that this case should emphasize Dr. Shenkin's closing remark that, in this type of case with rapidly deteriorating vision even without evidence of a space-taking lesion, decompression is essential for the continuation or preservation of whatever visual acuity is present or, as this case has pointed out, for an improvement in that visual acuity following the surgery.

Dr. Joseph C. Yaskin: Mr. President, I should like to emphasize some of the points of our paper since Dr. Shenkin did not have sufficient time to do so. In each of these cases, the outstanding problem was the saving of the eyesight. Most of these patients, when first seen, were suspected of having a brain tumor, but no evidence of any space-taking lesion could be found. Unfortunately, no very distinct evidence of infection could be determined even after prolonged studies.

Because of the ever present fear of blindness, we resorted to measures that we ordinarily avoid. Thus, we did not hesitate to do lumbar punctures in the presence of papilledema. We also did air studies on less than usual provocation.

In some cases, even though preliminary air studies failed to disclose a space-taking lesion, we decided on exploration, because of the desperate condition of the patient. It required a great deal of careful analysis and judgment to decide when to do air studies, and to operate, and in all these matters the ophthalmological findings played a major role.

I am quite sure that two of our patients owe their eyesight to decompressive procedures, and that, without these procedures, they would have been totally blind. One girl had not only subtemporal decompression for the papilledema but, because of the progressively increasing loss of sight, and despite the negative ventriculogram, a posterior craniectomy was resorted to.

Lastly, we have learned from the study of this group of patients that, in the presence of increased papilledema, air studies and decompression should be resorted to even though the process is not due to any definite cranial entity such as tumor, subdural hematoma or arachnoiditis.

Dr. Henry A. Shenkin: In reply to Dr. Adler's question, I cannot say that we eliminated polycythemia in each and every one of these cases, however, I was personally familiar with each patient, and I can tell you these people did not look polycythemic, and, furthermore, the course of the disease, I think, rules out the question of polycythemia.

The only other comment which I would like to make is that, unfortunately, some of these patients come to the hospital in series, and some of the younger residents are impressed with the fact that there may be 2, 3, or 4 cases of papilledema that turn out not to be due to brain tumor, and then for a year after that, they are a little disrespectful of papilledema as an evidence of a brain tumor. In general, I think it should be emphasized that true papilledema is due to brain tumor. Other causes are rare. Papilledema should be regarded as being due to brain tumor until proved otherwise.

George F. J. Kelly,
Clerk.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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THE JUNE MEETINGS

The 17th scientific meeting of the Association for Research in Ophthalmology was held in Chicago on June 21st and 22nd. It was noteworthy for several reasons: the size and excellence of its program and the bestowal of the first Proctor Medal.

Since its origin until the present, the association has held its meeting on one day only and limited the number of papers that were presented to 10 or, at the most, 12. It is an evidence of the marked growth and development of experimental ophthalmic research in the United States that 24 excellent papers were on the program.

Some of these presentations, notably those of Frenkel; Leopold *et al.;* Harris and Gehrsitz; Kinsey and Barany; and Newell and his associates, were particularly outstanding. Elsewhere in this number of the JOURNAL will be found the complete program.

Approximately 160 members and guests were in attendance. Most of these members were present at the association's banquet the evening of June 21st and witnessed the

presentation of the first Proctor Medal for ophthalmic research to one of its most distinguished members, Jonas S. Friedenwald of Baltimore. The award was made by Francis Heed Adler of Philadelphia, and was modestly received by Friedenwald who paid generous tribute to his co-workers of 25 years in outstanding research at Johns Hopkins Hospital.

In his acceptance address, Dr. Friedenwald spoke of the evolution of medical progress from the Natural-History stage through the era of Clinical Research. He pointed out that important discoveries from clinical studies are becoming fewer as the field is gleaned, while the era of experimental investigation into the basic problems of medicine is still unharvested and is, so far, inexhaustible.

He mentioned the pleasure and excitement to be found in experimental work. No one will agree with him, however, that the work is easy unless he is a master of modern techniques in chemistry, physics, and mathematics, as is Friedenwald.

The Proctor Address, given by Dr. Friedenwald the following morning, summarized his studies of the past 25 years on the "Formation of the Aqueous." It was a fascinating exposé of the painstaking work and laborious steps in the attempt to answer this fundamental problem of ophthalmic physiology.

On June 23rd, the scientific session of the Section on Ophthalmology of the American Medical Association began. John A. MacMillan of Montreal, Canada, was the guest of honor of the section. The subject of his address was "Diseases of the Lacrimal Apparatus." It is pleasing to note that Dr. MacMillan was elected an associate member of the A.M.A. by the House of Delegates.

The chairman of the section, Everett L. Goar, in his address, discussed "Ophthalmic Education and Results in the United States."

Thirteen other scientific papers were read and well discussed. The program was excellent. Among the outstanding contributions were those of Reese on "Retrolental Fibroplasia and Persistent Hyperplastic Primary Vitreous: Two Entities"; Ingalls on "The Epidemiology of Encephalo-ophthalmic Dysplasia"; "The Use of D.F.P. in Glaucoma," by McDonald and Leopold; "The Blindspot Syndrome," by Swan; and "The Use of Streptomycin and Streptomycin Plus Promizole in Experimental Ocular Tuberculosis," by Alan C. Woods.

The Research Medal of the section was presented to Alan C. Woods of Baltimore by Francis Heed Adler in the name of the executive committee of the section. The important and significant contributions of Dr. Woods in the fields of ocular immunity, allergy, sympathetic ophthalmia, tuberculosis, and uveitis were cited.

Unlike the Proctor Medal, the Research Medal of the section is granted for both clinical and experimental research. The choice of the recipient for this year's medal was a popular one.

A gold medal of the A.M.A. for scientific exhibits was given to Bertha A. Klien, department of ophthalmology, Northwestern University, for her splendid exhibit on "Diseases of the Fundus Oculi"; a bronze medal was awarded to William Stone, Jr., Massachusetts Eye and Ear Infirmary, for his exhibit on "A New Type of Movable Implant"; and John G. Bellows and Chester J. Farmer, of Northwestern University Medical School, received a certificate of merit for their exhibit on "Treatment of Ocular Infections: Use of Chemotherapeutic Agents."

After many years of devoted service, Arthur Bedell resigned as delegate of the section to the House of Delegates. A rising vote of thanks for his service to the section was evidence of the esteem, affection, and gratitude felt by the members of the section for Dr. Bedell. William L. Benedict of Rochester, Minnesota, was elected the delegate to replace Dr. Bedell.

M. Hayward Post, Jr., of St. Louis, was elected chairman, and Brittain F. Payne of New York, vice chairman, of the section for 1949.

The section recorded its support of the resolution adopted by the House of Delegates in 1947, condemning the acceptance of rebates and calling for punitive measures against members and fellows of the American Medical Association who are guilty of the practice.

The secretary, Trygve Gundersen, was appointed to represent the section on a joint committee with other ophthalmic organizations to investigate the use of penicillin as a prophylactic agent against ophthalmia neonatorum. A committee of the section to act jointly with representatives of the other ophthalmic organizations to celebrate in 1950 the centenary of the discovery of the ophthalmoscope by Helmholtz was proposed.

In spite of the rather small attendance, about 300 members having registered, the meeting was interesting and successful. The 1949 session will be held in Atlantic City, June 6th to 10th.

Derrick Vail.

OBITUARY

WALLACE PYLE
1875-1948

Dr. Wallace Pyle died June 10, 1948, at his residence in Orange, New Jersey, after several weeks' illness.

He was born in Jersey City, New Jersey, a son of the late Dr. Edwin Pyle. He attended the University of Michigan for two years, and then entered the Medical School of the University of Pennsylvania, from which he received his degree in medicine in 1897. He interned in Christ Hospital, Jersey City, and later became ophthalmologist on the staff of that hospital and several other Hudson County hospitals, including the Jersey City Medical Center.

He was a fellow of the New York Academy of Medicine, the American College of Surgeons, the American Academy of Ophthalmology and Otolaryngology, and the American Medical Association. He was also a member of several local medical societies.

Dr. Pyle was always affable, courteous, and generous. These traits, together with his professional ability, endeared him to his patients and his fellow practitioners. His ethical standards were of the highest. His chief diversion was travel. He made numerous trips to Europe, the far East, Alaska, the western part of the United States, and South America.

His wife, Ida Jarvis Pyle, a son, two daughters, and seven grandchildren survive him; also, a brother, Dr. Edwin Pyle, a physician in Waterbury, Connecticut.

Elbert S. Sherman.

CORRESPONDENCE

SPASTIC MYOPIA AS A COMPLICATION OF GLYCOSURIA

Editor,
American Journal of Ophthalmology:

Various writers have referred to refractive changes in diabetics. I should like to submit the following case which seems to be one of transient myopia accompanying transient glycosuria.

A retired Anglo-Indian lieutenant, aged 61 years, came to the Eye Clinic at Kotagiri, the Nilgiris, South India, complaining of rapidly changing vision. His old glasses (+0.5D. sph. for distance; +2D. sph. for reading) were no longer comfortable and he found that he could read better with no glasses. However, his distant vision without glasses was only 6/9, O.U.

Manifest acceptance on December 12, 1942, was: O.D., −0.75D. sph. ⌒ −0.75D. cyl. ax. 90° = 6/5; O.S., −1.0D. sph. ⌒ −0.25D. cyl. ax. 90° = 6/5. Reading acceptance was: O.D., +1.0D. sph. ⌒

+0.75D. cyl. ax. 180°; O.S., +1.25D. sph. ⊂ +0.25D. cyl. ax. 180.°

As the patient had been taking a strychnine tonic, he was advised to stop this and return for refraction and retinoscopy in 12 days. On December 24th, the repeated tests gave the same acceptance as before.

Glasses with the new prescription were comfortable for a time but after the patient, who meanwhile had learned of a diabetic condition (2-percent sugar), took insulin (5 injections only) and followed a diabetic diet, he could no longer tolerate the new glasses but returned to wearing the ones with the old prescription. By February, 1943, he was no longer able to use the new glasses.

A glucose tolerance test on March 6, 1943, showed: Fasting blood sugar, 75 mg. per 100 cc. After administration of 50 gm. glucose, it rose to 106 mg. at the end of 30 minutes; at the end of 1½ hours, it returned to fasting level, and reached 62 mg. at the end of two hours. Urinary sugar was absent throughout the test, the curve appeared to be normal, and there was no evidence of diabetes.

For some weeks before he discovered 2-percent sugar in his urine, the patient had noticed polyuria and polydipsia. By maintaining a low-carbohydrate diet after the five injections of insulin, he has remained sugar free. Never, since he became sugar free, has he been able to tolerate the new minus lenses prescribed during the time when he was suffering from glycosuria.

Parsons in his *Diseases of the Eye* (p. 591-592) says that in addition to diabetic cataract, retinitis, intraocular hemorrhages, and retrobulbar neuritis which may occur with diabetes, there are "remarkable changes in the refraction of the eye, both in the direction of hypermetropia and myopia," and he attributes this to "alterations in the refractive index of the cortex of the lens."

On page 319 he refers to the lenticular changes in diabetic cataract, and says "there is little doubt that osmotic changes are a prominent factor in the pathogenesis and account for the accumulation of droplets beneath the capsule of the lens."

In 1929, K. K. K. Lundegaard in Copenhagen wrote, "In diabetes mellitus a sudden hypermetropia arises due to alteration in the lens." The onset he described as a "sudden mist" obscuring the vision. But in our patient, there was no such symptom, and the lens remained clear throughout.

Instead of trying to explain the transient myopia with glycosuria in terms of osmosis beneath the lens capsule only, I would like to suggest the possible effect of diabetes on the ciliary muscle as well.

I recall two cases admitted to a large American hospital at different times, and by different resident physicians, both of which had been rushed to the surgical ward as "emergency appendix." In each case, fortunately, the coma and the boardlike rigidity of the abdominal muscles were discovered to be due to diabetic coma before surgical intervention supervened. Insulin produced rapid cessation of all symptoms. Both patients were children from the same home who had formed the habit of frequenting their father's candy shop and feasting on sweets instead of eating the meals their mother prepared for them.

If big abdominal muscles can become spastic with diabetic crises, is it not possible that the transient myopia also is a spastic myopia.

David O. Harrington of San Francisco, (J.A.M.A., *133:* (Mar. 8) 1947) makes no reference to diabetes but in his discussion of "Psychosomatic Disorders" describes a temporary visual disturbance which he considers to be due to a spastic myopia. "This condition," he says, "sometimes called 'ciliary spasm,' is thought to be due to spastic contraction of the ciliary body with resultant increase in antero-posterior diameter of the lens." He considers this to be always associated with emotional disturbance. The ex-

amination revealed "spastic myopia."

Although Harrington makes no mention of the myopia of diabetes, or of transient glycosuria, is it not possible that the pathogenesis of transient myopia with transient hyperglycemia and glycosuria may be a "measurable temporary *spastic myopia*" which appears when there is sugar in excess and disappears when the patient's blood sugar returns to normal?

(Signed) M. Pauline Jeffery,
Buffalo, New York.

BOOK REVIEWS

EL TRACHOMA. By Virgilio Victoria, M.D. Buenos Aires, El Ateneo, 1947. 315 pages, 76 illustrations.

The book is motivated by the desire to correlate the bibliographic data on trachoma with the author's clinical observations, and to stimulate public-health activity for the control of the disease in Argentina. Practicing in Tucumán, a trachoma-infested part of Argentina, Dr. Victoria has a large clinical, administrative, and research experience with the disease.

Of the six chapters into which the book is divided, three are devoted to a description of the clinical and laboratory features, one to therapy, one to the constitutional implications of the disease, and one to the public-health problem, principally as it affects Argentina. A bibliography follows each chapter.

The author rejects the view that invasion with pathogenic microörganisms is a complication of trachoma, and considers this invasion as an integral and constant part of the pathogenic process. He therefore discourages the use of the expression "complicated trachoma" as a misnomer.

In the first three chapters the trachomatous lesions in the conjunctiva, cornea, lids, and the lacrimal apparatus are described in detail, and illustrated with colored drawings and excellent microphotographs of pathologic material examined at the Institute of Regional Medicine of the University of Tucumán.

In the chapter on therapy the various therapeutic procedures reported in the literature are reviewed, and there is a useful and detailed account of the treatment patterns set up by Busacca, and followed in the main by the author in the management of the various phases of the disease.

While the procedure described by Busacca as "kneading-massage" is still the sheet anchor in the treatment pattern, the addition of sulfa therapy is recognized as of great value in hastening cicatrization, shortening the duration of treatment, and eliminating the need for subconjunctival injections. The chapter on surgical management of entropion and trichiasis is clear, concise, and illustrated with excellent drawings by Boltasar Isasi.

No new viewpoints relative to etiology are presented; the author does not believe that lymphatic diathesis, nutritional deficiencies, malaria, syphilis, tuberculosis, and intestinal parasites play any role in the etiology of trachoma, and denies the existence of natural or acquired immunity.

He believes that the great danger of infection is in childhood, and considers trachoma infectious in all its stages. In support of this contention he cites the case of an infant, 35-days old, with follicular trachoma, whose contact was limited to his mother; she had a cicatrized conjunctiva and had had no clinical symptoms for over 10 years.

Population density, low altitude, constant winds and dust, periodic migrations of labor groups without sanitary provisions, are factors favoring the spread of the disease; temperature and humidity appear to be without influence; and hygienic living conditions and the availability of running water diminish its incidence.

From the point of view of public health it may be said that Dr. Victoria is progres-

sive and sound. He advocates control of trachoma under a national public health program because of the greater economic capacity of the national government to support the program, the possibility of uniform prophylactic, therapeutic and technical patterns, and the freedom from interference from local regulations.

Specifically, he advocates supervision in schools, industry, and armed services through traveling dispensaries, educational campaigns, visiting-nurse services, and quarantine of trachoma patients with secretion.

An interesting survey of the trachoma problem in Argentina, of the industrial implications of the disease, and a tabulated analysis of the permanent visual disability of 100 patients conclude the book.

On the whole, this is a very useful volume, particularly for those who are required to deal with trachoma on any considerable scale.

Ray K. Daily.

TRANSACTIONS OF THE SOCIÉTÉ BELGE D'OPHTHALMOLOGIE. April 27, 1947, pp. 1-182.

Seventeen papers and case histories are presented. L. Weekers reports on a modified technique in the surgery of extensive divergent squint. The resected tendon of the internal rectus is attached to the conjunctiva and drawn toward the external rectus.

A. Potvin and J. Helin studied the sedimentation rate in ocular allergic diseases and found that it is of minor importance in diagnosis but of considerable interest in the prognosis of allergic manifestations.

R. Weekers' paper on the symptomatic treatment of ocular hypertension includes a study on D.F.P. and is a survey of his clinical observations. The drug, stimulating the parasympathetic, produces a miosis, a distention of the uveal vessels, and a spasm of accommodation and so changes the aqueous humor and the intraocular pressure. Its action is similar to that of eserine but lasts longer. A single instillation in favorable cases may hold the tension in normal limits for 8 to 10 days.

L. Coppez showed a film demonstrating corneal tattooing with platinum chloride. Van Canneyt and Kluyskens presented three case histories of secondary band-shaped keratitis and the possible etiology of this corneal degeneration.

A. De Jaeger and J. Bernolet suggest canthotomy as a preliminary to retrobulbar injection and akinesia in cataract operations. De Walsche reported on a tumor of the ciliary body whose first clinical symptom was hemeralopia.

In 10 patients with chronic glaucoma, 2 with retinitis pigmentosa, 2 with senile macular degeneration, and 2 with embolism of the central artery, J. Zanen and R. Wibolt could not verify the claim that retrobulbar injection of benzyl imidozoline influences the circulation of the choriocapillaris and retina.

Improvements of the ocular prothesis by using synthetic resin were recommended by R. Weekers and F. Roussel. A. Fritz compared the results of the retinal microphotometry with those of angioscotometry. R. Weekers and Thibert reported on congenital microcorie and M. Appelman on an ethmoidal-lacrimal fistula. Bilateral paracentral scotomas in a patient with an occipital lesion were studied by M. Humblet who also reviewed the anatomy and physiology of the central visual areas.

Alice R. Deutsch.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Wright, E. S. **A simple method of photomicrography.** Am. J. Ophth. 31:611-612, May, 1948. (3 figures.)

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Bocci, Georgio. **A rare bacteriologic finding: a bipolar germ recovered from palpebral vaccinia ulcers.** Boll. d'ocul. 26: 561-569, Sept., 1947.

A farmer's wife, 34 years old, acquired from her vaccinated son vaccinia pustules on her right lower lid which were complicated later by an ulceration of her right bulbar conjunctiva. A germ was found in smears and isolated by culture in blood agar, characterized by negative Gram staining, deeper staining of the ends of the rods measuring from 0.5 to 1.5μ, lack of capsules, lack of spores, motility, rapid growth in pepton agar, pellicle formation on broth and, if not identical with, resembling the rare germ Malleomyces pseudomallei or Pfeifferella Whitmorei. The lesions healed under staphylococcus anatoxin treatment in ten weeks.

K. W. Ascher.

Grant, W. M. **Ocular injury due to sulfur dioxide. II. Experimental study and comparison with ocular effects of freezing.** Arch. Ophth. 38:762-774, Dec., 1947.

Serious ocular injuries have occurred in the refrigeration industry from accidental contact with a jet of liquid sulfur dioxide. Experiments were conducted on the eyes of living rabbits to determine the cause of the severe damage. Freezing of the anterior portion of the eye for several seconds (by a nontoxic refrigerant) produced mild and transient disturbances. Lesions similar to those caused by liquid sulfur dioxide could be produced by several seconds' exposure to the pure gas at room temperature. It is concluded that the production of severe ocular injury by liquid sulfur dioxide is not due to freezing or to the formation of sulfuric acid, as has formerly been postulated, but is the result of its ready penetration of the corneal epithelium in high concentrations and its action, principally as sulfurous acid, in

denaturing corneal proteins, including enzymes. John C. Long.

Donegan, J. M., and Thomas, W. A. **Capillary fragility and cutaneous lymphatic flow in relation to systemic and retinal vascular manifestations: rutin therapy.** Am. J. Ophth. 31:671-678, June, 1948. (3 figures, 11 references.)

Hoof, Doris. **Tissue research and cell culture of the cornea.** Am. J. Ophth. 31:709-712, June, 1948. (2 figures, references.)

Maumenee, A. E., and Kornblueth, W. **Regeneration of the corneal stroma cells. I. Technique for destruction of corneal corpuscles by application of solidified (frozen) carbon dioxide.** Am. J. Ophth. 31:699-702, June, 1948. (4 figures, 6 references.)

Rosso, S. **Crystalline antigens and anti-crystalline antibodies in the aqueous humor.** Ann. d'ocul. 181:213-219, April, 1948.

The concentration of antibodies in the blood serum is tremendously greater than in the aqueous. Amorphous antibodies which have apparently not been studied as thoroughly as some other types are possibly a rather important factor in the genesis of cataract and some uveal diseases, such as endophthalmitis phaco-anaphylactica. Only alpha-globulins apparently have an antigenic action on the lens. The degree of antigen sensitivity has not been reported in studies of animals therapeutically treated for cataract. Intracapsular lens extraction is preferred in animal experimentation because lens masses affect the antigen and antibody composition of the aqueous. The preferred antigen and the grading of animal sensitiveness are discussed at some length. The aqueous of normal rabbits showed no complement change in seven of eight rabbits. Replaced aqueous, however, is clearly positive. In aphakic eyes the aqueous was also positive for 60 days after the beginning of the treatment. The blood serum of animals treated with crystalline proteins changed the complement in the presence of the same antigens employed in parenteral injections. In the normal eye the primary aqueous is not affected. In the secondary aqueous and in aphakic eyes the reaction is more active.

Chas. A. Bahn.

Sachs, E., and Larsen, R. L. **Cancer and the lens.** Am. J. Ophth. 31:561-564, May, 1948. (10 references.)

Solis-Cohen, Myer. **The real removal of focal infection as the cause of ocular disorders.** Am. Practitioners 2:576-579, May, 1948.

Focus of infection is bacterial, not structural, and is removed when the patient manufactures enough antibodies to destroy the organisms and neutralize the toxins. There is a frequent association of oral sepsis with ocular lesions. Tonsillectomy and sinusotomy do not remove the offending organisms. Most primary foci are in the upper respiratory tract. A properly cultured vaccine of proper dosage will contain endotoxins that will stimulate the production of bacterocidens.

Irwin E. Gaynon.

Woods, A. C., and Burky, E. L. **Studies in experimental ocular tuberculosis. The effect of promin and promizole in experimental ocular tuberculosis in the immune-allergic rabbit.** Tr. Am. Ophth. Soc. 45: 170-183, 1947.

Both promin and promizole exert a deterrent action in the immune-allergic rabbit. The action of the two drugs is about equal. Histologic evidence of tuberculosis persists in the majority of the eyes of treated animals, but the lesions are much fewer and less severe than in con-

trol eyes. On transfer experiments with the extract of the uveal tract from the eyes of seven treated animals only one positive result was obtained. All controls gave positive transfer.

These results may be due either to a degradation or attenuation of the virulence of the organs allowing the resistance of the host to become more effective or to a direct bacteriocidal action on the bacilli.

David O. Harrington.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Bárány, Ernst. **The rate of equilibration of intraocular pressure.** Acta ophth. 25:175-187, 1947.

The purpose of this investigation was to ascertain how rapidly the intraocular pressure regains its equilibrium. In a study of the influence of blood pressure on the intraocular pressure it was found that the effect of a change of blood volume in the eye is of short duration; after it is over the real change in equilibrium level due to the factors influencing the formation and circulation of aqueous becomes manifest. Bárány points out that the studies of Wessely and Duke-Elder did not take into consideration the first transitory changes. The briefly reviewed data of experimental investigation on the period of equilibration leads to the fairly unanimous conclusion that the period of equilibration should lie between 5 and 15 minutes. Bárány's own investigations consisted of a series of experiments on rabbits' eyes. Thirty minutes after placing a van Leersum loop on the carotid the tension was measured. Slight pressure of a finger on the eye on the side of the closed carotid was applied through the lid for 6 to 7 minutes. After the pressure was removed tonometry was performed on each eye alternately, with one reading per minute until constant values had been obtained, which was no longer than 15 minutes. The result was a series of slowly falling pressures in the control eye, and pressures that rose quickly at first and then slowly in the massaged eye. The mathematical deductions for the time constant are given in detail. For rabbits the time constant is 6 to 8 minutes, if the carotid is closed, and somewhat less if it opens. This corresponds to an equilibration time of 12 to 24 minutes. Only after the lapse of this period, as a minimum, can one be certain that the intraocular pressure reflects the change in equilibrium level.

Ray K. Daily.

Bárány, Ernst. **The influence of local arterial pressure on aqueous humor and intraocular pressure.** Acta ophth. 25:189-193, 1947.

This is a report of an attempt to demonstrate the passive changes in the caliber of the uveal vessels produced by changes in blood pressure. Previous experiments of compression of the carotid with a van Leersum loop have shown that the local blood pressure is reduced to about one-third of its normal level immediately after closure of the carotid. On ophthalmoscopic examination a slight diminution in the caliber of the retinal and long ciliary arteries is seen, with no change in the veins. On the release of the carotid pressure there is a distinct increase of the arterial caliber, but none in the veins. The vessels observed in this study were the capillaries of the ciliary processes, which in the albino rabbit pass down the back of the iris and can be seen with the corneal microscope as a shadow through the iris. There was no change in the uveal capillaries. Reduction of the arterial blood pressure by occlusion of the carotid caused a distinct and prompt decrease in the caliber of the uveal arteries but no discernible change in the caliber of the choroidal veins, nor in the ciliary processes at the back of the iris. Bárány believes that passive vas-

cular changes play no role in protecting the intraocular pressure from the influence of blood pressure changes. Since the capillary blood pressure is low there can be no possibility of passive aqueous formation. Ray K. Daily.

Christini, C., and Cuisa, W. **Methylization of the lens: normal and cataractous.** Ann d'ocul. 180:742-745, Dec., 1947.

In the metabolic reduction of the living protein molecule, methylization plays an apparently important part as one of the oxidoreductors. It also participates in the combustion of carbon with resulting CH_3 groups, and in lens metabolism. Cholin, methionine, and cysteine are involved as well as nicotinic acid and its amides, normally and especially in the diabetic. The methylization product of nicotinic acid (trigonelin) and that of nicotinic amide (trigonelin amide) were extracted from transparent beef lenses and cataractous human lenses. In cataractous lenses these products of methylization were absent, which is considered of importance.
Chas. A. Bahn.

Grignolo, Antonio. **Investigations concerning the possible interference between the bacteriostatic action of penicillin and the lytic action of the lacrimal lysozymes.** Boll. d'ocul. 26:699-709, Nov., 1947.

In vitro experiments performed on liquid and on solid culture media showed no interference of the agents named in the title; micrococcus lysodeicticus, hemolytic streptococcus, and staphylococcus aureus were the germs examined. Two figures show the Petri dishes after 24 hours of incubation (bibliography.)
K. W. Ascher.

Huber, A. **The pharmacology of the blood-aqueous barrier.** Ophthalmologica 114: 217-227 (Oct.-Nov.) 1947.

The rate of appearance of intravenously injected flourescein (2 cc. of a 10-percent aqueous solution of sodium-fluorescein) in the anterior chamber of human eyes has been extensively studied by Amsler and Huber (Ophthalmologica 111:155, 1945). Slitlamp examination permits fairly accurate in situ estimates of the fluorescein concentration in the aqueous. In normal human beings with normal eyes, the rate of appearance varies within fairly wide limits. There is, however, a high test-retest consistency in the same individual. The rate of the appearance of fluorescein in the anterior chamber may serve as a criterion of the permeability of the blood-aqueous barrier. In the paper under review Huber reports the effect upon the appearance of fluorescein in the anterior chamber of some of the commonly used ophthalmological drugs.

Atropine and homatropine are ineffective. Pilocarpine and eserine accelerate the appearance of fluorescein. Adrenaline injected subconjunctivally during the first 10 minutes delays and then slightly accelerates the entrance of fluorescein. In the discussion of this paper before the meeting of the Swiss Ophthalmological Society in 1946, F. P. Fischer states his preference for eosine injections as a permeability test. Eosine has the advantage of a very constant particle size upon injection into the blood stream whereas fluorescein occurs in several different particle sizes. Huber objects to the use of eosine because of its toxicity. The marked individual variations observed with fluorescein do not interfere with the latter's use in pharmacological studies since the individual's other (untreated) eye reliably serves as a control.
Peter C. Kronfeld.

Leoz de la Fuente, G. **Prostigmine in ophthalmology.** Arch. Soc. oftal. hispano-am. 8:130-133, Feb., 1948.

The author concludes that oral or parenteral administration of prostigmine has no effect on the pupil of the normal or

glaucomatous eye. Instillation of 3-percent prostigmine bromide does not affect the tension of the normal eye, but in an eye with hypertension, the instillation produces a fall in ocular tension, and miosis, which reaches its maximum in 30 minutes after which the miosis diminishes. The fall in tension persists for a longer time, varying with the conditions of each individual eye. The hypotensive action is similar to that of ½-percent eserine, and is better tolerated. The instillation is painless and does not produce the undesirable general and local effects occasionally produced by eserine, nor an annoying spasm of accommodation. Ray K. Daily.

Matteuci, P. **The innervation of the ciliary muscle in man.** Ophthalmologica 114:377-383, Dec., 1947.

According to the theory of Cogan (Arch. of Ophth. 18:739, 1937), contraction of the radial fibers of the ciliary muscle causes accommodation of the eye for far while contraction of the circular portion causes accommodation for near. According to the same theory the radial portion is innervated by sympathetic fibers or adrenergically and the circular portion by the parasympathetic or cholinergically. The specific purpose of the paper under review is to compare histologically the innervation of the three portions of the ciliary muscle in man. A number of human eyes with malignant melanomas, but normal anterior segments became available for this work. The silver impregnation method of Gros was used to demonstrate nerve fibers and their ramifications in the ciliary muscle. All three divisions of the ciliary muscle were found to contain myelinated parasympathetic as well as nonmyelinated sympathetic fibers. "The theory of Cogan needs revising."

Peter C. Kronfeld.

Panzardi, Domenico. **Effect of pentothal anesthesia on corneal reflex, intraocular pressure, and pressure in the central retinal artery; possibilities of this new anesthetic in ocular surgery.** Boll. d'ocul. 26: 570-580, Sept., 1947.

In 18 patients, anesthetized with sodium pentothal, the corneal reflexes disappeared rapidly and remained absent during the whole anesthetic period. Only three out of these 18 lost their corneal reflexes slightly later. Intraocular pressure values were diminished by 5 to 12 mm. Hg and assumed normal values at the end of the anesthesia; the increase is usually slow and the preanesthetic figures are found when the anesthesia is over. In all but one case, the light reflexes of the pupils remained active although weaker than before the anesthesia; in one case, it took two hours for the light reflex to reappear. The pupillary diameter is diminished during the anesthesia; in two patients a slight initial mydriasis was observed. The pressure in the retinal artery is increased for between 5 and 25 grams during the anesthesia; the measurements were taken only after ocular surgery, therefore it cannot be said whether in the initial period an opposite change might have been present. In 17 out of 18 patients, the eyes remained in primary position during the whole period of anesthesia. The author does not advocate the use of sodium pentothal in cases suitable for local anesthesia; if however severe pain is anticipated and general anesthesia seems preferable, sodium pentothal should be used in eye surgery for its quick and comfortable application. K. W. Ascher.

Ruedemann, A. D., and Schneider, R. W. **Alteration in plasma proteins in various types of cataract.** Tr. Am. Ophth. Soc. 45:319-327, 1947.

Twenty-seven patients with lens vacuoles and ten controls were studied in detail with reference to measurements of total and fractional plasma proteins by the electrophoretic method of Tiselius. In

24 patients an absolute increase in the beta globulin fraction was found. Three patients showed a relative increase in beta globulin fraction. None of the controls showed a comparable plasma protein pattern. David O. Harrington.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Bertotto, E. V. **The stereophotogrammetric study of the anterior segment of the eye.** Am. J. Ophth. 31:573-579, May, 1948. (8 figures.)

Campbell, D. A. **A comparison of dark adaptation with the psychological state in miners.** Brit. J. Ophth. 32:225-226, April, 1948.

This paper presents a comparison of the results of two articles reported in this same journal. It was seen that the average threshold values of dark adaptation in persons with hysteria or anxiety neurosis and in malingerers are the same as in those with normal mentality, whereas they are higher in the manic depressive individual and in the dull and backward. In the control group of miners, the psychologically abnormal had a lower threshold than the normal, while in the certified cases of miners' nystagmus the rise in threshold in hysteria and anxiety neurosis was more marked in those without nystagmus. Thus there is no significant relationship between the psychological state and the threshold of dark adaptation. Orwyn H. Ellis.

Campbell, D. A., and Tonks, E. **A comparison of dark adaptation in miners with their nutritional state.** Brit. J. Ophth. 32: 205-208, April, 1948.

A careful inquiry was made into the nutritional state of about 100 miners. Owing to the system of rationing there was no seasonal variation in the dietary content of vitamin A, nor in the choice of diet available. The blood levels of plasma carotene, vitamin A, and alkaline phosphatase, and liver dysfunction, tested by the thymol turbidity method, were determined. The raised threshold for dark adaptation, which is a constant feature of all miners, was not due to a lack of vitamin A or D, nor to any obvious nutritional disturbance. Orwyn H. Ellis.

Crisp, W. H. **Errors in the practice of ocular refraction.** Rev. brasil. oftal. 6:125-131, March, 1948.

After some historical considerations, the following points are emphasized: Hyperopia is usually undercorrected and need not be so. At least five out of six hyperopic patients can learn to use their full correction, with full use of their visual acuity, provided frame-fitting is perfect. The full trial-case measurement of hyperopia is always a slight overcorrection, because of the fact that rays of light forming a point at 4, 5, or 6 meters are divergent when they reach the patient's eye. The accurate myopic measurement at the trial case is a slight undercorrection, for the same reason. Eyestrain is frequently produced by undercorrection of myopia, because the patient resorts to various maneuvers to sharpen his vision. Accurate correction of either hyperopia or myopia is frequently impossible without exact correction of astigmatism and vice versa. Subjective tests for astigmatism are necessary and possess more accuracy and finality than the objective tests. The patient should be given his full visual acuity and not a supposed normal of acuity such as 20/20. Both eyes should be refracted with equal care and accuracy. W. H. Crisp.

Eames, T. H. **Comparison of eye conditions among 1,000 reading failures, 500 ophthalmic patients, and 150 unselected children.** Am. J. Ophth. 31:713-717, June, 1948. (2 tables.)

Feldman, J. B. **Use of the telescopic amblyoscope in visual training for defective vision.** Arch. Ophth. 38:494-505, Oct., 1947.

A telescopic amblyoscope is described which can be used for prognosis and for the training of defective vision in patients with ametropia of various intensities. Forty-seven patients with intractable ametropia were given reading lessons with this instrument once a week for twelve weeks. Prognosis may be determined by having the patient look through the telescopic amblyoscope at a test chart 6 meters away. Vision thus obtained, plus or minus one line, is the final vision to be expected after 12 lessons. The role of suppression in cases of amblyopia is discussed. A table is presented showing the number of patients, the number of lessons given, and the initial and terminal vision of each patient, as well as one that shows the refractive error and weekly progress in each of four cases. John C. Long.

Fillippi Gabardi, E. **Concerning contact lenses.** Rassegna ital. d'ottal. 17:3-10, Jan.-Feb., 1948.

The history of contact lenses begins with Cartesio, who, in 1637, suggested placing in contact with the cornea a tube containing water and having a lens at the distal end. He established the fact that light was no longer refracted by the corneal surface but from the distal end of the tube. The aim was to obtain an enlargement of the image.

In 1827, Herschel attempted to correct the defect in the corneal curvature in keratoconus and irregular astigmatism by the use of a spherical lens with parallel faces. This was placed over the cornea, using the animal gelatine for the medium between lens and cornea. Antedating Herschel was Thomas Young's effort to correct astigmatism by Cartesio's method but he found that it gave insufficient enlargement of the image.

The more modern practice of using contact lenses made of glass dates from 1887 when Fick of Zürich, Kalt of Paris and Müller of Hamburg independently began this work. Constant efforts to improve the technique and material has brought us to the present state where 90 percent of patients can wear contact lenses from 8 to 18 hours daily.

E. M. Blake.

Halldén, Ulf. **Use of polarized light in scotometry with binocular fixation.** Brit. J. Ophth. 32:186-188, March, 1948.

To obviate the universal difficulties of scotometry with monocular fixation of an eye with poor central vision, Halldén used polarized light. The screen is viewed with both eyes through polarized filters with the planes of polarization as right angles to each other. The test object is a spot of light which also shines through a filter which can be rotated to become invisible to either eye while the whole screen and fixation point are clearly visible to both eyes. The test object can be varied in size and color. The author uses a screen of aluminized sheet iron, and small permanent magnets as indicators.

Morris Kaplan.

Herzau, W. **Examination and measurement of discrepancies of ocular correspondence.** Klin. Monatsbl., f. Augenh. 112:267-277, 1947.

Discrepancies of ocular correspondence may exist under natural conditions during asymmetric convergence, under certain artificial optical conditions as in corrected high anisometropia and, finally, under pathologic conditions involving asymmetry of the eyeballs. Determination of the horopter is not quite as exact as haploscopy with the eikenometer of Ames or the Trieder haploscope. Other methods include the metroscope of Tschermak which measures the appearance of equal distances and instruments which compare

double images. The author describes an instrument based on these two last mentioned principles. It consists of a central fixation point which is binocularly seen and of four movable illuminated arrows (two on each side, one above the other) which are seen monocularly by means of polarization. This instrument measures either the apparent equalization of distances or coincidence. (9 figures, references.) Max Hirschfelder.

Hwai-sze Fang, **Amplitude of ocular accommodation in Chinese.** Chinese M. J. 66:32-34, Jan., 1948.

The accommodative power of 1,242 male Chinese subjects between 16 and 35 years of age was tested. It was found that the Chinese possess an amplitude of accommodation higher than that of Japanese but inferior to that of Americans and Germans. Irwin E. Gaynon.

Jaeger, A. **Limits of visual acuity.** Klin. Monatsbl. f. Augenh. 112:244-251, 1947.

After referring to the fact that the visual acuity of the light adapted eye conforms to an angle of 60 arc seconds and that the diameter of the foveal cones corresponds to this finding the author discusses the limits of visual acuity of the dark adapted eye. At the threshold of visual acuity in the dark adapted eye he finds a fluctuation in the visual field and the test objects "come and go" to the observing eye. This fluctuation disturbs the full utilization of the stage of adaptation. It can be avoided if one does not use total darkness for such adaptation but light values which correspond in intensity to the subsequent test objects. More constant values for visual acuity in subdued light are found in this manner. Similarly, a slight diffuse illumination is brought about by the tapetum lucidum of many animals, and this apparently is the purpose of the tapetum lucidum in night vision. (References.) Max Hirschfelder.

Jonkers, G. H. **Objective adaptometry.** Ophthalmologica 114:397-408, Dec., 1947.

Objective adaptometry is based on the elicitation of opticokinetic nystagmus by a pattern of white and black vertical stripes which move horizontally across the examinee's field of vision. The author has developed the method further by determining the most suitable dimensions of the pattern and the most suitable speed of its movement. He records the nystagmus by means of a cathode-ray-oscillograph with the electrodes placed against the skin overlying the temporal orbital rims. In a few trained examinees he obtained remarkably good agreement between subjective and objective tracings of the course of dark adaptation. "How far this method can be applied to clinical research I hope to be able to investigate further. In all probability, it (the method) is unfit for use in cases of unrest of the eyes. . . . The name 'objective adaptometry' may suggest a little too much."

Peter C. Kronfeld.

Krimsky, Emanuel. **Corneal light reflex in diagnosis of retinal correspondence.** Arch. Ophth. 38:468-486, Oct., 1947.

The physiology of retinal correspondence is discussed. The use of the corneal light reflex as an aid to the measurement of squint and in the study of retinal correspondence is described. The position of corneal light reflexes should tell one whether retinal correspondence is normal or abnormal. Any method or apparatus which can produce clearcut corneal light reflexes that can be flexibly displaced is suitable for the study. The technique of testing with the rotary prism, the phorometric stereoscope, the anglometer, the synoptophore and the Maddox rod is discussed. The original article should be consulted for the detailed conclusions derived from the study of retinal correspondence. John C. Long.

Lenoir, M., and Rose, M. **Molded contact glasses.** Arch. d'ophth. 7:604-608, 1947.

The authors review the history of molded contact lenses and describe in detail their technique for making molds of the eye as a preliminary to the fabrication of plastic contact lenses. They have definitely abandoned the use of preparations such as Negocoll, which require heat for melting, and work entirely with a plastic known as Perspex which can be used cold. The technique as outlined is complex and the authors believe it should be treated as a true ocular operation, and conducted with the same care. When properly done the mold will reproduce accurately all visible parts of the globe.

Phillips Thygeson.

Lo Cascio, G., and De Leonibus, F. **Experimental facts concerning intracapsular accommodation.** Boll. d'ocul., 26: 609-629, Oct., 1947.

Emmetropic eyes of young people with more than normal visual acuity and accommodation of about 9 diopters were measured before and during accommodation, and the dioptric values of the crystalline lens, the position of the principal points, both in rest and in accommodation, were calculated. In one eye, the intracapsular accommodation was found to be 28.5 percent of the whole accommodative effort, in the second eye, it was 65 percent. (2 figures, 22 tables, references.)

K. W. Ascher.

Loutfallah, Michel. **The cross cylinder of Jackson.** Ann. d'ocul. 181:136-147, March, 1948.

The history, description, theory and technique of this well-known adjunct to refraction are discussed in detail. The method is used to determine the best combination of sphere and cylinder to verify the strength of the cylindrical component, to localize the cylinder axis and to verify the spherical component.

Chas. A. Bahn.

Macnie, J. P. **Clinical aniseikonia.** Tr. Am. Ophth. Soc. 45:229-240, 1947.

From a clinical and statistical study of cases fitted with iseikonic glasses the author concludes that no symptoms are characteristic of aniseikonia; that the presence of aniseikonia can not be anticipated on the basis of anisometropia or the magnitude of the refractive error; that it is not possible to anticipate whether the correction of aniseikonia will aid the individual and that iseikonic lenses should be used only for the relief of symptoms and then only after the failure of the usual ocular therapeutic measures to give relief.

David O. Harrington.

Miles, P. W. **A comparison of aniseikonic test instruments and prolonged induction of artificial aniseikonia.** Am. J. Ophth. 31:687-696, June, 1948. (5 figures, 9 references.)

Osborne, E. S. **Nature's disturbances and cures in ophthalmology.** J. M. A. Georgia 37:142-144, April, 1948.

Most of the asthenopia caused by illuminants are traced to those of short-wave lengths. Yellow-green wave lengths cause the least eye fatigue. Dark glasses, tinted lenses, dim lights and poor illumination stimulate rod vision but fails to stimulate and activate cone vision.

Irwin E. Gaynon.

Raphael Sebas, S. **Cross cylinder.** Rev. brasil. oftal. 6:173-177, March, 1948.

This brief article emphasizes especially the following points: a normal eye, or one rendered emmetropic by spectacle lens, will have its visual acuity disturbed if a Jackson cross cylinder is placed before it in any position. Self-observation of the effects of the cross cylinder is of great

utility to the oculist because it illustrates what passes through the mind of the patient when subjected to these tests.

W. H. Crisp.

Sharpley, F. W. **The dark adaptation of coal miners suffering from nystagmus.** Brit. J. Opth. 32:199-204, April, 1948.

Dark adaptation tests were made under strictly controlled conditions, not only on miners who were obviously suffering from nystagmus, but on miners who were not and also on completely normal men in other occupations. The final rod threshold value only was measured with a series of short flashes. The continuous increase in the threshold value with age in normal subjects was very evident. It was noted that the threshold value in all miners, with or without evidence of the disease, was substantially higher than in the normal group. Orwyn H. Ellis.

Tower, Paul. **Contact lenses for correction of myopia complicated by lesions of the retina and choroid.** Arch. Ophth. 38: 521-528, Oct., 1947.

Contact lenses were prescribed in 30 cases of myopia with degenerative conditions of the fundus of the eye. The data on 12 cases presenting more pronounced pathologic changes are presented, 4 of which are described in detail. In each case vision was greatly improved as to clarity and detail of objects perceived.

The reasons for the improvement of vision through the use of contact lenses are discussed. The increase in the size of the retinal image is approximately 20 percent in the case of a minus 10.00 lens. The average wearing time for the contact lenses was seven hours. John C. Long.

v. Tschermak-Seysenegg, A. **Binoculars with different image size (aniseiconic binoculars).** Klin. Monatsbl. f. Augenh. 112:277-279, 1947.

A quick change of magnification in a binocular is sometimes desirable to enable an observer of wild life or an airplane spotter to identify certain details. The construction and application of aniseiconic binoculars for comparing moving images in different magnification is described. An auxiliary lens attachment is suggested which changes the magnification in one of the tubes of the binocular sufficiently to create a noticeable size difference in haploscopic vision.

Max Hirschfelder.

Valière-Vialeix. **The stenopaic slit: its clinical applications and technique.** Ann. d'ocul. 180:721-741, Dec., 1947.

Generally speaking, vision is improved by the stenopaic slit in abnormalities due to defective light transmission, but not improved in defects of perceptive origin. Acquired diffuse lesions, such as corneal edema and vitreous opacities, are exceptions to this statement. Regular, refractive errors, irregular ones as in conical cornea, and lens opacities are included in the first group. Visual defects due to inflammatory or degenerative lesions of the uvea, retina or optic nerve form the second group. If the visual defect is essentially optical and focal, a supplementary smaller pupil which facilitates marginal sharpness of more diffuse retinal images will tend to improve vision. The more transparent media are used to the greatest optical advantage. Thus in a patient with a partial senile cortical cataract and the sequellae of uveitis, that part of the visual loss due to the former would probably be improved by the stenopaic slit, but the sight loss due to the uveitis would not be improved. The optical principles involved and the technique of its use are discussed at some length. Chas. A. Bahn.

5

DIAGNOSIS AND THERAPY

Amsler, M. **Qualitative examination of the function of the macula.** Ophthalmologica 114:248-261, Oct.-Nov., 1947.

For the quick qualitative examination of the central portion of the visual field the author recommends a black screen ruled with white ink in squares, which at the distance of 28 cm. subtend an angle of one degree. At this distance the whole screen represents a square measuring 20 degrees in width and height. The center is marked by a white spot. To facilitate central fixation in cases of absolute central scotoma the diagonals are also traced out in white. The subject who looks at the screen monocularly is asked the following six questions: (1) Do you see the white spot in the center of the square? (2) Keeping your eye on the white spot (or on the intersection of the diagonals) do you see the four corners of the big square? Do you see the four sides? Do you see the entire square? (3) Keeping your eye on the white spot, do you see a regular system of small squares? Or do you notice interruptions, spots or blotches disturbing the regular arrangement of squares? Is the latter veiled or blurred in spots? Where are these spots? (4) Keeping your eye on the central white spot, do you see the white lines of the square pattern in their proper relationship, that is parallel or at right angles to each other? (5) Aside from spots or deformities do you see any other irregularities, any movement, vibration or discoloration of any of the lines? (6) Where do you see those spots or deformities? How many little squares are there between the spot and the center of the field?

The method described here is essentially that of survey perimetry ("Uebersichts-perimetrie," of Salzer [Internat. Congress, Amsterdam, 1929 and Klin. Monatsbl. f. Aug. 85:34, 1930]). It is very generally used for quick orientation before the quantitative campimetry.

Peter C. Kronfeld.

Arruga, H. **Formalin sterilization in daily practice.** Arch. Soc. oftal. hispano-am. 8:134-136, Feb., 1948.

Arruga keeps his instrument sterile in metal or glass containers in which he places a tablet of formalin. Bacteriologic studies demonstrated the effectiveness of this method of sterilization. The illustrations show a tonometer, diathermy handles, lacrimal probes, sutures, and syringes in their containers. (9 illustrations.) Ray K. Daily.

Bell, A. E. **A modified erisophake.** Am. J. Ophth. 31:610, May, 1948. (1 figure.)

Bruens, E. **The visible influence of concentrated sulfonamid instillations on the tissues of infants in gonorrheal ophthalmia.** Klin. Monatsbl. f. Augenh. 112:251-255, 1947.

Solutions of 10 to 30 percent Albucid and 10 to 20 percent Cibazol were used in hourly and half hourly intervals. Aside from the therapeutic effect on the gonococci such concentrated solutions are at the same time irritating to the eye. Increased redness of the lid margin, edema of the lids, possible damage to the corneal epithelium and pain are cited as proof. A bluish-red discoloration of the conjunctiva is often found in the healing stage of the disease. This may be due to the removal of the pathogenic organisms or to a toxic vasoconstrictor effect of the sulfonamides. The author now uses 15 percent Albucid and 15 to 20 per cent Cibazol solutions. Max Hirschfelder.

Chamlin, Max. **Recording of visual fields.** Am. J. Ophth. 31:565-573, May, 1948. (7 figures, 11 references.)

Doggart, J. H. **Slit-lamp microscopy.** Brit. J. Ophth. 32:232-246, April, 1948.

The author discussed the history of the development of the slitlamp and corneal microscope. He notes the many advantages of its use, especially the diagnosis of different forms of lens change, and of metal impregnation of certain structures of the eye. The types of pigment changes

and depositions of the cornea and lens are described. The instrument has proved to be of inestimable value, although early ophthalmologists were sceptical as to its worth. Orwyn H. Ellis.

Dufour, R. **Modern methods of localization of intraocular foreign bodies.** Ophthalmologica 114:298-303, Oct.-Nov., 1947.

The author recommends the method of Goldmann and Bangerter which consists of roentgenographic localization of the foreign body with reference to a metal ring attached to the cornea by means of tiny hooks (Ophthalmologica 107:75, 1944). The advantages of this method are that the plane of reference, the ring, cannot slip and that incorrect position of the globe during the taking of the picture can be recognized by distortion of the ring in the X-ray picture. The author has worked out a diagram to make the best possible use of this simple roentgenographic method. Peter C. Kronfeld.

Esteban, Mario. **Fluoroscopy for diagnosis and localization of intraocular foreign bodies.** Arch. Soc. oftal. hispano-am. 7:1038-1090, Nov., 1947.

The author has used fluoroscopy instead of X-ray pictures for diagnosis and localization of intraocular foreign bodies with good results. He uses the Ritter unit used in dental work and describes his technique. He hopes that this procedure can be combined with the magnet for the extraction of foreign bodies imbedded in the posterior segment of the eye.

J. Wesley McKinney.

Huber, A. **The Tyndall phenomenon in the anterior chamber.** Ophthalmologica 114:228-241, Oct.-Nov., 1947.

The author describes a photometric attachment to the slit-lamp of Haag-Streit which permits accurate measurement of the intensity of the light beam in the anterior chamber, and thus permits accurate quantitative studies of inflammatory processes of the anterior segment of the eye. The incident light is divided into a main portion which enters the eye in the usual fashion and produces the Tyndall phenomenon in the anterior chamber. The other portion of incident light is deviated into an optical system that reduces and accurately measures its intensity and a clever optical device permits direct comparison with the Tyndall phenomenon produced by the main portion of the incident light. In the discussion Goldmann describes a similar apparatus. The colloidomeder of Roenne, an attachment to the slitlamp of Zeiss intended for the same purpose (see Kronfeld, Am. J. Ophth. 24, January, 1941), has apparently not stood the test.

Peter C. Kronfeld.

Hylkema, B. S. **An eye speculum with different blades for upper and lower lids.** Brit. J. Ophth. 32:184-186, March, 1948.

Since the two lids are entirely different both anatomically and functionally, it seemed to the author that the specula with two similar blades could be improved considerably. Simple retraction of the lower lid by the ordinary specula is all that is necessary; on the other hand, the upper lid must be pushed back into the orbit and elevated away from the eye against the upper rim of the orbit. In the new speculum, the lower retractor is a blade formed as a simple hook while the upper retractor possesses an arch which is parallel to the surface of the bulb. The two blades are interchangeable on the speculum for the right and left eyes. The use of the wire speculum is deplored.

Morris Kaplan.

Kelly, T. S. B. **A note on intra-vitreous penicillin.** Brit. J. Ophth. 32:153-160, March, 1948.

The cases here treated with intravitre-

ous penicillin were roughly divided into four groups: prophylactic, post-traumatic vitreous infection, postoperative vitreous infection and vitreous infection of unknown origin. Nine cases are described in this series, in six of which an eye was enucleated mostly as a prophylaxis against sympathetic ophthalmia and not as a result of progress of infection. However, since it could be assumed that all nine eyes would have ordinarily been removed, the treatment is considered unquestionably beneficial. Routinely a retrobulbar injection of novocaine and adrenalin is given; then, in the traumatic lesions, through the wound of entry one or two thousand units of pure penicillin in 0.1 or 0.2 cc. of distilled water is injected into the vitreous. Where there is no wound, the drug is injected with a tuberculin syringe about 8 mm. back of the limbus, and the needle is inserted no more than 5 mm. The author feels that chance of benefit makes the injection worthwhile in prophylaxis of all wounds and suggests that is is also useful in longstanding uveitis. He also uses it in doses of 100 to 200 units per cc. as a routine prophylaxis in vitreous transplants. Morris Kaplan.

Knapp, A. A. **The time for eye surgery.** New York Medicine 4:16-19, March 20, 1948.

Surgery may be performed any time from the first few weeks of life to the last. Complicating systemic diseases need not cause the eye surgeon to delay. Cataract surgery should be performed as early as is necessary to give the patient the vision required for his occupation. The two stage operation with preliminary iridectomy is the safer method. Glaucoma surgery should not be delayed after medical treatment has been found to be ineffective. The patient that has glaucoma should be prepared for surgery psychologically early in the course of his disease. The surgery of detached retina and strabismus and traumatic and plastic surgery of the eye are discussed.

H. C. Weinberg.

Knipfer, A. **Late results of Roentgentherapy in hemorrhagic glaucoma.** Boll. d'ocul. 26:644-654, Oct., 1947.

Eyes irradiated for treatment of hemorrhagic glaucoma during the years 1937-1945, were reviewed after an interval of two to ten years. Among 41 patients, 19 could not be studied long enough but they had a tolerable relief of pain when seen last; eleven patients had a good result, two were improved, and in nine, no effect could be ascertained. The action of the X rays is to be understood as a) relief of spasm in the thrombosed vessels, hyperemia and improved circulation, possibly even recanaliculisation; b) reabsorption of the effused blood; c) restriction of the transudation inside the eyeball; d) analgesic action. In successful cases no new hemorrhages occurred, and the retinal vessels showed a certain degree of healing. Failures are ascribed to inadequate technique, mostly overdosage, insufficient duration of treatment, and the nature of the underlying disease such as arteriosclerosis, hypertension, diabetes, or menopausal vascular crisis. Early treatment is necessary; not more than 80 r should be given per session, in highly irritated eyes even only 40 r; three to five applications should be given over a period of two to three weeks, particularly if some vision is left and in more resistant cases, after an interval of two to four weeks, another series of three or four applications is indicated. (More than 50 references.) K. W. Ascher.

Koke, M. P. **A review of common ocular problems in children.** California Med. 68:370-373, May, 1948.

The author presents a comprehensive review of the common ocular problems

in children. Of 2,432 ocular problems 51 percent were refractive errors, 11 percent were muscular abnormalities, and 35 percent were due to external disease. In the list of congenital abnormalities two cases of retrolental fibroplasia were seen and four of toxoplasmosis. The author recommends the dilatation of all infants' pupils during the first office visit.

O. H. Ellis.

Kornerup, Tore. **An investigation, in successively variable monochromatic light of vessels of the human eye in diseased conditions.** Acta ophth. Suppl. 28, 1947, pp. 1-117.

The author examines the vessels of the eye with the use of monochromatic light. The light source is a carbon arc. The light is thrown on a dispersing system, the monochromator, the essential part of which is a constant deviation prism designed by Pellin and Broca. The prism can be rotated to bring different parts of the spectrum before a slit which cuts off all light but a certain wave length which can be read on a scale.

On observing the retinal vessels with a wave length of about 575mμ the vessels are distinctly seen. However, if the prism is slowly rotated to bring the longer wave length of the spectrum before the slit, at a certain wave length the vessels disappear because they assume the same color as the surrounding tissues. This wave length is noted and is called the L value (L for long). If the prism is now rotated back so that rays of shorter wave length are projected upon the slit, there will appear a wave length at which the retinal arteries of medium or finer caliber just become visible, this is the K value (K for short). The arithmetical mean between L and K value is the LK value.

It was found that the veins have a higher LK value than the arteries, thus in a pericorneal injection the arteries can be distinguished from the veins. If the LK value of the pericorneal injection showed a steady decrease, the course of a disease, such as iritis, scleritis, or keratitis was favorable, if, however, the LK value increased, the disease progressed to deterioration. The variations in the LK values are probably associated with variations in the percentage saturation of oxygen in the examined area.

The author also determined the LK value of the normal arteries. The pathologic arteries had a lower LK value and thus the author was able to detect a pathologic change in the arteries earlier than it was possible to recognize with the ophthalmoscope. In diabetes the LK value revealed pathologic changes in the retinal arteries in 60 percent of eyes which on ophthalmoscopic examination appeared normal. The assumption of many authors that the arteries in diabetes are normal is thus contradicted. The retinal hemorrhages seen in some cases of diabetes are in the majority of cases of venous origin.

R. Grunfeld.

Mata López, Pedro. **Penicillin of retarded elimination in ophthalmology.** Arch. Soc. oftal. hispano-am. 7:1111-1120, Nov., 1947.

For the past year the author has been using penicillin in sesame oil and bees' wax. Doses of 50,000 and 100,000 units per cc. were administered daily by injection. By this means he avoids the inconvenience of giving repeated intramuscular injections or frequent local applications of this drug. The therapeutic effects in ocular infections were found to be the same as those of an aqueous solution of penicillin.

J. Wesley McKinney.

Morón Salas, José. **A new gonioscope.** Arch. Soc. oftal. hispano-am. 8:149-159, Feb., 1948.

Morón Salas designed a new gonioscopy lens, which when placed on the eye permits inspection of the entire angle, with-

out the necessity of rotating the lens, as with the Goldman and Allen lenses. The technic for using the lens is described in detail. (16 illustrations.) Ray K. Daily.

Pelayo y Martín del Hierro, M. **Citrin or vitamin P in ophthalmology.** Arch. Soc. oftal. hispano-am. 7:1129-1140, Nov., 1947.

Vitamin P has been found to be effective in the treatment of capillary fragility and permeability. The author has successfully treated postoperative hemorrhage following cataract extractions, dacryocystorhinostomy and plastic surgery of the lids. Citrin is administered by mouth, intramuscularly and intravenously in doses of 7½ grains or more per day with no toxic effects. J. Wesley McKinney.

Posner, Adolph. **A simplified tangent-screen technique using a pantograph attachment.** Am. J. Ophth. 31:728-729, June, 1948. (1 figure.)

Streiff, E. B. **Plastic operations.** Ophthalmologica 114:294-298, Oct.-Nov., 1947.

After some general remarks about plastic techniques used in the Eye Department of the University of Lausanne (Switzerland), the author describes two specific operations: (1) a tarsorrhaphy just temporal to the lacrimal puncta for the correction of lagophthalmos and ptosis of the lower lid after facial nerve palsy, and (2) the repair, by means of a sliding skin graft, of a hole in the nasal orbital wall after exenteration for orbital malignancy. Peter C. Kronfeld.

6

OCULAR MOTILITY

Campbell, D. A., Harrison, R., and Vertigen, J. **Binocular vision in miners.** Brit. J. Ophth. 32:226-232, April, 1948.

The binocular vision in full light adaptation and in full dark adaptation of miners with nystagmus was compared with that of a large group of miners of the same age. It was noted that in all men the subjective angle tends to become convergent when they are dark adapted. The majority of miners showed an abnormal fixation in that their eyes tended to look upwards. All miners were found to have a lower percentage of stereoscopic vision than other men, and those with nystagmus only occasionally were found to have stereoscopic vision.

The power of adduction did not vary with illumination. Miners who had good stereoscopic vision had a noticeably greater power of adduction than normal. As would be expected, miners of all types who had poor stereoscopic vision had little power of duction. Orwyn H. Ellis.

Healy, Electra. **Treatment of phorias in adults.** Am. J. Ophth. 31:703-708, June, 1948.

Hilgartner, H. L. **Paralysis of superior rectus and inferior oblique from diabetes mellitus.** Am. J. Ophth. 31:608-609, May, 1948. (3 figures.)

Kirby, D. B. **Surgery of strabismus.** Rev. brasil. oftal. 6:135-142, March, 1948.

The necessary surgery may properly be executed at an early age. The operation should be rather such as will require supplemental surgery than one whose excess will have to be corrected later. Various surgical details are reviewed with respect to the more usual as well as the rarer types of case. Use of a routine technique is not advisable, but the process should be adapted to the individual.

W. H. Crisp.

Marín Amat. **A new technic for muscle shortening in strabismus.** Arch. Soc. oftal. hispano-am. 8:143-148, Feb., 1948.

This technique eliminates the use of a muscle clamp, and secures the reattachment of the muscle to its original insertion by looping the muscle. The steps of the

operations are as follows: an elliptical piece of conjunctiva is excised over the muscle, the conjunctiva and Tenon's capsule are undermined, the muscle is stretched on two muscle hooks, pulling in opposite directions and a fixation suture is introduced through the tendon, which is cut in front of the suture. The three reattachment sutures of 00 silk pass through the distal lip of the conjunctiva and the capsule of Tenon, loop the muscle, pierce the episclera at the original insertion, and come out through the proximal lip of the conjunctiva. (6 illustrations.)

Ray K. Daily.

McGillivray, James. **Vertical deviations.** Canad. M. A. J. 56:361-365, April, 1948.

Vertical deviations are classified as those which occur in infancy and usually are paretic in origin and those which occur in children over one year of age. The patients in the first group usually have false projection, amblyopia or suppression. The others usually have a certain degree of fusion, and usually can obtain single binocular vision. The functional anatomy of the vertical muscles is reviewed.

Failure to obtain single binocular vision denotes an incurable vertical deviation but a good cosmetic result with useful vision may be obtained by the use of surgery and orthoptics. The operation of choice often is that performed on the inferior oblique. Early refraction, prompt occlusion, and preventive measures are advised to help prevent false projection or amblyopia from developing. (15 figures.)

H. C. Weinberg.

Meacham, C. T. **A screen for prism cover test.** Am. J. Ophth. 31:610, May, 1948.

Motto, M. P. **Practical surgical points in strabismus.** Ohio St. M. J. 44:465-468, May, 1948.

Surgery should be performed before the sixth year. If the refractive error is small, operation may be performed earlier. Overacting internal rectus muscles require recession, underacting external rectus muscles require resection but never more than three millimeters. Refraction should be done several months after surgery.

Irwin E. Gaynon.

Rintelen, F. **Disturbance of conjugate gaze.** Ophthalmologica 114:325-331, Oct.-Nov., 1947.

The author describes an unusual disturbance of ocular motility in a bricklayer, 27 years of age, who, one year after a fall from a height of 15 feet, complained of blurred distance vision and diplopia. The immediate effects of the fall had been an extensive scalp wound without bone injury, unconsciousness for a few minutes and a mild retrograde amnesia. Ophthalmologic examination two years after the accident revealed (1) ciliary spasm (amount not stated), (2) spasm of convergence causing a constant non-paralytic esotropia of 20 prism diopters for distance, (3) fixation of both pupils in extreme lateral version, (4) horizontal jerk nystagmus in monocular excursions regardless of their direction, (5) a peculiar disturbance of lateral gaze and convergence, characterized by jerky, "reluctant" performance of the internal rectus muscles and normal, smooth performance of the external. Similar ocular motor disturbances have been observed in cases of postencephalitic Parkinsonism in which the basal ganglia and specifically the globus pallidus and the substantia nigra are involved. By analogy, the author assumes a traumatic lesion of the basal ganglia as the basis of the various motor symptoms exhibited by his patient.

Peter C. Kronfeld.

Sala, C., and Pozzan, A. **The latent asymmetry from galvanic stimulation re-**

vealed by the optokinetic nystagmus. Riv. oto-neuro-oftal. 22:263-271, July-Aug., 1947.

A number of normal individuals were studied to determine whether the optokinetic nystagmus could reveal a latent asymmetry of the vestibular nuclei in galvanic stimulation. After the number of the nystagmust jerks in the horizontal plane was established the latent asymmetry produced in the vestibular nuclei was recognized by noting that the nystagmus jerks were more frequent in one direction than the other. (Bibliography.)

Melchiore Lombardo.

Scobee, R. G., and Green, E. L. Size of line in the Maddox-rod test. Am. J. Ophth. 31:697-699, June, 1948. (1 table.)

Weber, E. Esotropia with diplopia in myopes. Ophthalmologica 114:320-324, Oct.-Nov., 1947.

In 1922 Bielschowsky described a peculiar disturbance of coordination that occurred in myopes and was characterized subjectively by diplopia of gradual onset and present only in distant vision. The objective findings were comitant esophoria and intermittent esotropia at distance only, with normal excursions and without any perceptible paralytic component. The condition which many Americans would describe as divergence insufficiency differs from divergence paralysis in that the onset is gradual, in contradistinction to the sudden development of divergence paralysis.

Two cases of such divergence insufficiency in myopes are described in detail. The treatment consisted of prisms incorporated in the distance correction. The results of the treatment are not stated.

Peter C. Kronfeld.

Weekers, L. Monocular operation for high divergent strabismus. Am. J. Ophth. 31:541-544, May, 1948. (10 figures.)

7

CONJUNCTIVA, CORNEA, SCLERA

Amsler, M. Keratographic observations of corneal transplants. Ann. d'ocul. 180: 746-748, Dec., 1947.

Two series of corneal photographs are presented in which the image of the Placido disc is reflected. In one series the reflection is irregular because the corneal transplant surface is optically perfect whereas in the other the reflecting surface is normal. Unexplained poor vision in some corneal transplants may thus be better understood.

Chas. A. Bahn.

Atkinson, W. S. Delayed mustard gas keratitis (dichlorodiethyl sulfide). A report of two cases. Tr. Am. Ophth. Soc. 45:81-92, 1947.

The signs and symptoms of delayed gas keratitis are reviewed and two cases with illustrative photographs are presented. Recognition of this condition is important in order to establish the service connection of the disability.

David O. Harrington.

Bischler, V. A case of congenital sclerocorneal cyst. Ophthalmologica 114:371-376, Oct.-Nov., 1947.

A congenital small intrascleral cyst in the 9-o'clock position near the limbus with large secondary extension into the stroma of the inferotemporal quadrant of the cornea was treated successfully by aspiration and removal of the anterior wall of the scleral portion. With the disappearance of the corneal extension pocket the cornea cleared and the vision improved to 20/20 with a smaller astigmatic correction than before the operation.

Peter C. Kronfeld.

Bourquin, J. B. Eosinophilia in the conjunctiva and in the blood. Ophthalmologica 114:203-216, Oct.-Nov., 1947.

Scrapings from the normal human con-

junctiva contain no eosinophile leukocytes even in the presence of high degrees of eosinophilia in the patient's blood. The conjunctival eosinophilia is a characteristic sign of allergic conjunctivitis of which the author gives a detailed clinical and histopathologic description. The subjective symptoms (itching and pricking sensations) are out of proportion to the objective findings (slight hyperemia, epithelial and lymphoid hypertrophy, swelling of the preauricular gland). In contra-distinction to vernal catarrh "simple" allergic conjunctivitis is characterized clinically by transparency of the conjunctiva, and histologically by the absence of fibrotic changes in the stroma. Eosinophilia in the conjunctiva, as well as in the blood, is characteristic of both conditions. Antihistaminic drugs are effective in both conditions. No mention is made of any effort to determine the specific offending allergen. Peter C. Kronfeld.

Bowes, C. F. **The use of anti-allergic drugs in the treatment of phlyctenular ophthalmia.** Brit. J. Ophth. 32:163-164, March, 1948.

In 15 children who had phlyctenular disease, a positive Mantoux reaction and positive X-ray evidence of tuberculous infection, benadryl and antistin were used. Benadryl was given as elixir and antistin as tablet. Divided doses, increasing with time, were given and none of the expected side actions of benadryl were noted but some drowsiness was present with the antistin. No appreciable beneficial effects could be found. Morris Kaplan.

Buerki, E. **A new method for the preservation of corneal tissue.** Ophthalmologica 114:288-293, Oct.-Nov., 1947.

Pieces of cadaver cornea are more easily available than whole corneas or eyeballs. The methods which are now in use for the preservation of whole eyeballs (storage in serum, whole blood or in a moist chamber, at 4 to 6 degrees centigrade) are not applicable to the excised cornea, which swells and becomes cloudy under these conditions. The author discovered that the excised cornea remains perfectly clear and retains its normal metabolic characteristics if stored in liquid paraffin at 6 degrees centigrade. Pieces of rabbit cornea stored in liquid paraffin for eight days were used successfully for transplantation and remained clear for a year. The new method has proved successful in one human eye. The oil adherent to the donor cornea is carefully removed by means of filter paper and the graft placed on a gauze sponge moistened with saline until its "bed" has been made ready. Peter C. Kronfeld.

Bursaux, M. **A case of conjunctivitis petrificans.** Ann. d'ocul. 180:749-757, Dec., 1947.

Small pearly concretions were discharged from the conjunctiva of the right eye at about two week intervals in an 11-year-old girl. The eye became red and painful preceding attacks, but between them was almost normal. The number discharged in an attack varied from one to six and the size ranged from that of a pin head to a grain of rice. The concretions were white, dry, friable and irregularly crystalline. Chemically they were found to be calcium phosphate. Somewhat similar concretions were observed in the urine. Otherwise bodily examinations were normal. Conjunctivitis petrificans is believed to be due to a bodily alkalinosis with a tendency to precipitation in predisposed tissues. Because of the increased alkalinity of the tears, the conjunctiva is a frequent location. The concretions apparently become an irritant and the resulting vasomotor reaction aids in their expulsion. Chas. A. Bahn.

Dean Guelbenzu, Manuel. **An operation for pterygium which eliminates recur-**

rence. Arch. Soc. oftal. hispano-am. 8:137-142, Feb., 1948.

The well illustrated technic, which was used without a recurrence in 117 cases, is as follows: the head of the pterygium, including the invaded superficial corneal layers is dissected with a sharp knife, beginning in clear cornea. Two incisions, parallel to the pterygium, are made with scissors in the healthy conjunctiva as far as the internal canthus, the pterygium is excised with scissors by two slightly convergent cuts at the internal canthus, leaving a rhomboidal raw surface, and all episcleral tissue is thoroughly removed from this surface. Two triangular conjunctival flaps are fashioned above and below and brought down to cover the raw area, with the superior triangle adjacent to the limbus and the inferior behind it. The flaps are anchored by one suture to the episclera and the conjunctival wounds closed with two rows of vertical sutures. A small piece of conjunctiva is excised adjacent to the limbus to leave a small area of sclera uncovered. (12 illustrations.) Ray K. Daily.

Franklin, H. C. **Penicillin in drops for prophylaxis against ophthalmia neonatorum: a single instillation method.** South. M. J. 41:320-325, April, 1948.

Almost 1200 infants were studied in the nursery and home during the first two weeks of life, as to the effectiveness of one instillation of penicillin for prophylaxis against ophthalmia neonatorum. It was found that 1.1 percent had pus in the eyes while in the nursery. Twice as many had pus in a previous series wherein penicillin had been given in four doses, and about six times as many have been previously reported after the routine use of silver nitrate.

The crystalline sodium salt was used, 2,500 units per cc. in sterile isotonic sodium chloride. The solution was kept refrigerated constantly, it was never out of the refrigerator for more than five minutes at any time, and was made fresh every five days. The sodium chloride was autoclaved twice weekly. The lids of the infant were wiped with sterile cotton, the eyes were irrigated with sodium chloride solution and then four drops of penicillin were put into each eye. Any pus was carefully noted and cultured. (2 figures, 4 tables, 1 chart, discussion, references.)

Bennett W. Muir.

Franklin, H. C., and Loeb, L. N. **Bacterial flora in eyes of newborn infants during first forty hours of life after single instillation of penicillin and silver nitrate.** J. Pediat. 32:251-256, March, 1948.

The bacterial flora in the eyes of 200 infants was studied during the first 48 hours of life. In 100 a single instillation of penicillin had been used for prophylaxis and in the others a single instillation of silver nitrate. The number of positive cultures was slightly less after penicillin prophylaxis (41 percent) than after silver nitrate (45 percent). That anaerobic organisms are encountered in the conjunctiva only during the first hours of life is to be expected. The oxygen tension in the conjunctival sac produces conditions unsuitable for growth.

This study indicates that a single instillation of penicillin compares favorably with silver nitrate as a prophylactic agent. In this series penicillin was slightly better than silver nitrate in depressing the bacterial flora of the newborn conjunctiva during the first 40 hours of life. Further study is required for interpretation of the observed increase of the bacterial flora with time in the conjunctiva of the newborn infant. Theodore M. Shapira.

Grignolo, A., and Bruna, F. **Importance of penicillin in the treatment of septic corneal ulcers.** Boll. d'ocul. 26:630-643, Oct., 1947.

Forty-eight patients of the Rome Eye

Clinic were treated for pneumococcic corneal ulcer with penicillin in drops, ointments, baths, subconjunctival injections, injections into the anterior chamber, and application as powder, to ascertain the most efficacious way of administration. Eye drops and ointments were sufficient in mild cases only; for more advanced ulcers, penicillin in substance was better, but in some cases, even the most aggressive therapy was helpless. Among 17 slight ulcers, only one did not respond to the treatment; among 15 of medium gravity, three remained uncured, and among 16 severe ulcers, 11 were failures. (5 tables, 27 references.) K. W. Ascher.

Hallermann, W. **The question of the intrauterine origin of the brown saucer-shaped lens opacity in congenital lues.** Klin. Monatsbl. f. Augenh. 112:222-225, 1947.

A woman with old interstitial keratitis and luetic choroiditis exhibited a brown saucer-shaped opacity in the region of the posterior external embryonal lens nucleus. The border of the nucleus was seen as a fine line behind this opacity. The author concludes that this opacity was formed during intrauterine development of the lens and was a direct result of the lues in the mother. Max Hirschfelder.

Hilgartner, H. L., Wilson, R. T., and Wilson, J. D. **Surgical treatment of pterygia followed by X-ray therapy to prevent recurrence.** Am. J. Ophth. 31:667-670, June, 1948. (1 colored plate, 1 figure, references.)

Kant, Alfred. **An unusual case of leptothricosis conjunctivae.** Am. J. Ophth. 31: 607-608, May, 1948.

Larsen, Victor. **Luetic keratitis caused by an operation.** Acta ophth. 25:195-199, 1947.

To clarify the role of trauma in the development of interstitial keratitis, Larson reports a case occurring several days after the extraction of a congenital cataract in a woman, 32 years old. It was then discovered serologically that she had congenital lues. She gave a history of poor vision since childhood. Syphilis had never been suspected before operation. The interstitial keratitis was cured in three to four months, leaving a large corneal opacity, which reduced vision to 3/60; the eye subsequently developed a secondary cataract, and a rise in ocular tension which required the use of miotics. Four years later she came to Larson for an operation on the right eye. He did an intracapsular extraction without an iridectomy and she made an uneventful recovery, with a final visual acuity of 6/12, because of a congenital choroiditis. The interesting features of the case are the occurrence of congenital cataracts in lues, the role of surgery in initiating an interstitial keratitis, and the favorable postoperative course in the second eye. The latter is attributed to antiluetic therapy, and to the avoidance of trauma to the iris. Larsen believes that trauma is a factor in the etiology of interstitial keratitis. When conditions for its development are favorable, trauma acts as a catalyzer in starting the pathologic process. Ray K. Daily.

Meader, G. and Danis, T. **A new form of corneal dystrophy associated with keratoconus.** Ophthalmologica 114:246-248, Oct.-Nov., 1947.

The author describes a system of fine "filiform" opacities in the deepest layer of both corneas of a patient with pronounced keratoconus in one eye and a questionable one in the other.

Peter C. Kronfeld.

Mattos, R. B. **Primary complex of conjunctiva.** Arq. brasil. de oftal. 11:7-9, 1948.

The author describes, in a girl child aged four years, a granulating mass in

the lower palpebral conjunctiva, presenting necrosis and surrounded by cell groups including giant cells and lymphocytes, and to which the diagnosis of productive tuberculuosis was given. The child was placed on treatment with vitamins A and D, in combination with mineral salts, but disappeared from observation too soon for the final result to be recorded. W. H. Crisp.

Moretti, Ezio. **Efficiency of penicillin in herpes zoster; uselessness in interstitial keratitis.** Boll. d'ocul. 26:717-719, Nov., 1947.

Four illustrative case histories are given to confirm the conclusion mentioned in the title. K. W. Ascher.

Nataf, R. **On the etiology of trachoma.** Arch. d'opht. 7:589-598, 1947.

In this report Nataf reviews his own previous studies, made with the collaboration of Cúenod, on the etiology of trachoma and answers the criticisms which have been levelled against a number of his conclusions. He considers first his cytological conceptions which center mainly around the term "plastilles" (described as granular formations occurring in the trachoma follicles), and vigorously defends their specific trachomatous nature. He states that they occur only in trachoma but that he is still unable to conclude as to their nature. Other cytological findings which he considers to be of importance include the Prowazek bodies in the conjunctival epithelium and the epithelioid cells of the follicles which show necrotic changes and contain coccobacillary bodies. He concludes that these bodies are identical with those observed in the inclusions of Halberstaedter and Prowazek. He denies that he and his collaborators ever considered Rickettsia Rocha-Lima as the cause of trachoma but states again his belief that the agent of trachoma might be related or adsorbed on to the Rickettsia. He also denies the conclusion attributed to him by certain authors that the louse was the sole vector and reservoir of trachoma virus but still affirms his belief that the louse could be a possible vector or reservoir of the infection. In support of this hypothesis he reports an experiment in which lice were inoculated with trachomatous material. After three passages in lice, the right conjunctiva of a human volunteer was inoculated with ground louse intestine. A mild follicular conjunctivitis developed and was interpreted by the author as an abortive trachoma. Because of the war he was unable to follow the patient beyond the fourth month.

Nataf concludes that the agent of trachoma is a corpuscular virus intermediate between the ordinary viruses and the rickettsiae and that it appears in such different forms as the elementary and initial bodies of the Prowazek-Halberstaedter inclusion and the rickettsioid bodies. For this agent he proposes the name of Prowazekia trachomatis.

Phillips Thygeson.

Pascheff, C. **New histological proofs of follicular pannus.** Arch. d'opht. 7:599-603, 1947.

Pascheff reaffirms his previous statements that in the pannus of trachoma there form follicles with germinal centers just like those in the trachomatous conjunctiva. To this pannus rich in follicles he gives the name "follicular pannus." When these follicles become hyperplastic, as a result of proliferation or confluence, they give rise to small hyperplastic tumors which might be called folliculomas. On the cornea this condition can be called folliculomatous pannus. Pascheff concludes that true trachomatous pannus is not an exudative inflammation, nor a simple granulomatous inflammatory process, but that it is a follicular hyperplasia of reticulo-endothelial lymphatic tissue.

He recommends for treatment of follicular pannus either the use of skin grafts or removal of the pannus by superficial keratectomy. Phillips Thygeson.

Venco, L., and Rosso, L. **The evolution of corneal grafts in syphilitic parenchymatous keratitis.** Ann. d'ocul. 181:199-212, April, 1948.

The most successful results in keratoplasty are obtained in corneas with opacities due to syphilitic parenchymatous keratitis. This is attributable to the minimal vascularization as compared with that in ulcerative diseases. Subsequent uveitis is three times more frequent, however, in syphilitic eyes than in all others combined, due apparently to a toxic reaction from bodily spirochetes. The basic reaction in syphilitic parenchymatous keratitis is largely of the allergic type and is precipitated by a variable trauma to a cornea which contains inactive spirochetes. A complicating cicatrizing uveitis will produce greater corneal opacification and other uveal sequellae. The primary stage of healing involves a traumatic non-granulomatous type of reaction somewhat similar to the traumatic allergic reaction in syphilitic parenchymatous keratitis. Early and slight vascularization favors a local immunity of the transplant against foreign protein reactions. In the second stage the transplant has survived the initial traumatic reaction and the proteins of the host are no longer toxic to the implant. This is followed by slight vascular invasion which bridges the cornea of the host and that of the implant.

Chas. A. Bahn.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Bamatter, F. **Toxoplasmic chorioretinitis.** Ophthalmologica 114:340-358, Oct.-Nov., 1947.

The paper is based on the clinical and anatomic findings in a premature female infant who during her life of 27 days showed symptoms of encephalomyelitis with hydrocephalus and a large chorioretinal lesion in one eye. This combination of symptoms suggested the diagnosis of toxoplasmosis which was verified by the demonstration (and photomicrography) of the toxoplasma photozoon in the chorioretinal lesions. The baby's twin brother died of severe ulcerative, probably also toxoplasmic, enterocolitis at the age of 30 days. Peter C. Kronfeld.

Cunningham, E. R. **A study of (1) attenuation of the iris root; (2) attachment between the dilatator and ligamentum in the Chinese eye.** Chinese M.J. 66:22-28, Jan., 1948.

The anterior limiting layer of the Chinese iris is very dense and tough. There are few crypts and hollow spaces. The innermost part of the iris in this case was attenuated and consisted only of the posterior layer of pigment epithelium and a delicate strand connecting the dilatator muscle and the pectinate ligament.

Irwin E. Gaynon.

Richardson, Shaler. **Diffuse malignant melanoma of the iris. Report of two cases.** Tr. Am. Ophth. Soc. 45:327-342, 1947.

The salient features of this unusual and rare condition are presented in considerable detail and with good illustrations. Two cases of the diffuse type, primary in the iris are reported.

David O. Harrington.

9

GLAUCOMA AND OCULAR TENSION

Elwyn, Hermann. **Nature of glaucoma.** Arch. Ophth. 38:506-520, Oct., 1947.

According to the author's concept, normal intraocular pressure is maintained in the following manner: There is a unit mechanism consisting of an effector organ

(tissues of the angle of the anterior chamber with Schlemm's canal, the ciliary body and the vessels of the choroid) and a central control from a center in the brain mediated by means of cholinergic nerves of the parasympathetic nervous system. Primitive peripheral regulation is maintained by the activity of the ciliary body and that of the angle of the anterior chamber by means of a constellation of electrolytes. The volume of blood in the choroid is regulated by the vessel walls. The primitive peripheral regulation is not sufficient and is superseded by a central regulation. This central regulation is effected from a center in the brain, probably situated in the brain stem near or in the Edinger-Westphal nucleus.

Glaucoma is a heredoconstitutional functional disease, involving primarily the function of central regulation of the intraocular pressure. When insufficient impulses from the central regulation reach the units of the effector organ, either the constant volume of the blood in the choroidal vessels is increased or the constant volume of the aqueous is increased. The result is glaucoma with a shallow chamber when an increase in the constant volume of blood in the choroidal vessels predominates, or glaucoma with a normal anterior chamber when the increase in the volume of the aqueous predominates. Primary glaucoma is one disease only. Secondary glaucoma is the increase in intraocular pressure which results when the outflow of aqueous or the choroidal blood volume is interfered with by organic changes in the eye.

John C. Long.

Kronfeld, P. C., and McGarry, H. I. **Five year follow-up of glaucomas.** J.A.M.A. 136:957-965, April 10, 1948.

Glaucoma is divided into early, moderately advanced, and far advanced, depending upon the perimetric findings. The authors report 225 cases of wide angle glaucoma and 100 of narrow angle glaucoma. These cases had remained in their respective states for at least five years.

The course of the disease after normalization of tension showed a strong dependence on the stage of the disease when normalization became effective in wide angle glaucoma. Semi-normalization of tension preserved the existing vision in two-thirds of the patients. The late stage of glaucoma showed a tendency to progress in the wide angle glaucomas in spite of normalization of tension. The center of the visual field seems to exhibit a specific resistance to the glaucoma in these eyes.

The narrow angle glaucomas remain stationary after normalization of tension in approximately 90 percent of the cases. These patients usually presented themselves early. (6 figures, 3 tables.)

H. C. Weinberg.

Posner, A., and Schlossman, A. **Mild glaucoma.** Am. J. Ophth. 31:679-686, June, 1948. (11 references.)

Snydacker, Daniel. **The prevention of cycloplegic glaucoma.** Am. J. Ophth. 31: 730-731, June, 1948. (9 references.)

Thomassen, Thore Lie. **The venous tension in eyes suffering from simple glaucoma.** Acta Ophth. 25:221-241, 1947.

The author reviews the literature and reports his own investigations of 30 glaucomatous eyes. He made 71 series of measurements of the diurnal variation of the intraocular and the episcleral venous tension. The intraocular tension was measured with a tonometer, and the tension of the episcleral veins taken by a modification of Seidel's method. The tension necessary to compress an episcleral vein was measured with a water manometer; the water from the manometer was conducted into a transparent chamber 8 mm. in diameter and 7 mm. deep of

which one side is covered with a thin, nonelastic, soft cellophane paper, which bulges with pressure. Through the chamber the moment of collapse of the vein could be observed, and the tension read on the manometer. A careful analysis of the plotted data shows that the venous tension in the eye is high in proportion to the ocular tension, when the ocular tension is in an increasing phase, it is medium when the ocular tension remains constant, and low when the ocular tension is in a decreasing phase. The changes in the venous tension are primary. Pilocarpine produces a fall first in the venous tension of the eye, then in the ocular tension. The outstanding result of this study is the demonstration of considerable oscillations that arise spontaneously in the venous tension of the eyes and precedes changes in the ocular tension. (7 curves.)

Louis Daily, Jr.

Zaretskaya, R. B. **Intraocular pressure of normal and glaucomatous eyes as affected by accessory light stimuli.** Am J. Ophth. 31:721-727, June, 1948. (8 figures, references.)

10

CRYSTALLINE LENS

Franceschetti, A. **Congenital cataract due to German measles during pregnancy. The digito-ocular phenomenon.** Ophthalmologica 114:332-339, Oct.-Nov., 1947.

The literature is reviewed and two pertinent cases are described. In these two, as well as in other cases of complete congenital cataract, the author has observed the "digito-ocular phenomenon," that is a natural tendency of these children to press against their eyeballs with one or several fingers placed against the closed lids close to either the upper or the lower orbital rim. The author recommends surgery at the earliest possible date, before the nystagmus which occurs several months after birth, becomes firmly established. The idea of therapeutic abortion, which is considered a legitimate form of prophylaxis by some, has met opposition on legal, religious and social grounds. For the time being, one should investigate the following possibilities of prophylaxis: vaccination, premarital voluntary contraction of the disease, isolation of the mother during the first three months of pregnancy.

Peter C. Kronfeld.

11

RETINA AND VITREOUS

Ayberk, Nuri F. **Two cases of obstruction of the central artery of the retina treated with Heparin.** Göz Kliniği 5:129-135, 1947.

One patient who had received inadequate amounts of the drug because enough was not available was not improved. In the other patient the visual acuity improved for light perception to 5/10 after he had received 600 mgms. of Heparin in six days and no other treatment.

F. H. Haessler.

Bedell, A. J. **Ophthalmoscopy and the hypertensive state.** Mississippi Doctor 25: 347-349, April, 1948.

Patients with hypertensive disease in whom the fundus is devoid of retinal edema and shows only moderate blood vessel changes, are favorable for splanchnicectomy. Those with mild retinopathy as evidenced by cotton wool exudates, hemorrhages and narrow arteries with irregular lumen may be done after a thorough study of the response to rest, cold, drugs and kidney function tests. Those with papilledema, fulminating retinopathy and extensive hemorrhages are least likely to be benefited by surgery.

Irwin E. Gaynon.

Bedell, A. J. **The diagnosis of retinoblastoma.** Tr. Am. Ophth. Soc. 45:282-291, 1947.

Six case histories with description of the ocular signs which led to enucleation in five and in the sixth, to the diagnosis of angiomatosis are presented. Differential diagnosis, the difficulty of early diagnosis, and the implications of birth control in affected families are discussed.

David O. Harrington.

Braveman, B. L., Koransky, D. S., and Kulvin, M. M. **Quinine amaurosis.** Am. J. Ophth. 31:731-733, June, 1948. (1 figure, references.)

McFarland, C. B. **Vascular changes of the eye associated with diabetes mellitus.** J. Indiana St. M.A. 41:487-488, May, 1948.

The earliest change is a non-uniform dilatation and tortuosity of the veins of the retina. Small micro-aneurysms occur in the smallest capillaries of the inner nuclear layer and are usually situated beneath the larger retinal vessels and on or near the small perimacular arterioles.

Irwin E. Gaynon.

Pignalosa, G. **Examination of hypermetropic maculas in red-free illumination.** Boll. d'ocul. 26:672-682, Nov., 1947.

There is no correlation between the degree of hypermetropia and of amblyopia; some eyes with very high hypermetropia may have an excellent visual acuity, and sometimes, in a case of strabismus, the eye with greater hypermetropia may be the leading one and have better acuity than the one with lesser hypermetropia. Among 447 hypermetropic patients examined with the red-free ophthalmoscope of Zeiss, there were 21 patients with abnormal appearence of the yellow spot. In some of them the area of yellow coloration or its intensity was reduced, and in others the macular reflex was modified or missing. All these eyes were more or less amblyopic. The finer structure of the retina in amblyopic eyes is probably altered in all eyes showing a not otherwise explainable diminution of their visual acuity. (4 colored fundus pictures, 1 table, bibliography.)

K. W. Ascher.

Rutherford, C. W. **Hemorrhages of the retina; newer treatment.** J. Indiana St. M.A. 41:494-495, May, 1948.

Retinal hemorrhages occur because of increased capillary fragility and permeability. Fragility is tested by the method of Göthlin and premeability by the method of McMaster. Rutin decreases capillary fragility. The initial dose of rutin is 20 mg. three times daily and may be increased to 400 mg. daily. It is nontoxic and noncumulative. In venous thrombosis, dicumeral has almost replaced heparin. The patient must be hospitalized, frequent prothrombin time taken, and only after the dosage has been calculated to make the prothrombin time 50 percent normal, can the patient be ambulatory.

Irwin E. Gaynon.

Verhoeff, F. H. **Successful diathermy treatment in a case of recurring retinal hemorrhages and retinitis proliferans.** Tr. Am. Ophth. Soc. 45:194-201, 1947.

Observations on a patient are reported in considerable detail in whom vision in the right eye was apparently hopelessly lost from vitreous hemorrhage arising from retinal periphlebitis and in whom retinitis proliferans indicated the same fate for the left eye. No improvement had occurred either with tuberculin therapy or with treatment with diazone, and accordingly surface diathermy was applied to the affected region in the left eye. When the reaction had subsided the foci of periphlebitis had apparently subsided and hemorrhages had disappeared. A series of new retinal hemorrhages in the left eye nine months later was treated with diathermy, again successfully, and vision has remained normal.

The author suggests the use of dia-

thermy treatment as a means of establishing communication between retinal and choridal vessels, thus restoring retinal circulation in all cases of impending blindness from retinal vessel obstruction.

David O. Harrington.

Wagener, H. P., Clay, G. E., and Gipner, J. F. **Classification of retinal lesions in the presence of vascular hypertension.** Tr. Am. Ophth. Soc. 45:57-73, 1947.

This report to the American Ophthalmological Society by the committee on the classification of hypertensive disease of the retina is a comprehensive evaluation of the retinal complications of cardiovascular renal disease with hypertension. In outline form the report deals with the terminology of lesions of retinal vessels, the grading of lesions of retinal arterioles and the terminology of retinopathies associated with vascular hypertension. More detailed consideration is given to lesions of the retinal arterioles, retinal arteries, retinal veins and choroidal arteries and to the retinopathies of acute hypertension, chronic progressive hypertension, terminal malignant hypertension, and the retinopathies of glomerulo nephritis. David O. Harrington.

Weber, E. **The asymptomatic retinal hole.** Ophthalmologica 114:304-311. Oct.-Nov., 1947.

The asymptomatic hole in the retina, that is, a complete hole without retinal separation, is not as rare as is generally assumed. The author describes four cases of this condition. From the excellent fundus drawings it is evident that chorioretinitic tissue alterations surrounded the tears in at least three of the cases. Jess has recommended immediate operation whereas Amsler advocates observation to determine the natural course of the process (stationary or progressive). The author bases his decision upon the following factors: (1) the condition of the other eye, (2) the position of the tear (tears in the upper half call for early operation), (3) stationary or progressive course of the degenerative retinal changes, (4) presence or absence of detachment of the vitreous, (5) the refractive error and (6) the incidence of degenerative eye conditions in other members of the patient's family.

In the discussion Amsler recommends immediate surgical treatment of complete retinal tears without separation if there are no visible signs of spontaneous demarcation or walling-off of the diseased portion. It happens only very exceptionally that a retinal tear without visible demarcation does not lead to a detachment.

Peter C. Kronfeld.

12

OPTIC NERVE AND CHIASM

Bruetch, W. L. **Surgical treatment of syphilitic primary atrophy of the optic nerves (syphilitic optochiasmatic arachnoiditis).** Arch. Ophth. 38:735-754, Dec., 1947.

Recent theories have attributed the cause of primary syphilitic atrophy of the optic nerves to optochiasmatic arachnoiditis, and surgical intervention has been recommended. On the basis of a histologic study of 12 cases of syphilitic primary atrophy of the optic nerves, the propriety of surgical intervention is discussed. In four cases of syphilitic atrophy no arachnoidal adhesions were present at all, and in two others the slight arachnoidal thickening could be considered as still within normal limits. In the others there was definite syphilitic arachnoiditis in the optochiasmatic region. Microscopic examination revealed that the thickened arachnoid passed harmlessly over the optic nerves and chiasm, leaving no signs of pressure. Primary syphilitic optic nerve atrophy is essentially the result of an

inflammatory process in the intracranial portion of the optic nerves and in the chiasm. The inflammation has its origin in a basilar syphilitic meningitis, which in some instances produces an optochiasmatic arachnoiditis and in others leaves the basilar arachnoid grossly unaltered. Surgical removal of the arachnoidal adhesions will be of little, if any, benefit because the inflammatory process within the optic nerves and chiasm remains unaltered by the operative procedure. The most efficacious treatment of primary syphilitic optic atrophy is malarial therapy aided by a course of concomitant and subsequent injections of penicillin, with 5,000,000 units in each course.

John C. Long.

Focosi, M. and Grignolo, A. **Two cases of acute optic neuritis occurring in acute, benign lymphocytic meningitis.** Rassegna ital. d'ottal., 17:11-23, Jan.-Feb., 1948.

The authors report two cases of acute optic neuritis developing during attacks of an acute, benign lymphocytic meningitis, one in a man of 31 years, the other in a woman of 23. After discussion of the clinical aspects and the etiology it was assumed that both developed from the same agent, possibly a virus, which had caused the meningitis. It is suggested that the optic neuritis may, at times, be the only evidence of this infection, or that the other symptoms are so slight as to escape observation.

Finally, a group of five other instances of acute optic neuritis without recognizable extraocular symptoms, is described. These developed in the same period during which the first two were seen.

E. M. Blake.

Hamburg, J. **The treatment of toxic amblyopia by raising the oxydative cell metabolism.** Ophthalmologica 114:358-368, Oct.-Nov., 1947.

The oxygen consumption of the optic nerve in a state of early ascending or descending degeneration after mechanical trauma (in cats) is markedly lower than under normal conditions. In acute or chronic poisoning with quinine or methyl alcohol the oxygen consumption of the retina of cold-blooded animals has been found diminished. On this and similar evidence the author bases his concept that the mechanism of most forms of toxic amblyopia is a specific diminution of the oxydative cell metabolism, caused by the direct action of the toxic substance on nerve tissue. Specific treatment of toxic amblyopia should, therefore, consist of abstinence, the administration of a high-caloric diet with large amounts of vitamin B and an oxydation-raising agent. For the latter purpose the author uses manganese chloride in 0.02 molar solution in daily doses of from 1 to 3 cc. (intramuscularly). Manganese intoxication can be prevented by watching the pulse rate which should not go up more than 10 beats per minute. Several cases of combined alcohol-nicotine amblyopia were first treated with total abstinence plus high-caloric, high-vitamin diet for several weeks. If only minimal improvement in visual acuity occurred the manganese treatment was instituted. In three such cases the visual acuity started to improve "almost suddenly" on the fourth to sixth day of the manganese therapy.

In the discussion F. P. Fischer reports negative results with a similar, cell metabolism-raising treatment by means of intramuscular injections of potassium permanganate (1 cc. of a one-percent solution) in cases of "camp eyes."

Peter C. Kronfeld.

Lin, Chang-yuin, and Tao, Kuo-tai. **Neuromyelitis optica in a Chinese.** Chinese M.J. 66:18-25, Jan., 1948.

A case of neuromyelitis optica in a 25-year-old woman is presented. Within a few days she lost light perception in

both eyes. Three and seven years later the patient developed myelitis in the form of a brown sequard syndrome. There was a complete remission of spinal symptoms between attacks. Irwin E. Gaynon.

Man, H. X. **Diagnostic etiology of a case of unilateral optic atrophy.** Ann. d'ocul. 181:106-110, Feb., 1948.

A 22-year-old man with a primary optic atrophy in the left eye only, had noted gradual failing sight for two years. The right pupil was somewhat larger, but both direct and indirect light reactions were normal in both eyes. The fields were normal, except for a concentric contraction to one-half in the left eye and a bitemporal chromatic contraction in both eyes. Radiographically, the sella appeared abnormally calcified. In addition to failing vision the patient had also noticed increased somnolence and decreased virility during two years. Otherwise he was clinically and serologically normal, except for slight clinical indications of hypothyroidism and sexual hypopituitarism. After cystic drainage and partial removal of an intrasellar craniopharyngioma the bitemporal chromatopsia improved. The differential diagnosis of the mechanism that produces monocular primary optic atrophy with bitemporal chromatopsia is discussed at some length.

Chas. A. Bahn.

Missiroli, Giuseppe. **A new congenital familial syndrome: hypoplasia of the optic nerve and binasal hemianopia.** Boll. d'ocul. 26:683-698, Nov., 1947.

Two daughters and one son showed the syndrome named in the title. In otherwise normal eyes of physically normal individuals, the optic nerves showed an extremely small diameter, about one-fourth of the usual size, sharp outlines, and normal color. There were no other children in this family, and both parents had normal eyes, and there was no consanguinity of the parents. Similar but not identical cases have been previously reported by Schwarz (1915) and Velhagen (1930) (1 colored fundus picture, 2 visual fields, bibliography.) K. W. Ascher.

Verzella, M. **The injection of nicotinic acid "juxta forum opticum" in some forms of optic neuritis.** Rassegna ital. d'ottal., 17:24-77, Jan.-Feb., 1948.

Since 1937, when Goldberg isolated nicotinic acid and its amide from a liver extract, there has been much effort to explain the complex biological action of this substance. Of particular interest to the ophthalmologist is the effect upon the blood vessels, especially the arterioles, capillaries and venules. Here its action has been seen to produce hyperemia, increased velocity of the blood stream, with resulting increased oxidation. Condorelli has suggested that these results are due to stimulation of the cerebrospinal vegetative centers. Intramuscular injection of 60 mmgr. of nicotinic acid produces a dilatation of the retinal veins lasting 45 minutes.

Verzella gives minute directions for the introduction of the hypodermic needle into the orbit so that the solution of nicotinic acid is made close to the optic foramen. Ten injections of 15 mmgr. were given in each orbit. Sixteen patients, with various types of optic nerve disease were treated, eleven with very good results. An elaborate discussion of the action of the nicotinic acid, especially at the site of injection, follows. (18 figures)

E. M. Blake.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month

ANNOUNCEMENTS

ARGENTINA CONGRESS MEETS IN DECEMBER

The 4th National Argentinian Congress of Ophthalmology will convene in Mar del Plata, a beach resort 250 miles south of Buenos Aires, from December 13 to 18, 1948. The congress meets every four years. Prof. Diego M. Arguello is president and any correspondence concerning the meeting should be addressed to him at Casilla Correo 4097, Buenos Aires.

WANTED

The Ophthalmic Publishing Company will pay $1.50 for copies of the January, 1947, and January, 1948, numbers of the *American Journal of Ophthalmology*. Send copies to the Manager of Subscriptions, Ophthalmic Publishing Company, 664 North Michigan Avenue, Chicago 11, Illinois.

CALIFORNIA POSTGRADUATE COURSE

A postgraduate course in ophthalmology will be given by the University of California Medical School, September 6th through 11th. The course, under the direction of Dr. Frederick C. Cordes, will be held at Toland Hall, University of California Hospital, San Francisco.

Officers of instruction include the following:

Dr. Samuel D. Aiken, Dr. Crowell Beard, Dr. George S. Campion, Dr. Frederick C. Cordes, Dr. Joseph W. Crawford, Dr. C. Allen Dickey, Dr. Owen C. Dickson, Dr. David O. Harrington, Dr. Margaret Henry, Dr. Michael J. Hogan, Dr. Warren D. Horner, Dr. Robert N. Shaffer, Dr. Joseph G. Smith, and Dr. Phillips Thygeson.

On Friday evening, September 10th, the third annual Francis I. Proctor Lecture will be delivered by Dr. David G. Cogan, associate professor of ophthalmic research and director of the Howe Laboratory of Ophthalmology, Harvard University Medical School. His subject will be "The Physio-Pathologic Basis for Some of the Signs and Symptoms of Corneal Disease."

The schedule of classes is:

Monday, September 6

8:30-8:40 a.m.—Opening Address—*Dr. Cordes*
8:40-9:30 a.m.—Diagnosis and Treatment of Blepharo-Conjunctivitis—*Dr. Crawford*
9:45-10:45 a.m.—Practical Observations in Refraction, Part I—*Dr. Cordes*
11:00-12:00 noon—Practical Observations in Refraction, Part II—*Dr. Cordes*
1:30-2:30 p.m.—Thyrotropic and Thyrotoxic Exophthalmos—*Dr. Dickson*
2:45-3:45 p.m. Emergency Treatment of Eye Injuries—*Dr. Smith*
4:00-5:00 p.m.—Diagnosis and Pre-Operative Management of Retinal Detachment—*Dr. Dickson*

Tuesday, September 7

8:30-9:30 a.m.—Optic Atrophies in Children and Adults—*Dr. Dickson*
9:45-10:45 a.m.—Etiology and Treatment of Uveitis, Part I—*Dr. Thygeson*
11:00-12:00 noon—Etiology and Treatment of Uveitis, Part II—*Dr. Thygeson*
1:30-2:30 p.m.—Congenital Ocular Anomalies—*Dr. Henry*
2:45-3:45 p.m.—Diagnosis and Management of Lid and Conjunctival Tumors—*Dr. Hogan*
4:00-5:00 p.m.—Preparation, Sterilization, and Care of Ophthalmic Solutions—*Dr. Hogan*

Wednesday, September 8

8:30-9:30 a.m.—The Office Treatment of External Diseases—*Dr. Horner*
9:45-10:45 a.m.—X-ray Localization of Intraocular Foreign Bodies—*Dr. Smith*
11:00-12:00 noon—Routine Testing of Eye Muscles (Demonstration)—*Dr. Dickey*
1:30-2:30 p.m.—Congenital Anomalies of the Eye Muscles—*Dr. Campion*
2:45-3:45 p.m.—Diagnosis and Treatment of Paralytic Squint—*Dr. Dickey*
4:00-5:00 p.m.—Physiology of the Extraocular Muscles—*Dr. Campion*

Thursday, September 9

8:30-9:30 a.m.—Pediatric Ophthalmology—*Dr. Henry*
9:45-10:45 a.m.—Neuro-Ophthalmology, Part I—*Dr. Harrington*
11:00-12:00 noon—Neuro-Ophthalmology, Part II—*Dr. Harrington*
1:30-2:30 p.m.—Medical Ophthalmology, Part I—*Dr. Aiken*
2:45-3:45 p.m.—Medical Ophthalmology, Part II—*Dr. Aiken*
4:00-5:00 p.m.—The Importance of the Pupil in Diagnosis—*Dr. Beard*

Friday, September 10

8:30-9:30 a.m.—Diagnostic and Differential Diagnostic Problems in Early Glaucoma—*Dr. Cordes*
9:45-10:45 a.m.—Glaucoma, Part I—*Dr. Shaffer*
11:00-12:00 noon—Glaucoma, Part II—*Dr. Shaffer*
1:30-2:30 p.m.—Ocular Allergies—*Dr. Crawford*
2:45-3:45 p.m.—Toxoplasmosis—*Dr. Hogan*
4:00-5:00 p.m.—Virus Diseases of the Cornea—*Dr. Thygeson*

Saturday, September 11

8:30 a.m.—Clinical Conference—*Dr. Cogan*

This course is open only to qualified physicians and requests for registration should be addressed to:

Dr. Stacy R. Mettier, Medical Extension, University of California Medical Center, San Francisco 22. The fee for the course is $60.00 payable at the time of enrollment.

Miscellaneous

Luncheon for Journal staff

The editorial staff and collaborators of the Journal were entertained at a luncheon given by the Ophthalmic Publishing Company at the Kungsholm restaurant, Chicago, on June 24th.

Those present were: Dr. Charles A. Bahn, New Orleans; Dr. Alston Callahan, Birmingham; Mrs. Katherine Chalkley, Lake Geneva; Dr. F. M. Crage, Chicago; Dr. Beulah Cushman, Chicago; Dr. Ray K. Daily, Houston; Dr. Orwyn H. Ellis, Los Angeles; Dr. Irwin E. Gaynon, Milwaukee; Dr. and Mrs. F. Herbert Haessler, Milwaukee; Dr. Max Hirschfelder, Centralia, Illinois; Dr. Peter C. Kronfeld, Chicago; Dr. Donald J. Lyle, Cincinnati; Dr. William A. Mann, Chicago; Dr. Lawrence T. Post, Saint Louis; Dr. A. B. Reese, New York; Dr. Ernst Schmerl, Toledo; Dr. Theodore M. Shapira, Chicago; Mrs. Mildred Skinner, Chicago; Dr. Phillips Thygeson, San Jose, California; Dr. Derrick Vail, Chicago; and Dr. Alan C. Woods, Baltimore.

Lions Club scholarships

At a luncheon at the Savoy Plaza Hotel, New York, on June 2nd, the Lions Club of New York presented a check for $2,000 to the New York University College of Medicine to finance four scholarships for graduate training in ophthalmology.

The scholarships were awarded to Dr. Goodwin M. Breinin and Dr. Walter J. Maher of New York, Dr. Edwin H. Kent of Riverside, Connecticut, and Dr. Charles H. Toomey of Lakewood, Ohio. They will study special phases of eye conservation at Bellevue Hospital under the direction of Dr. Daniel B. Kirby, chairman of the ophthalmology department at the College of Medicine.

Honored guests at the luncheon were: Mr. William E. Cotter, guest speaker; Mr. Benet Polikoff, president of the Lions Club; Dr. E. M. Bernecker, commissioner of city hospitals; Mr. E. R. Fryxell, chairman of the Eye Conservation Committee of the Lions Club; Dr. Currier McEwen, dean of the New York University College of Medicine; Dr. Daniel B. Kirby, professor of ophthalmology, New York University College of Medicine; Dr. Townley Paton, technical adviser for the Eye-Bank for Sight Restoration, Inc.; Dr. F. M. Foote, director of the National Society for the Prevention of Blindness; Mrs. Grace Harper, director for the Bureau of Service for the Blind, New York; Dr. Philip S. Platt, executive director, New York Association of Blind.

Societies

Research Association scientific program

The Association for Research in Ophthalmology, Inc., met at Thorne Hall, Northwestern University Medical School, Chicago, on June 21st and 22nd. The program follows:

Monday, June 21

Alston Callahan, M.D.———Aniridia, Ectopic Lenses, and Congenital Glaucoma: Genetic, Pathologic, and Surgical Considerations

Harold F. Falls, M.D.———A Gene Producing Various Defects of the Anterior Segment of the Eye

William T. Kruse, M.D., Harold F. Falls, M.D. ———Three Cases of Marcus-Gunn Phenomenon in Two Generations

Harold G. Scheie, M.D., Jerome Bourne, M.D. ———Electrocoagulation of the Sclera: Reduction in Ocular Volume and Pathological Changes Produced

J. Lloyd Burns, M.D., W. Stanley Hartroft, M.D. ———Intraocular Hemorrhage in Young Rats on a Choline-Deficient Diet

Edward P. Danforth, M.D.———The Fate of Transplanted Ciliary Body Tissue

R. K. MacDonald, M.D.———Changes Observed in the Eyes of Animals Following Prolonged Administration of Testicular Extract

Donald T. Hughson, M.D.———The Use of Alkyldimethyl-benzyl Ammonium Chloride for Maintenance of Sterility in Solutions

Dorland J. Davis, M.D., Margaret Pittman, Ph.D. ———Streptomycin in the Treatment of Experimental Conjunctivitis due to *Hemophilus sp.*

Murray Sanders, M.D., Alson Braley, M.D.——— Aureomycin in Ocular Infections, A Study of Its Spectrum

J. K. Frenkel, M.D.———Uveitis and Toxoplasmin Sensitivity

John C. Locke, M.D.———Experimental Studies with Antibiotics (Bacitracin, Streptomycin, Penicillin) and Antibiotic Mixtures in Intraocular Infections with Penicillin-resistant Staphylococci

Henry A. Imus, Ph.D., Lt. Comdr. (MC) U.S.N.R. ———Industrial Vision Testing Techniques

Tuesday, June 22

Irving H. Leopold, M.D., Joseph Smolens, Ph.D., James H. Parker, Jr., M.D.———Some Physical, Chemical, and Biological Properties of Normal Human Tears

Frank W. Newell, M.D., John A. D. Cooper, M.D., Chester J. Farmer, M.D.———Effect of BAL (2, 3 Dimercaptopropanol) on Intraocular Copper

John E. Harris, Ph.D., Leta Gehrsitz, M.S.——— Movement of Monosaccharides into and out of the Aqueous Humor

V. Everett Kinsey, M.D., Ernst Barany, M.D.——— The Rate of Flow of Aqueous Humor and its Significance for Intraocular Fluid Problems

Jonas S. Friedenwald, M.D.———Proctor Address: Formation of the Aqueous

T. D. Duane, M.D.———The Steady State of Corneal Hydration

W. A. Robbie, Ph.D., P. J. Leinfelder, M.D.——— The Use of Isolated Retinal Tissue in Studies of the Metabolism of the Central Nervous System

Lawrence Ely, M.D.———Respiration of the Crystalline Lens

Paul W. Miles, M.D.———Flicker Fusion Frequency in Amblyopia ex Anopsia
John W. Henderson, M.D., Ph.D.———The Anatomical Basis for Certain Reflex and Automatic Eye Movements
K. W. Ascher, M.D.———The Compression Test of Aqueous Veins of Glaucomatous Eyes

Section on Ophthalmology program

The Section on Ophthalmology, American Medical Association, met at Thorne Hall, Northwestern University, Chicago, on June 23rd, 24th, and 25th, under the chairmanship of Dr. Everett L. Goar, Houston, Texas.

The program included: Chairman's Address, with lantern demonstration, Dr. Everett L. Goar; Address, Dr. John A. MacMillan, Montreal, Canada; "Retrolental Fibroplasia and Persistent Hyperplastic Primary Vitreous: Two Entities," Dr. A. B. Reese, New York; "The Epidemiology of Encephalo-Ophthalmic Dysplasia," Dr. Theodore H. Ingalls, Southborough, Massachusetts; "Treatment of Glaucoma Associated with Iridocyclitis," Dr. Adolph Posner and Dr. Abraham Schlossman, New York; "The Use of Strips of Orbicularis Oculi Muscles in Surgery of the Eyelids," Dr. William B. Clark, New Orleans; "Verified Refraction," Dr. S. Judd Beach, Portland, Maine; "Intraorbital Tumors," Dr. Arnold W. Forrest, New York; "The Use of D.F.P. in Glaucoma," Dr. P. Robb McDonald and Dr. Irving H. Leopold, Philadelphia; "The Blindspot Syndrome," Dr. Kenneth C. Swan, Portland, Oregon; "Nonmedical Problems in Industrial Ophthalmology," Dr. Ralph S. McLaughlin, Charleston, West Virginia; "The Use of Streptomycin and Streptomycin Plus Promizole in Experimental Ocular Tuberculosis," Dr. Alan C. Woods, Baltimore; "A Method of Retrobulbar Anesthesia which Produces an Associated Muscle Block of the Extraocular Muscles," Dr. Harold Gifford, Jr., Omaha, Nebraska; "Basic Principles of Ocular Muscle Surgery," Dr. Watson Gailey, Bloomington, Illinois; "A Further Exceedingly Delicate Test for Astigmatic Axis," Dr. William H. Crisp, Denver, and Dr. George H. Stine, Colorado Springs.

Scientific exhibits at A. M. A. convention

The Section on Ophthalmology exhibits at the A.M.A. convention included: "New Type Movable Implant," by Dr. William Stone, Jr., Massachusetts Eye and Ear Infirmary, Boston, awarded the bronze medal; "Tumors of the Orbit," Dr. Raymond G. Ingalls, Institute of Ophthalmology, Presbyterian Hospital, New York; "Diseases of the Fundus Oculi," Dr. Bertha A. Klien, Department of Ophthalmology, Northwestern University Medical School, Chicago, awarded the gold medal; "Prevention of Ophthalmic Neonatorum: Antibiotics Replace Silver Nitrate," Dr. Louis Lehrfeld, Wills Eye Hospital, Philadelphia; "Treatment of Ocular Infections: Use of Chemotherapeutic Agents," Dr. John G. Bellows and Dr. Chester J. Farmer, Northwestern University Medical School, Chicago, awarded the certificate of merit; "Ocular Toxoplasmosis: Clinical Observations," Dr. Lorand V. Johnson, Western Reserve University School of Medicine, Cleveland; "Observations on the Course of Glaucoma," Dr. Adolph Posner and Dr. Abraham Schlossman, New York.

Better Vision Institute officers

At the annual meeting of the Better Vision Institute the following men were chosen to serve two-year terms ending in June, 1950: manufacturers—Beverly Chew, J. E. Hansen, B. A. Ramaker, G. B. Wells; supply house representatives—T. A. Byrne, Roy Martin, L. W. Myers, C. N. Shelden; optometrists—John F. Hill, John Hughes, W. E. Malinka, J. A. Palmer; ophthalmic dispensers—W. A. Blocker, William Cook, J. A. T. Obrig, A. F. Weber.

At the meeting of the board of directors, officers and members of the executive committee were elected for one-year terms as follows: officers—M. J. Julian, president; E. E. Williams, treasurer; Carl Hallauer, George Nagel, Roy Martin, H. B. Carpenter, and John F. Hill, divisional directors; executive committee—M. J. Julian, chairman; E. E. Williams, Herbert Eisenhart, C. N. Shelden, John F. Hill, and J. A. T. Obrig.

Reading meeting

The 82nd meeting of the Reading Eye, Ear, Nose, and Throat Society was held June 9th. It consisted of surgical and dry eye and ear, nose and throat clinics. The speakers were Dr. F. L. Philip Koch, chief surgeon, Glaucoma Clinic, Manhattan Eye and Ear Hospital, New York, who spoke on "Glaucoma"; Dr. Karl M. Houser, professor of otology, University of Pennsylvania, who spoke on "The Diagnosis and Treatment of Meniere's Disease." There was a study club conducted by Dr. Robert R. Impink, chief of general surgery, St. Joseph's Hospital, on "General Principles of Surgery."

Carolinas meeting

The South Carolina Society of Ophthalmology and Otolaryngology and the North Carolina Eye, Ear, Nose, and Throat Society will hold a joint meeting in Charleston, South Carolina, from September 13th through 16th. Headquarters will be at the Francis Marion Hotel. Invitations will be sent to specialists in Virginia, Tennessee, Georgia, and Florida. The first two days of the meeting will be devoted to ophthalmology; the last two days to otolaryngology.

Personals

Awarded Lucien Howe prize

Dr. Jonas S. Friedenwald of Baltimore, has been awarded the Lucien Howe Prize in Ophthalmology by the University of Buffalo for his basic research work in ophthalmology. The prize is awarded only when, in the opinion of the committee, a man is worthy of such recognition. It has been several years since the last award was made.

PAN-AMERICAN NOTES

Edited by M. URIBE TRONCOSO, M.D.
500 West End Avenue, New York 24

Communications should reach the editor by the 12th of the month

SYMPOSIUM ON OCULAR ONCHOCERCOSIS

The Mexican Ophthalmological Society, with the coöperation of some foreign oculists, held a symposium on onchocercosis on August 5, 1947. Guests were: Dr. Thomas R. Yanes and Dr. Miguel A. Branly of Cuba and Dr. R. Pacheco Luna of Guatemala. The papers read were: "A brief history of the Mexican Society of Ophthalmology and its journal, *Anales de Oftalmologia,*" Dr. R. A. Chavira; "History of onchocercosis, especially in Guatemala," Dr. R. Pacheco Luna; "Parasitology of onchocercosis," Dr. L. Mazotti; "Transmission of the disease," Dr. Luis Vargas; "Synthesis of the studies on the entomology of onchocercosis," Dr. I. Ochoterena; "Cutaneous lesions in the disease and frequency of blindness as a complication," Dr. L. Benitez Soto: "Histopathological examination of the affected eyes," Dr. Bertha Riveroll; "Report of a trip through the zone where the disease is prevalent," Dr. R. Nettel; "The presence of microfilaria in the human eye and the tissue changes which it produces," Dr. A. Torres Estrada; "New statistics on the frequency of onchocerosis," Dr. M. Puig Solanes.

At the conclusion of the meeting several members brought up the idea of founding a Pan-American society of tropical ophthalmology. The idea was discussed and approved, and a committee was formed to organize the society. On the committee are Dr. Pacheco Luna, Dr. Puig Solanes, and Dr. Palomino Dena.

IV PAN-AMERICAN CONGRESS OF OPHTHALMOLOGY

This congress will convene in Mexico City in January, 1952. The ophthalmological societies in Mexico sent representatives to a meeting at which the organization and preliminary work were started. A permanent committee was appointed: President, Dr. A. Torres Estrada; vice-president, Dr. M. Puig Solanes; general secretary, Dr. L. Sanchez Bulnes; treasurer, Dr. F. Palomino Dena; secretary of scientific activities, Dr. Raul A. Chavira; secretary of surgical activities, Dr. Lino Vergara Espino; secretary of organization; Dr. F. Martinez Hinojosa; secretary of propaganda, Dr. Teodulo Agundis; secretary of social activities, Dr. Daniel Silva; secretary of technical exhibits, Dr. M. Rivas Cherif; director of courses, Dr. Abelardo Zertuche. The official address of the committee is: Dr. A. Torres Estrada, Gomez Farias No. 16, Mexico, D.F.

FIRST NATIONAL CONGRESS OF OPHTHALMOLOGY IN MEXICO

This congress will convene from January 9 to 15, 1949. The committee has made the following appointments: Honorary presidents: Dr. Manuel Uribe Troncoso, Dr. Manuel Marquez, Dr. Antonio F. Alonso, Dr. Ricardo Tapia Fernandez, and Dr. Carlos Bauer; president, Dr. Lino Vergara Espino; vice-president, Dr. Raul Arturo Chavira; general secretary, Dr. M. Puig Solanes; treasurer; Dr. F. Palomino Dena; secretary of scientific activities, Dr. A. Torres Estrada; secretary of technical exhibits, Dr. M. Rivas Cherif; director of courses, Dr. Abelardo Zertuche. Addresses are as follows: Dr. Lino Vergara Espino, president, 5 de Mayo No. 40-106, Mexico, D.F., and Dr. M. Puig Solanes, general secretary, Av. Lopez Cotilla No. 811, Mexico, D.F.

PROCEEDINGS OF THE II PAN-AMERICAN CONGRESS OF OPHTHALMOLOGY

The Transactions of the II Pan-American Congress have been published in Montevideo under the editorship of Dr. A. Vazquez Varriere and Dr. R. Rodriguez Barrios. The three well-printed and illustrated volumes contain all the papers and discussions presented to the congress and also a brief history of the foundation and development of the I and II Pan-American meetings.

PERSONALS

Dr. Moacyr Alvaro, of Sao Paulo, Brazil, read a paper on "Pathogenesis of Uveitis" before the Mexican Ophthalmological Society.

Dr. David C. Cogan of Harvard University gave a series of lectures on physiopathology of the cornea in Mexico City, under the auspices of the Mexican Ophthalmological Society.

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 31 SEPTEMBER, 1948 NUMBER 9

OPTIC NEUROPATHIES: A SIMPLIFIED CLASSIFICATION AND OUTLINE FOR ETIOLOGIC DIAGNOSIS*

THE ESTELLE DOHENY EYE FOUNDATION LECTURE

ALAN C. WOODS, M.D.
Baltimore, Maryland

The confusion in the etiologic diagnosis of diseases of the optic nerve is due to two factors: first, the complexity of the subject and, second, to the fact that the subject lies in several fields—ophthalmology, neurology, and internal medicine. As a result, there has gradually been developed a welter of terms, some highly descriptive, many others highly confusing, all of which have been used both discriminantly and indiscriminantly by various authors. Many of the classifications proposed are so comprehensive and formidable that the average practitioner, confronted with a case of optic-nerve disease, scarcely knows where to begin his investigation. The diagnostic approach to the problem proposed in this paper has at least the advantage of relative simplicity and works out well in actual practice.

GENERAL CLASSIFICATION OF OPTIC-NERVE DISEASE

Primarily, from the viewpoint of etiology, diseases of the optic nerve may be divided into two general classes:

1. Degenerations of the optic nerve secondary to local ocular disease, circulatory failure, local malformations, local accidents or infections, or hereditary in basis.
2. Diseases of the optic nerve due to central nervous system disease, intracranial anomalies, systemic disease, and various intoxications.

GROUP 1

The first group lies predominantly in the field of the ophthalmologist, and requires little comment. A thorough ophthalmic examination by a competent specialist will almost invariably reveal the true nature and cause of the neuropathy. As a rule, little further investigation is required, although in some cases confirmatory evidence may be sought, and in others certain special examinations may be indicated for the exclusion of remote possible etiologic factors.

In this large group are included: (a) atrophies secondary to glaucoma and retinal degeneration (pigmentary degeneration, and so forth); (b) those associated with congenital retinal and often cerebral degeneration (Tay-Sachs's disease, juvenile cerebroretinal degeneration, familial retinal degeneration); (c) atrophies secondary to circulatory failure—embolus of central retinal artery, sclerosis of the nutrient vessels of the optic nerve (atherosclerosis, arteriolar sclerosis, vascular spasm); (d) atrophies secondary to such bony changes as oxycephaly, abnormalities of the optic foramina, fractures of the orbit; (e) neuropathies secondary to orbital conditions—hemorrhage, infections, tumors, and so forth (Leber's disease).

The one essential common denominator of this entire group is that a careful history, a

* From the Wilmer Ophthalmological Institute of The Johns Hopkins University and Hospital. Delivered at Los Angeles, December 18, 1947.

thorough ophthalmic examination including all visual and motor functions, and local or radiographic examination of the orbit will usually reveal the cause of the optic neuropathy. This group of neuropathies therefore offers no general diagnostic problem.

Group 2

The second group of optic diseases includes those associated with central nervous-system disease, intracranial anomalies, systemic disease, and intoxications of one sort or another. When the ophthalmologist is confronted with cases of this type, it becomes his duty: (1) to exclude etiologic factors belonging to the first group; (2) to analyze and to evaluate all the information obtained by the ophthalmic examination and to classify the disease as far as possible; (3) to direct the consultant services of the neurologist, internist, otolaryngologist, and radiographer along the indicated lines; and (4) in the light of all the assembled information, to arrive at the diagnosis and direct the patient to the proper channels for treatment.

Classification of an optic neuropathy

In the classification of an optic neuropathy, the initial step is to decide whether the neuropathy belongs to the primary or secondary group of optic-nerve disease. This requires a word of explanation. It is of course admitted that, in the etiologic sense, there is no such thing as a primary atrophy. The application of the words primary and secondary neuropathies refers only to the ophthalmoscopic examination. Since all diseases of the optic nerve—inflammations, degenerations, and pressure changes—will, if of sufficient severity and duration, ultimately produce either a primary or a secondary atrophy of the nerve, they may first be considered from this viewpoint. "Primary" neuropathy implies that the optic nerve shows no ophthalmoscopic evidence of present or past inflammation or pressure change. "Secondary" neuropathy implies that the optic nerve shows evidences either of present or past inflammation or pressure changes.

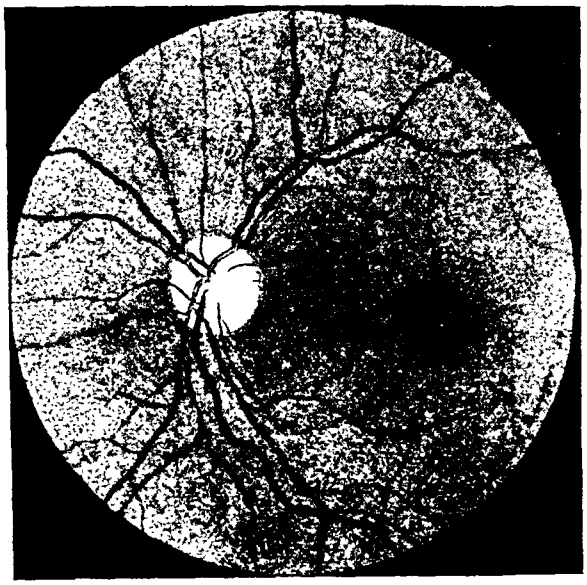


Fig. 1 (Woods). Complete primary optic atrophy.

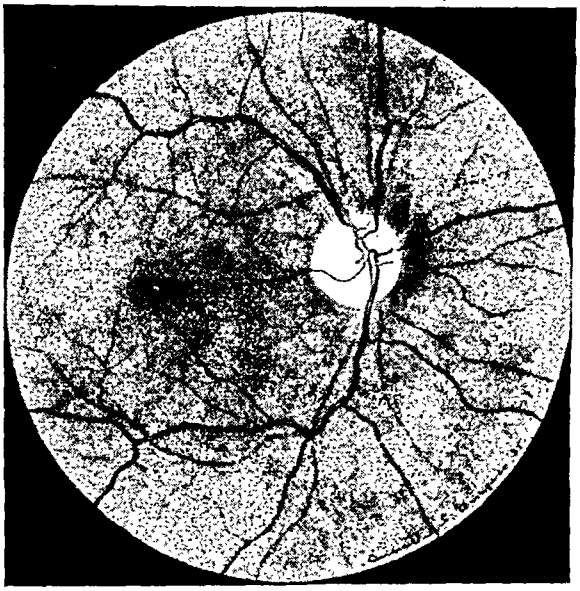


Fig. 2 (Woods). Atrophy of the papillomacular bundle.

Primary neuropathy

A primary optic atrophy may be complete (fig. 1), involving the entire nerve, or may be partial, involving the papillomacular bundle (fig. 2). The abnormality is confined to the optic nerve, the edges are normally outlined, the physiologic cup and lamina cri-

brosa are normal, there is no evidence of edema, congestion, exudation or hemorrhage, or distortion of the neuroretinal outlines. A whitish or bluish-white color, involving either the entire nerve or the temporal sector occupied by the papillomacular bundle, is the one abnormal finding. As the disease progresses, the degree of atrophy increases. Attenuation of the vessels, due to fibrosis in the nerve and up-stream traction, is a late development.

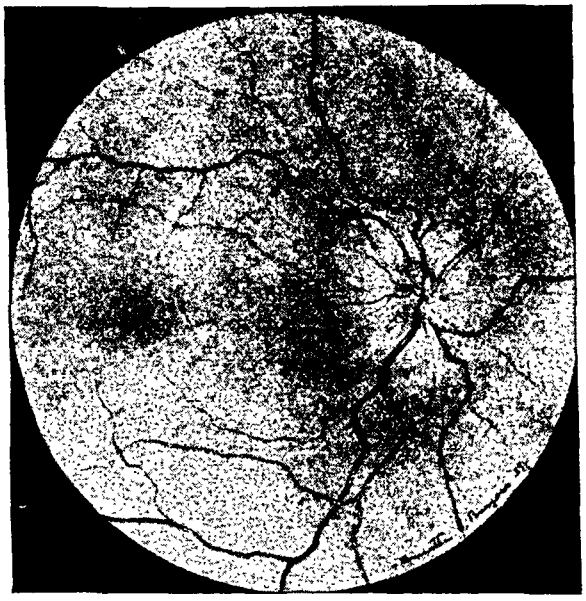


Fig. 3 (Woods). Papilledema.

Secondary neuropathy

The early picture of secondary neuropathy is edema of the nervehead (fig. 3). This may be due either to increased intracranial pressure or to actual inflammation of the nerve. The picture of early pressure changes are edema, actual elevation of the nervehead, blurring of the neuroretinal margins, loss of the physiologic cup from edema, overfilling of the veins, with bending of the vessels at the edge of the edematous papilla (fig. 4).

Hemorrhages and exudates occur later, usually in the peripheral retina, as a result of capillary stasis and local anoxemia (fig. 5). If increased intracranial pressure is established as the cause of the papilledema, the term "choked disc" is used. Actual visible

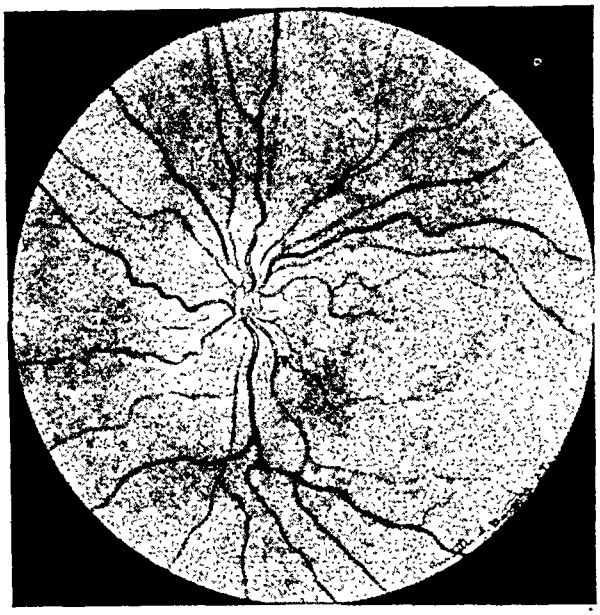


Fig. 4 (Woods). Choked disc—early.

inflammation in the nerve is termed "optic neuritis." In optic neuritis the same edema of the papilla occurs, although often of less degree than in choked disc (fig. 6). There are often other evidences of inflammation, hemorrhages and exudates usually occurring over the nervehead or in the immediately adjacent retina (fig. 7).

The final picture, ophthalmoscopically, is secondary atrophy. The disc is gray, dirty-

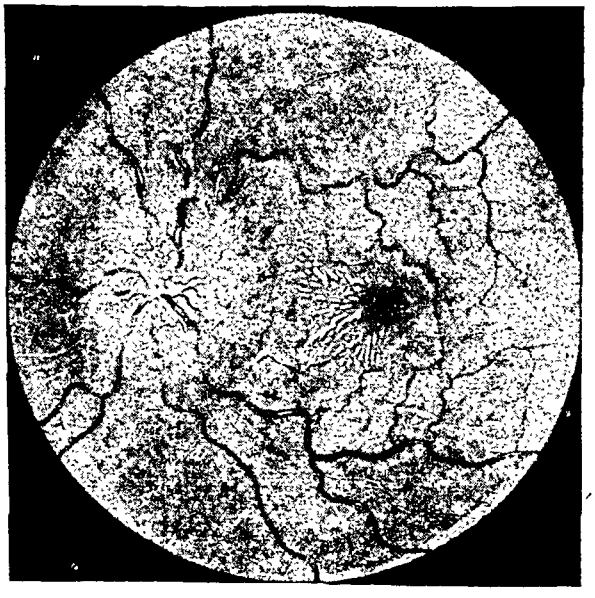


Fig. 5 (Woods). Choked disc—late with beginning secondary atrophy.

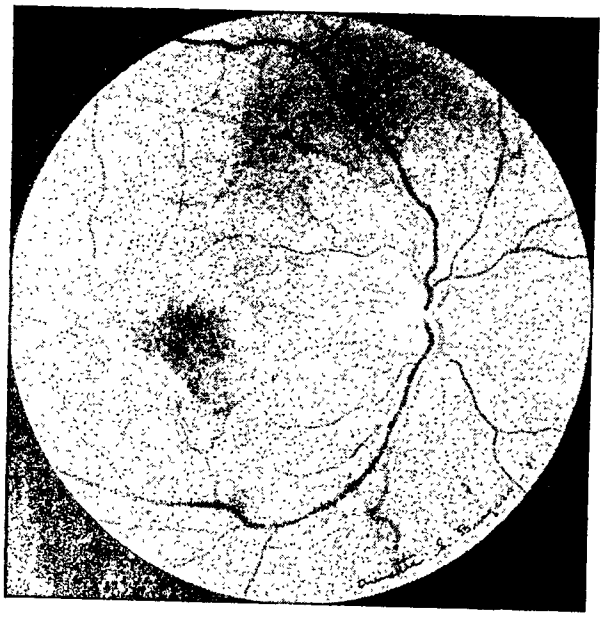


Fig. 6 (Woods). Early optic neuritis.

gray, or reddish-gray in color. The neuroretinal outlines are irregular and slightly distorted with glial tissue. The physiologic cup is lost and the lamina cribrosa is veiled with fibrous or glial tissue which often extends a short distance along the perivascular spaces of the retinal vascular bed as it emerges from the disc and fans out over the retina. This marks the extent of the former pressure or inflammatory changes (fig. 8).

Primary optic atrophy and secondary neuropathies usually arise from distinctly different etiologic factors, although, as will presently be seen, certain conditions may cause either clinical picture, depending on the location of the lesion in the nerve (retrobulbar neuritis and optic neuritis), or on the severity of the intoxication.

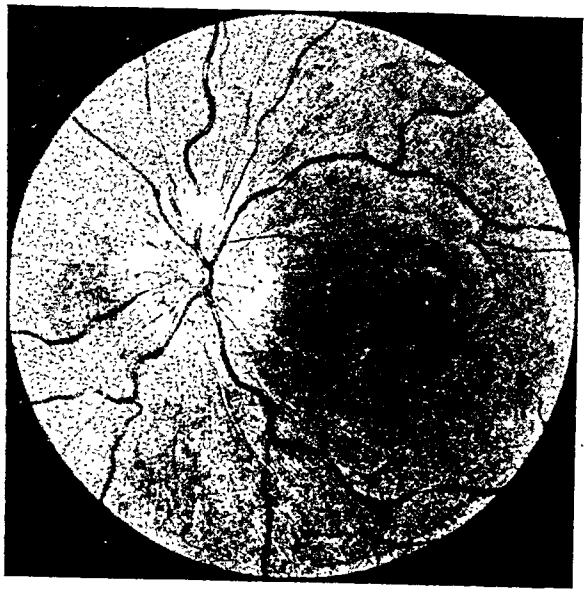


Fig. 7 (Woods). Advanced optic neuritis.

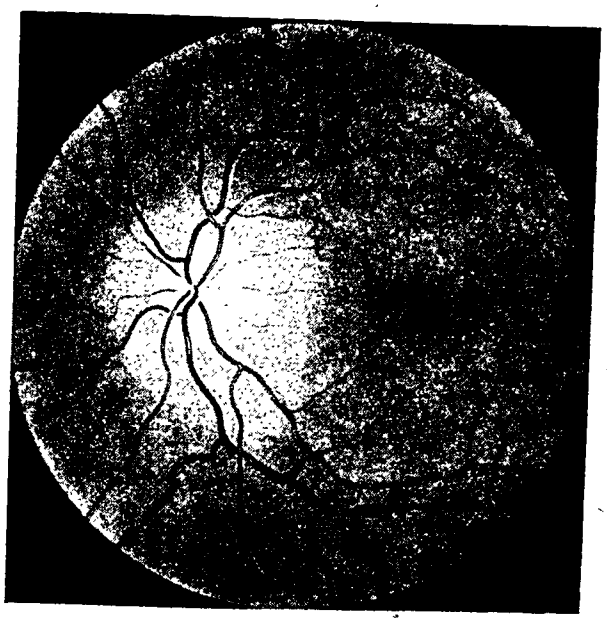


Fig. 8 (Woods). Secondary optic atrophy.

I. Primary Optic Neuropathies

Primary optic atrophy may be total, including the entire nerve in the atrophic process, or partial, including either the peripheral fibers, the papillomacular bundle, or a nerve fiber bundle. The degree of involvement depends in the main on the extent and severity of the underlying lesion, although certain etiologic factors tend to produce total nerve involvement, and other more localized lesions affect especially the papillomacular bundle. The ophthalmologist determines the degree of the nerve involvement by the appearance of the disc, the determination of the visual acuity, and by the visual field changes.

The more important causes producing primary atrophy of the optic nerve may be listed as follows:

1. Central nervous system syphilis: tabes, taboparesis
2. Breaks in the line of conduction: tumors, aneurysms, hemorrhages, trauma

3. Retrobulbar neuritis:
   a. Inflammation in the nerve posterior to the papilla
   b. Demyelinizing disease
   c. Toxic amblyopias

Central nervous system syphilis and large tumors tend ultimately to affect the entire nerve, although in early stages only the peripheral fibers or the papillomacular bundle may be involved. Small tumors and aneurysms often involve a portion of the nerve, the papillomacular bundle, or peripheral sectors. Retrobulbar neuritis usually affects only the papillomacular bundle, although if the local inflammation or the area of demyelinization is large, the entire nerve may be involved. The greater number of the toxins with a selective action of the optic nerve involve the papillomacular bundle only, the pentavalent arsenicals only affecting the peripheral fibers primarily. In massive intoxications the entire nerve may be affected by either group.

Ophthalmic examination does not, as a rule, give sufficient information to differentiate between primary atrophies due to syphilis and those due to breaks in the line of conduction. In general, if the degree of visual failure is slight and the ophthalmoscopic picture of atrophy marked, syphilitic atrophy of the nerve without involvement of the papillomacular bundle is at once suspected. Conversely, if the failure of vision is marked and the picture of atrophy slight, breaks in the line of conduction are suspected. The picture of sharp visual failure, central scotoma, and a normal optic nerve is of course diagnostic of retrobulbar neuritis.

1. Central nervous system syphilis

The primary optic atrophy of syphilis has certain peculiarities. Primarily, in the overwhelming majority of cases, it is associated with a single form of the disease, tabes or taboparesis. It rarely, if ever, occurs in pure paresis. The peculiarities which differentiate it from other forms of syphilis are:

a. Long incubation period
b. The extraordinary selectivity for certain parts of the brain and spinal cord
c. The relative refactoriness to treatment
d. The low reagin content of the blood serum and spinal fluid—the tendency to negative serology
e. The relative paucity or absence of T. pallida in the lesions

The pathogenesis of the primary atrophy of syphilis has long been a problem both to syphilologists and ophthalmologists. Various theories have been proposed. These fall in three general groups.

The first set assumes that the atrophy is due to some form of circulatory failure of the nutrient vessels of the nerve, assumed by some to be related to a disturbance between the retinal and systemic blood pressure. Suffice to say there is no scintilla of evidence in favor of such theories, and there is a wealth of established evidence against them.

The second group of theories attributes the atrophy to adhesions around the chiasm involving the optic nerves—the so-called adhesive chiasmoarachnoiditis. While this condition does occasionally exist, as testified by reputable and trustworthy neurosurgeons, nevertheless it is rarely found in central nervous-system syphilis and when present usually produces a picture midway between primary and secondary atrophy. There is no evidence that it is the cause of the optic atrophy of tabes.

The third group of theories is based on certain experimental evidence and attributes the atrophy to a combination of central nervous-system syphilis and vitamin deficiency, involving both vitamin A and the B-complex. This evidence, which has been fully presented elsewhere, is highly intriguing, fits most of the known facts, and may ultimately be proved to be either the underlying cause or closely related to it. About all we can say at present is that the riddle of syphilitic primary optic atrophy is probably the riddle of tabes itself.

There is much misconception about the

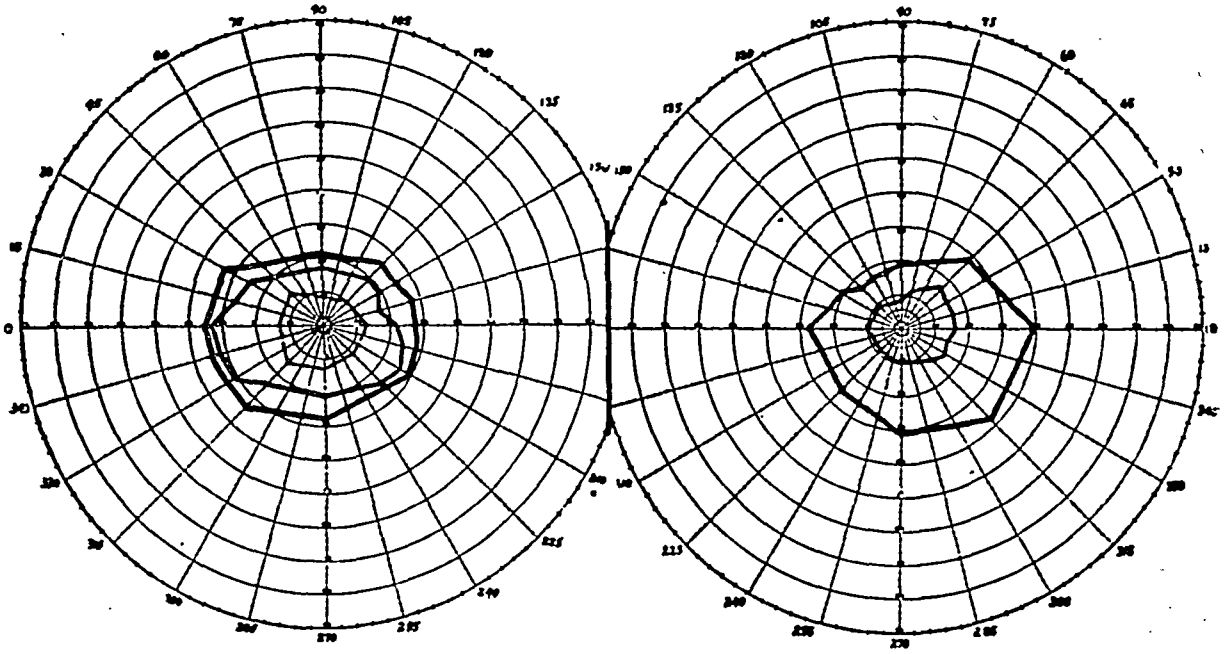


Fig. 9 (Woods). Concentric contraction of visual fields in syphilitic primary optic atrophy.

involvement of the optic nerve in tabes and the resultant visual-field changes. It was formerly supposed that the peripheral fibers were as a rule first involved, and the papillomacular bundle much later, Uthof reporting central scotomas in only two percent of the cases.

This question has been recently investigated and it was found that the visual fields in this group of patients fell into four general classes. These are:

1. Concentric constriction of the field, late loss of vision, occurring in 12.5 percent of the cases (fig. 9).

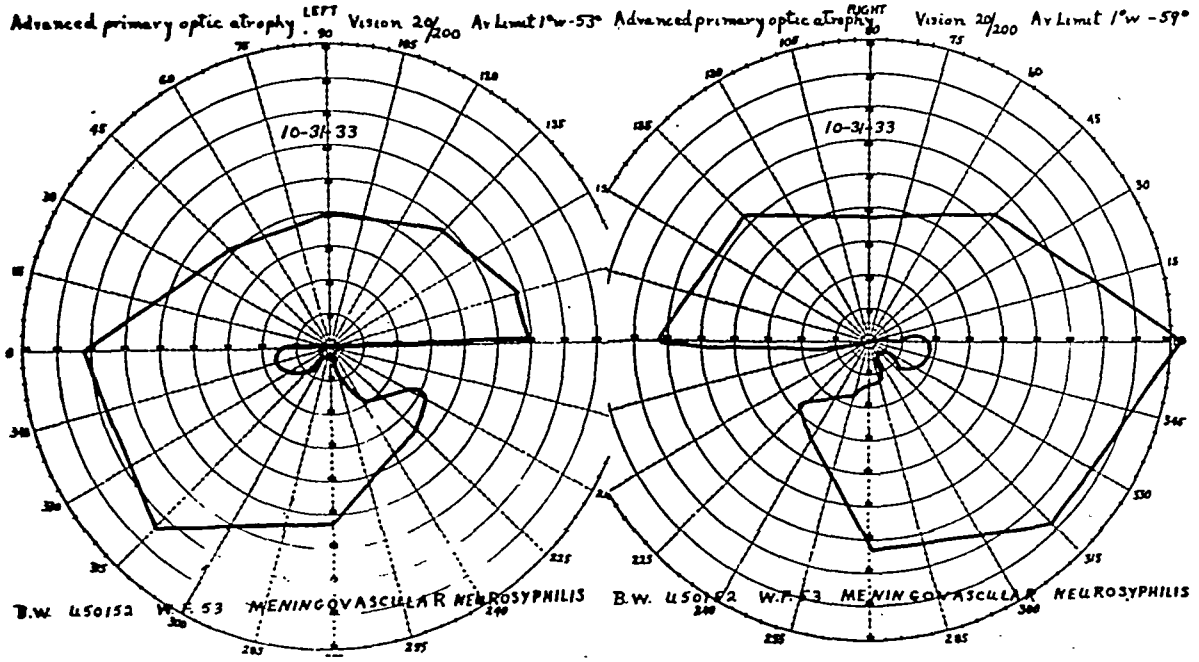


Fig. 10 (Woods). Sector defects in syphilitic primary optic atrophy.

2. Sectorlike defects, due to nerve-bundle involvement. The loss of vision in these cases might be early or late, depending on the involvement of the papillomacular bundle. This type of field occurred in 34 percent of the cases (fig. 10).
3. Central, or cecocentral, scotomas, with normal peripheral fields and early loss of vision. This was present in 14 percent of the cases (fig. 11).
4. Central or cecocentral scotomas, associated with changes in the peripheral fields, and early failure of vision, occurring in 40 percent of the cases (fig. 12). Thus, in the series as a whole, 54 percent of the patients had central or cecocentral scotomas with early failure of vision.

Course. The course of syphilitic primary atrophy has been the subject of several studies. Whether the visual failure be early or late, the course is the same. Untreated cases progress to total blindness in from 7 to 9 years, with atrophy of the entire nerve and loss of all light perception (fig. 13).

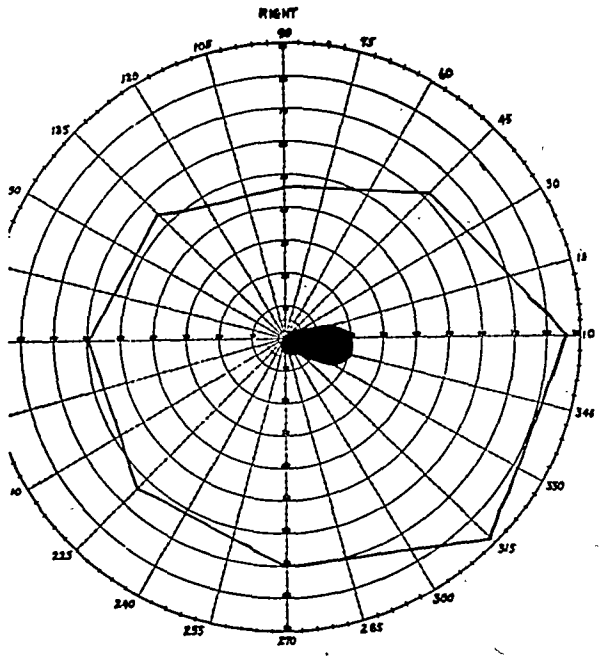


Fig. 11 (Woods). Central and cecocentral scotomas in syphilitic primary optic atrophy.

Treatment. It is traditional that the treatment of syphilitic primary optic atrophy has always been regarded with extreme pessimism by both syphilologists and ophthalmologists. This pessimism is, however, unjustified.

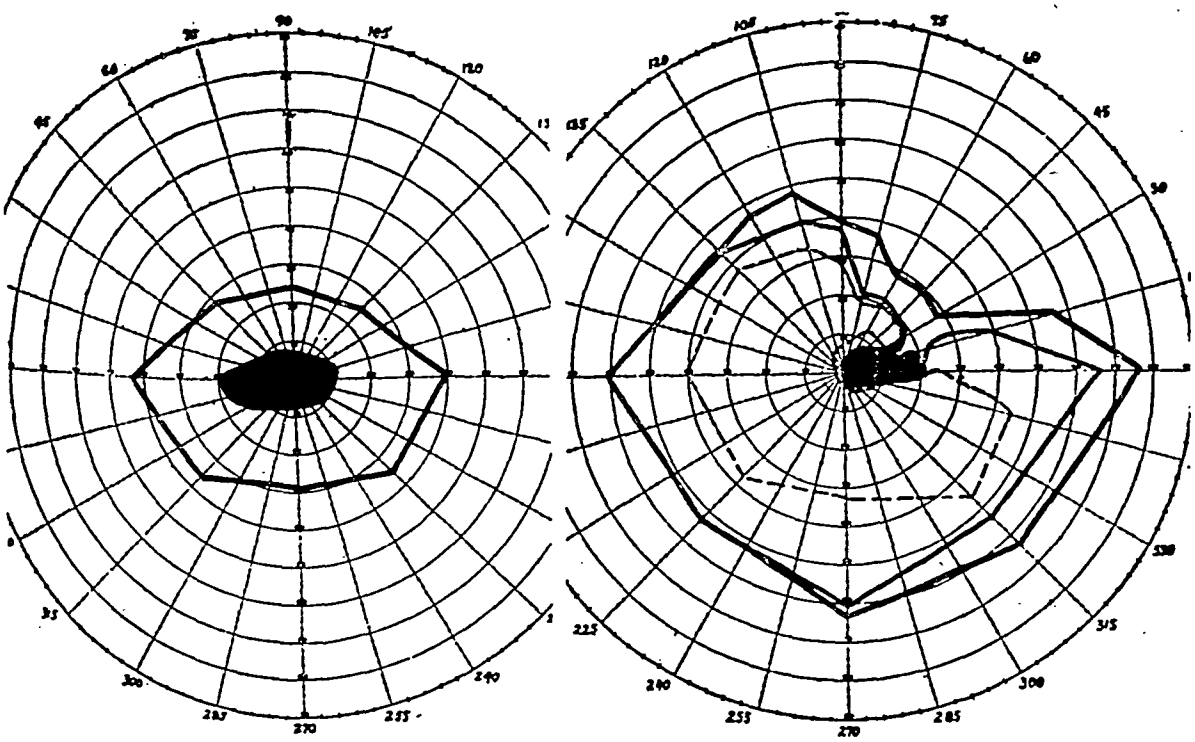


Fig. 12 (Woods). Central scotomas with peripheral field changes in syphilitic primary optic atrophy.

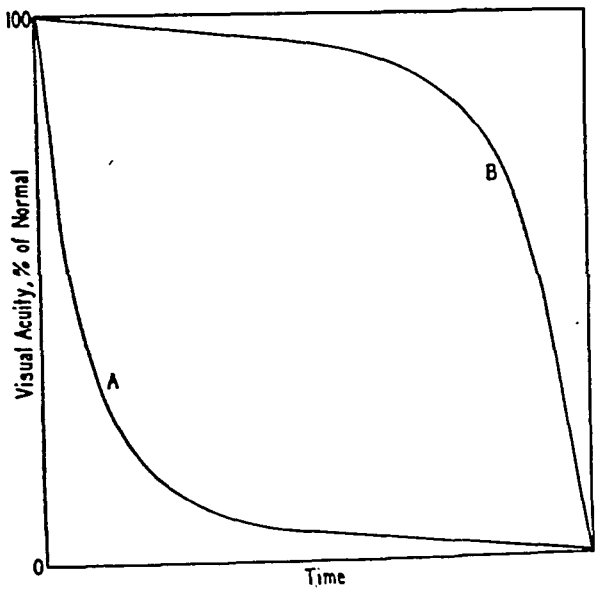


Fig. 13 (Woods). Course of syphilitic primary optic atrophy. Hypothetical curves showing rate of loss of central visual acuity in (A) patients with central and cecocentral scotomas and (B) patients with peripheral constriction of the visual fields only.

No one yet knows what will be the effect of the early treatment of syphilis by penicillin on the later development of primary optic atrophy and tabes. There is some evidence that penicillin is of value in arresting primary optic atrophy, although the results are not uniform. Klauder concludes that since "penicillin does not uniformly benefit the optic atrophy of all patients, the wisdom of its exclusive use in treating the disease is questionable."

The effect of malaria treatment is known. Our earlier experiences with this have already been reported, and our later experiences confirm our first impressions. With this form of treatment only 14 percent of the patients treated lost their vision in the first two years. Thereafter the curve flattened out and 86 percent of the patients retained their remaining vision, of whatever degree it might be (fig. 14).

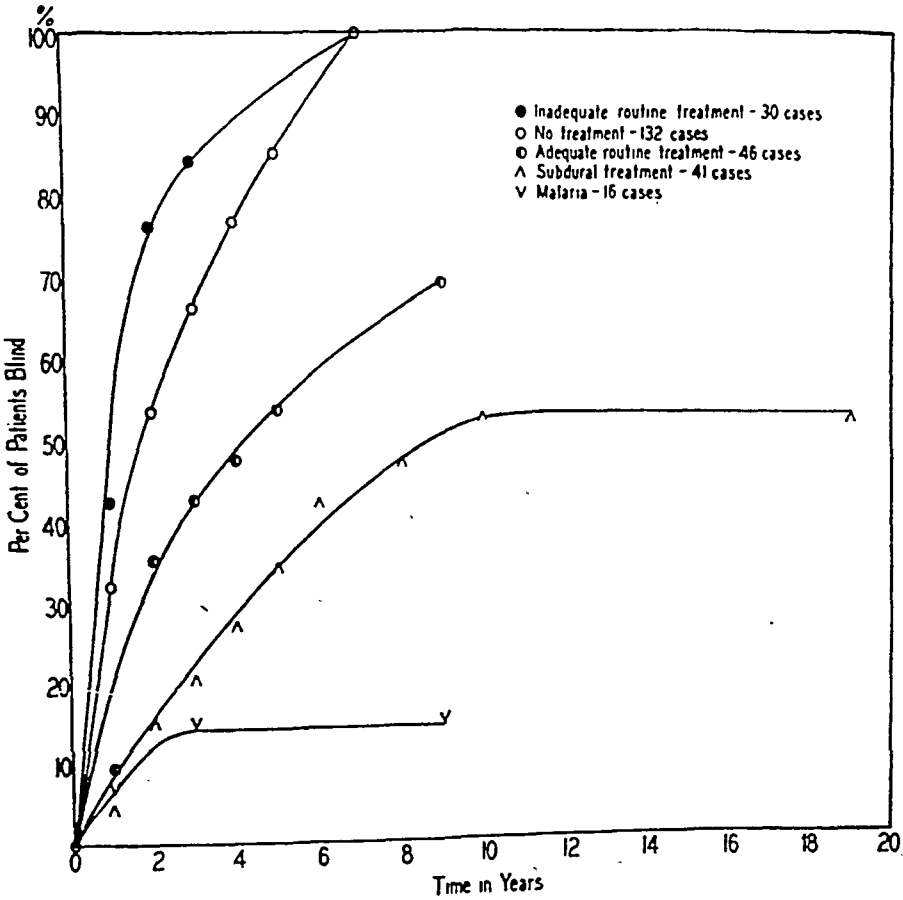


Fig. 14 (Woods). Results of treatment of syphilitic primary optic atrophy.

In his recent book on *Penicillin in Syphilis,* Moore recommends the combination of penicillin and malaria treatment, believing that this form of treatment, capable of completion in about five weeks, may give as satisfactory lasting results as malaria alone followed by prolonged chemotherapy.

2. BREAKS IN THE LINE OF CONDUCTION

By atrophies due to breaks in the line of conduction is implied mechanical pressure on the optic nerves either anterior to the chiasm or in the neighborhood of the chiasm, which produce either total or partial primary atrophy of the optic nerves. The most frequent conditions in this category are:

a. Prechiasmal tumors
b. Pituitary tumors
c. Suprasellar tumors (chiasmal syndrome—Cushing's syndrome)
d. Sclerosis of vessels impinging on the chiasm

Prechiasmal tumors. Nothing can be more difficult than the preoperative diagnosis of these tumors. The optic atrophy is usually unequal and of slow development; the visual-field changes are bizarre and unpredictable. Prechiasmal tumors should be suspected only when no other cause for the atrophy can be found and when the field changes are unequal and bizarre. The actual diagnosis can only be made by exploratory craniotomy by the transfrontal route and direct examination of the optic nerves. The usual prechiasmal tumors are meningiomas, dural endotheliomas, and olfactory-groove tumors. They frequently undergo psammoma body changes.

Pituitary tumors. The classic picture of pituitary tumors is destruction of the bony walls of the sella, bilateral primary optic atrophy, bitemporal hemianopia, and radiographic changes in the sella. The older literature occasionally states that the primary optic atrophy secondary to pituitary tumors has a faint yellowish tinge. This is probably incorrect. In appearance the atrophy from pituitary tumors is indistinguishable from

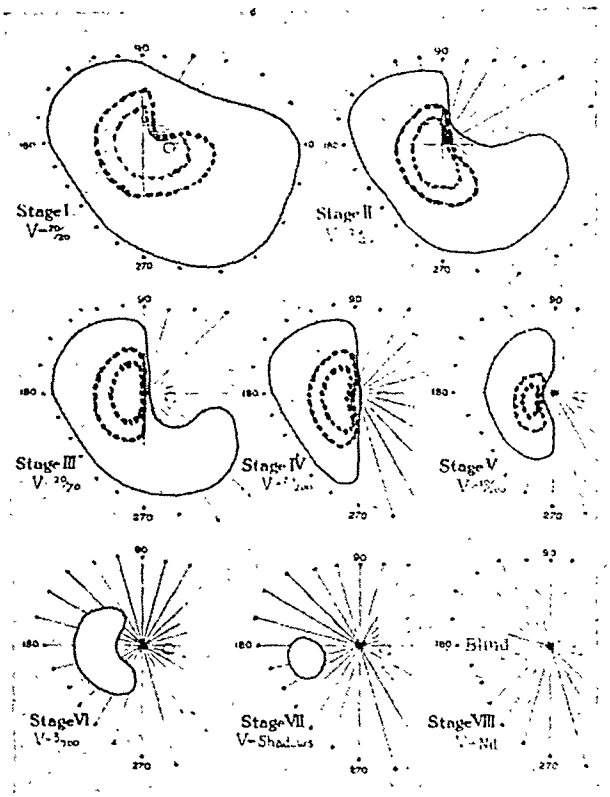


Fig. 15 (Woods). Visual fields in pituitary tumors. (From Cushing and Walker.)

other forms of primary optic atrophy. It should be emphasized that pituitary tumors rarely if ever cause choked disc or papilledema. Hypothetically, this could only occur if the tumor is so placed and of such size that it blocks off the entire intravaginal space.

Despite the volumes which have been written on pituitary tumors, practically nothing has been added to the visual-field studies since the classic paper of Cushing and Walker. These authors divided the perimetric changes into eight grades, from the upper bitemporal slant to total blindness (fig. 15). They emphasized the early loss of the upper temporal color fields, the development of a complete bitemporal hemianopia with involvement of the papillomacular bundle, the gradual limitation of the white fields to the lower nasal quadrants, and the ultimate blindness if the pressure on the nerves was not relieved. Up to and including Stage 4, the condition was reversible, and improvement in the fields and vision might be ex-

pected to follow successful operation.

One additional point should be stressed. In a small percentage of cases, the chiasm is prefixed; that is, instead of lying above and slightly posterior to the sella, the chiasm lies somewhat anteriorly. In such cases an enlarging pituitary might not press on the lower nasal aspects of the optic nerves or on the anterior chiasm but on the posterior portion of the chiasm. Here it might first impinge on the crossed macular fibers and so produce a central scotoma as the cardinal symptom, mimicking the picture of a suprasellar tumor. These cases are rare, but they do occur.

The suprasellar meningiomas tend to press on the lower posterior surface of the chiasm, where the crossed nasal fibers lie, thus producing a bitemporal hemianopia.

Adenomas of the pituitary stalk and Rathke's pouch tumors usually press on the posterior lip of the chiasm where they impinge on the crossed macular fibers and so cause a central scotoma. Since there is some intermingling of the lower nasal fibers in the posterior chiasm, they may also produce more or less associated bitemporal hemianopia. Since they all lie centrally, they do not involve any of the nerves going to the extraocular muscles.

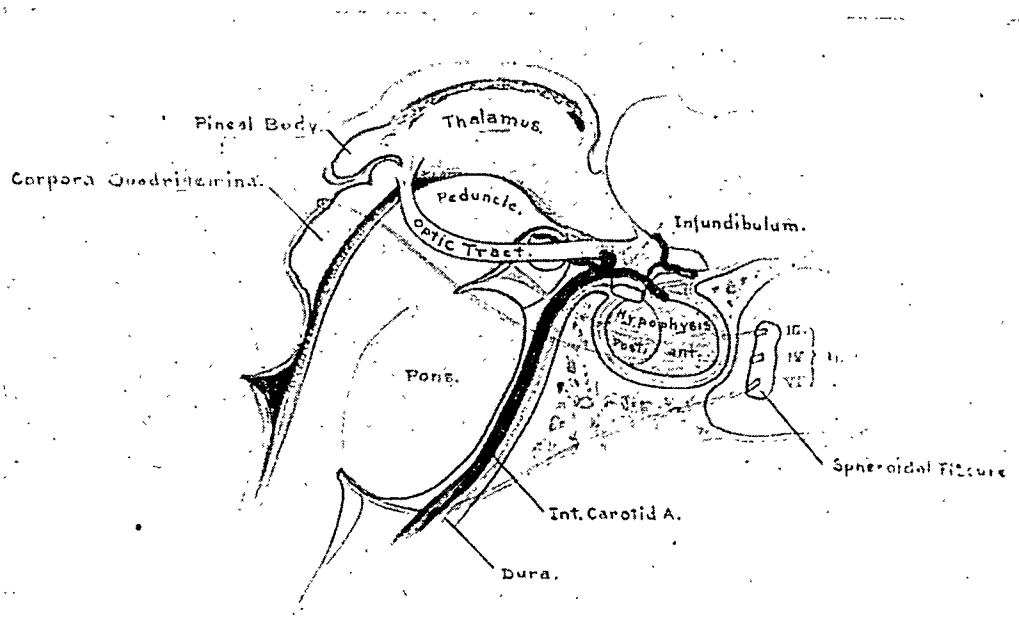


Fig. 16 (Woods). Diagram of relations at chiasm.

Chiasmal syndrome. The chiasmal syndrome is primary atrophy of the optic nerves, or the picture of retrobulbar neuritis, with bitemporal hemianopia or central scotoma and no radiographic evidence of destruction of the sella.

The most frequent tumors causing this syndrome are suprasellar meningiomas, adenomas of the pituitary stalk, craniopharyngiomas (Rathke's pouch tumors), and aneurysms of the anterior portion of the circle of Willis.

Aneurysms of the circle of Willis produce visual-field changes according to their location. The most frequent picture is a central scotoma due to pressure in the papillomacular bundle fibers. Since they lie laterally, they often involve the third cranial nerve.

The actual diagnosis of these tumors is made on the presence of the chiasmal syndrome and exploratory craniotomy. Unfortunately, X-ray examination and ventriculography are of little or no assistance, although at times in the Rathke's pouch tumors the

areas of calcified and keratinized epithelium cast definite shadows in the roentgenograms.

Sclerosis of the vessels, especially the carotids, impinging on the chiasm may produce a primary optic atrophy simulating the so-called "soft glaucoma," with visual-field changes affecting primarily the nasal fields. In his 1916 Bowman lecture, de Schweinitz called attention to the various vascular anomalies which might occur around the circle of Willis, and pointed out how sclerotic vessels might impinge either on the chiasm, the tracts, or the optic nerves and produce bizarre and unusual field changes.

While such changes, binasal hemianopias and bizarre field changes associated with primary optic atrophy, are somewhat rare, in all such cases where no other obvious explanation is present, sclerotic changes in the carotids of the circle of Willis should be considered.

Especially suggestive of pressure changes from sclerosis or aneurysms of the circle of Willis are the altitudinal or unilateral quadratic hemianopias. This is readily understood when one recalls Walker's description of the position of the vessels in relation to the optic neuropathways; the anterior cerebrals passing "over the toes" of the optic nerves, while the posterior communicating pass "under the heels" of the tracts (fig. 16).

The pressure changes from anterior cerebral vessels would produce inferior or altitudinal hemianopia, which might be unilateral if only one nerve is affected. Pressure from the posterior communicating would produce a superior hemianopia, and if only on one side, a quadratic superior defect.

3. Retrobulbar neuritis

Retrobulbar neuritis implies a pathologic process in the optic nerve so far posterior to the papilla that not until a descending atrophy becomes evident at the nervehead is any ophthalmoscopic change evident. Thus in the early stage, Parsons' definition "that neither the patient or the doctor sees anything" is singularly apt.

In general, all the various conditions which cause inflammatory changes at the papilla may likewise cause a retrobulbar neuritis—the essential question is whether the lesion in the nerve is anterior to the lamina so the inflammatory changes are visible, or so well posterior to it that there is no ophthalmoscopic change. However, there are certain conditions which usually produce the clinical picture of retrobulbar neuritis, and others which usually produce the picture of optic neuritis, with visible swelling and inflammation at the nervehead.

The clinical picture of retrobulbar neuritis is as follows:

a. Failure of vision
   1. Acute—sudden loss of central vision
   2. Gradual loss of central vision with fluctuations
b. Ophthalmoscopic picture
   1. Early stages—clear media and normal fundus
   2. Late stages—clear media, atrophy of temporal sector of disc
c. Visual fields
   1. Normal outlines for white and color
   2. Central scotoma varying from relative to absolute white

The more frequent causes of retrobulbar neuritis may be grouped as follows:

1. Intracranial lesions—suprasellar tumors, and so forth
2. Direct involvement of nerve from infections of posterior ethmoids and sphenoids
3. Demyelinizing disease—usually multiple sclerosis
4. Endogenous toxins—diabetes (avitaminosis) and alcohol-tobacco amblyopia
5. Toxic amblyopias

The intracranial lesions, suprasellar tumors, aneurysms of the circle of Willis have already been discussed.

Posterior nasal infection. Retrobulbar neuritis from infection of the posterior nasal sinuses was formerly a fashionable diagnosis. At present it has fallen into disrepute,

and its clinical entity is seriously questioned. While giving full credence to the various clinical studies which have thus cast doubt on it as an actual clinical entity, nevertheless there do appear to be occasional cases of retrobulbar neuritis secondary to infection of the posterior nasal sinuses. Quite probably the changes in the optic nerve are pressure changes only rather than actual infection. Certainly, however, clinical experience indicates that posterior nasal infection must be considered in the search for the etiologic factor in retrobulbar neuritis.

Demyelinizing disease presents a unique problem. The various recognized demyelinizing processes: disseminated sclerosis, acute disseminated encephalomyelitis, neuromyelitis optica, and Schilder's disease of diffuse periaxial encephalitis, may all affect the optic nerve, producing either a retrobulbar neuritis or an actual optic neuritis, according to the location of the lesion. Nevertheless, disseminated or multiple sclerosis usually causes the clinical picture of retrobulbar neuritis while the other demyelinizing diseases tend to give a visible optic neuritis.

It is well recognized that the early retrobulbar neuritis of multiple sclerosis may precede by years the other characteristic changes of the disease, the loss of the abdominal and cremasteric reflexes, the scanning speech, the nystagmus, the ataxia, and other evidences of central nervous-system involvement.

Ophthalmologists are therefore confronted with a group of cases of early retrobulbar neuritis, the attacks beginning with periodic blurring of central vision, the only positive finding being a fluctuating, gradually intensifying central scotoma. There are long remissions between the attacks, which gradually become more severe.

No other etiologic factor can be discovered or suspected; the early neurologic examination is negative; laboratory tests show nothing. Only after several years do the development of the other neurologic manifestations of the disease cement the diagnosis. Few cases can be more exasperating, and all too frequently these patients are subjected to exploratory craniotomies and drainage of the posterior nasal sinuses. No blame can be directed to the ophthalmologist, the neurologist, the neurosurgeon, or the otolaryngologist for such mistakes. The intrinsic baffling nature of the disease is responsible, and until some more accurate method of early diagnosis is developed, such mistakes will continue to be made in the best clinics.

Endogenous toxins. The retrobulbar neuritis from endogenous toxins is interesting. For a long time tobacco-alcohol amblyopia has been recognized as a clinical entity, with the peculiar dumb-bell scotomas involving the blindspot. It has also been recognized that individuals with some debilitating disease, especially diabetes, are especially prone to this type of amblyopia. Only in recent years has it been recognized that the underlying cause is an avitaminosis involving the B-complex, especially thiamine chloride. Fortunately, a form of therapy other than total abstinence is thus afforded sufferers with this unfortunate condition.

The toxic amblyopias affect vision in difference ways. The majority of the known poisons which act on the optic nerve affect primarily the papillomacular bundle. Chief of these are methyl alcohol, carbon disulphide, lead, iodine, thallium, aspidium, salicylates, and aniline dyes.

Methyl alcohol in the commercial form is a universal poison. The others usually produce symptoms only in certain individuals, after varying degrees of exposure.

Quinine amblyopia, on the other hand, results from degeneration of the ganglion cells of the fovea, in individuals with an idiosyncrasy, with resultant ascending atrophy of the papillomacular bundle.

Most important of these especially selective drugs are the pentavalent arsenicals, especially tryparsamide. These arsenicals act first on the peripheral fibers of the optic nerve sparing the papillomacular bundle until the last stages of intoxication. The visual

fields are characteristic with marked constriction above and below (fig. 17). Again, only a small percentage of the population appear susceptible to the toxic action of tryparsamide, and in these, if the field changes are detected early and the drug stopped, central vision can be saved. If, however, the drug is continued and the early visual symptoms ignored, total blindness inevitably results.

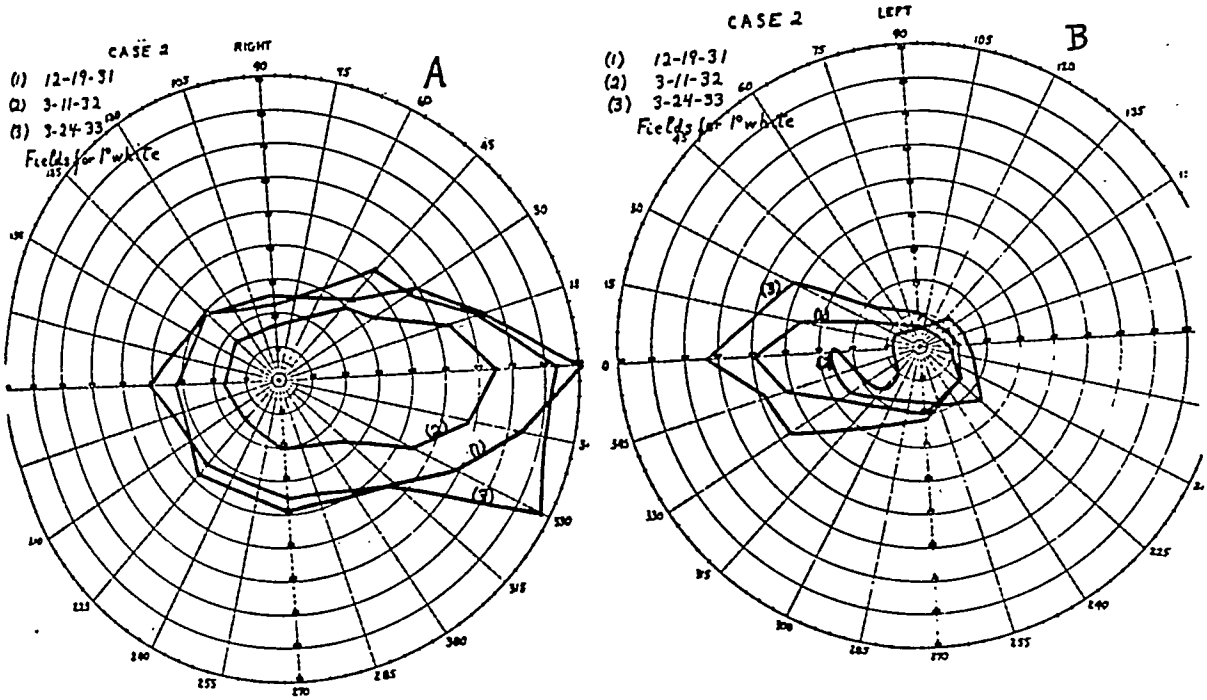


Fig. 17 (Woods). Visual fields in tryparsamide poisoning.

In any event, the usual end-picture of retrobulbar neuritis, unless the cause is early determined and removed when possible, is the same—temporal pallor of the optic nerve from papillomacular-bundle atrophy, with an absolute central scotoma and greatly reduced central vision.

II. Secondary Optic Neuropathies

Optic neuritis and choked disc—two distinct conditions—both produce the same end-picture of secondary optic atrophy. If the patient is encountered in the early stages of papilledema, every effort must be made to differentiate between optic neuritis and choked disc. If the patient is encountered in the final stage of secondary atrophy, the possibility of either primary condition must be considered.

In general, in optic neuritis the inflammatory symptoms are more marked; there is a greater tendency to hemorrhages and exudates over the disc; there is a greater tendency for the inflammatory process to extend out over the immediately adjacent retina; the actual elevation of the disc is usually moderate, usually two diopters or less; and the visual loss may be either slight, if only the peripheral fibers are involved, or severe if the papillomacular bundle is involved.

In the early stages of choked disc which is, by definition, the ophthalmoscopic evidence of increased intracranial pressure, the edema is first manifested at the upper and lower poles of the disc, where the fibers supplying the upper and lower retina are crowded together (fig. 18). In the latter stages, the elevation of the disc becomes high, the physiologic cup is lost, the veins become engorged, edema vesicles form beneath the internal limiting membrane of the retina in the macular area (fig. 19), and ultimately there is a

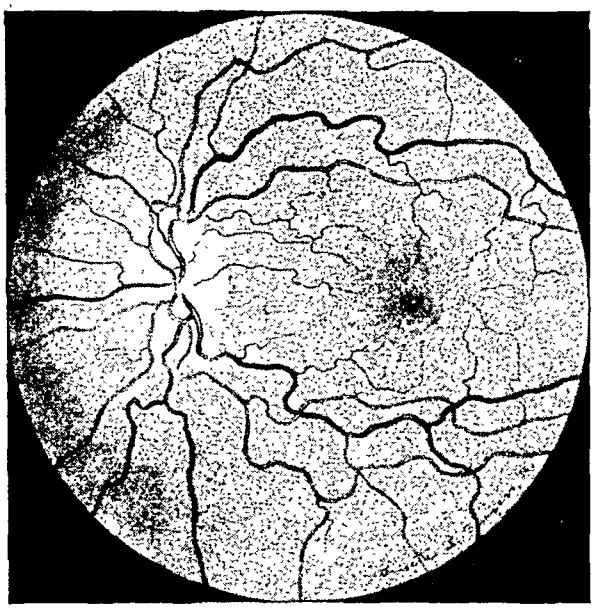


Fig. 18 (Woods). Early choked disc.

full macular figure, with areas of degenerated nerve fibers and hemorrhage, the result of prolonged anoxemia and capillary stasis (fig. 20). While the edema alone may spread out a short distance into the adjacent retina, the maximum elevation is over the papilla itself. The actual elevation of the disc is usually high, often up to 4 to 6 diopters. The visual loss in the early stages, even with high degrees of swelling, may be minimal. Indeed, it is amazing how long the optic-nerve fibers can stand high degrees of pressure from edema alone without atrophy.

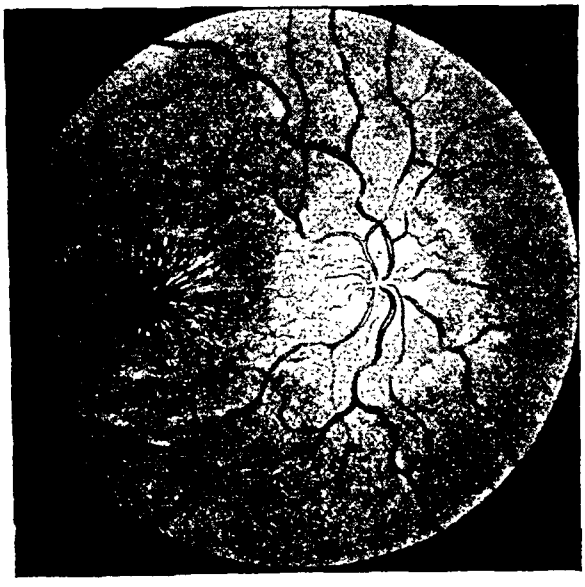


Fig. 19 (Woods). Moderately advanced choked disc.

These are the general criteria which guide the ophthalmologist in the differentiation of optic neuritis and choked disc. Admittedly, in many cases, the differentiation is presumptive, and in other cases, cannot be made at all. When this is the situation, the etiologic study must proceed upon both presumptions until the actual underlying cause of the papilledema is established.

Optic neuritis is commonly found in the following conditions, excluding such orbital

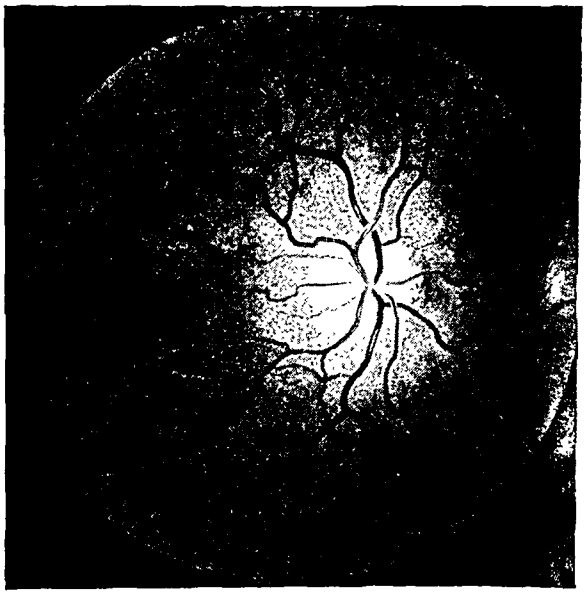


Fig. 20 (Woods). Advanced choked disc.

conditions as infections, periostitis, and so forth:

1. Intracranial infections
2. Acute febrile disease
3. Severe toxic amblyopias—especially methyl alcohol
4. Early syphilis
5. Demyelinizing disease—especially neuromyelitis optica
6. Tuberculosis of the sheaths of the optic nerve—(a hematogenous infection or extension of a tuberculous meningitis)

Few of the conditions require special comment. The optic neuritis complicating a meningitis is obviously the result of direct

extension of the inflammation to the sheaths of the nerve. The optic neuritis of acute febrile disease is an expression of a general toxemia. In severe methyl-alcohol poisoning, with a manifest optic neuritis, the symptoms of systemic intoxication are so marked there is no doubt of the diagnosis. The most interesting conditions in this category are the optic-nerve inflammations of early syphilis, neuromyelitis optica, and tuberculosis.

Early syphilis. The incidence of actual optic neuritis in early syphilis is unknown. The Coöperative Clinical Group reported optic-nerve changes in 11 percent of 3,244 patients with early syphilis, the changes varying from simple hyperemia of the nerve up to an outspoken neuritis.

The one amazing thing about the optic neuritis of early syphilis is how intense the optic neuritis may be without provoking any marked visual symptoms. For this reason it is often detected only as a result of a thorough physical examination. If only the peripheral fibers are involved, as is often the case, there may be no visual changes other than a slight peripheral constriction of the field. If the papillomacular bundle is involved, which is frequent, the visual failure will of course be marked.

Irrespective of the degree of early visual failure, the general rule is that the patients recover from the optic neuritis of early syphilis with little or no loss of vision; some irregularity of the neuroretinal outlines and gliosis over the cup being the only ophthalmoscopic residua. Only in extremely severe cases does secondary optic atrophy and serious impairment of vision result.

Neuromyelitis optica presents a distinct problem, much like that of multiple sclerosis. Indeed the similarity is such that neuromyelitis optica is considered by some to be an acute disseminated sclerosis, although various clinical and histologic differences have been pointed out (Walsh).

Essentially, the disease is a spotty demyelinizing disease with scattered lesions throughout the gray matter especially, with a marked tendency to affect the optic nerves and the spinal cord. In the classic form, the picture is optic neuritis with loss of vision, and a preceding, concomitant, or following paraplegia. In the early stages, there is orbital pain and in the cases with paraplegia often severe root pain. At the onset there is usually a mild fever and pleocytosis of the spinal fluid. The tendency is to recovery both of vision and limb function, although some patients are permanently blind, and some die.

Thus, in the classic form of the disease there is no diagnostic problem. However, there are an appreciable number of cases that show only the eye signs, orbital pain, especially on movement of the eyes, followed by the development of low-grade papilledema without marked evidences of hemorrhage or exudation, loss of vision, usually a central scotoma and sector defects from nerve-bundle involvement, and only minimal evidences of spinal irritation or associated systemic reaction. The disease may be unilateral or bilateral. The most profound investigation reveals no other cause for the optic neuritis.

Gradually, over a period of weeks, the patients slowly recover, without the later development of the expected paraplegia. How these cases are classified—as acute disseminated sclerosis or neuromyelitis optica or by some other name—is an academic question. The essential thing is to realize these cases are a definite clinical entity and recurrences may follow, even years after apparent total recovery.

Tuberculosis is a rare cause of optic neuritis. When it does occur, it is the result either of an extension of the tuberculosis process along the sheaths of the nerve, and into the nerve itself along the pial septa, or the result of a tuberculous periphlebitis of the central retinal vein. In either case the process is destructive. Secondary glaucoma usually results from thrombosis of the posterior veins, and destruction of the optic nerve with secondary atrophy follows. Fortunately the condition is rare and the patients usually die from the concurrent infection.

Comment. These are the main causes of optic neuritis. It may also occur in a variety of rarer conditions, some fungus infections, encephalitis of various causes, Friedreich's ataxia, systemic allergic reactions, Pick's disease, and so forth. These are, however, rare occurrences, and usually present no diagnostic problem.

If optic neuritis is excluded by ophthalmic and clinical examination, the diagnosis of the papilledema as a choked disc is justified. Choked disc must be regarded as the ophthalmoscopic evidence of increased intracranial pressure, and the clinical investigation of the patient extended to establish and determine the course of such pressure.

Examination. The immediate examinations are full perimetric studies and examination of the extraocular muscles to determine any present or latent paralyses. A complete neurologic examination is then indicated to detect any associated neurologic changes. This should be followed by lateral stereoroentgenograms of the skull to detect any pressure changes or abnormal shadows. Lastly comes the serologic examination, cell count, and manometric pressure reading of the spinal fluid. The one caution to be remembered in relation to the spinal puncture is that, in high degrees of choked disc, care should be exercised in the release of spinal fluid pressure, on account of the danger of damage to the brain stem at the foramen magnum.

Diagnosis. On the basis of this ophthalmic and neurologic information, the diagnosis can usually be made between intracranial tumor, which accounts for approximately 75 percent of all choked discs; central nervous system syphilis, which accounts for probably 10 to 15 percent of the cases; and the various other rarer causes (pseudotumor, brain abscess, hydrocephalus, subdural hemorrhage, meningitis, and so forth), which account for the remaining 10 or 15 percent of the cases.

If brain tumor is the underlying cause, a knowledge of the various syndromes caused by tumors at various intracranial levels may greatly help to localize the lesions. These various syndromes have been outlined elsewhere.* They are the pituitary syndrome, the chiasmal syndrome, the Foster-Kennedy syndrome for frontal-lobe tumors, the indefinite changes produced by parietal-lobe tumors, the often more precise changes which accompany temporal-lobe tumors, the characteristic pineal-gland syndrome, the well-known occipital and angle syndromes, and the exact changes produced by tumors at various levels of the brain stem—the so-called Benedikt's, Weber's, Nothnagel's, de Raymond's, Millard-Gubler, and Foville's syndromes. However, only in a limited number of cases, especially those of the chiasmal area, can an exact location be made by the ophthalmic, neurologic, and radiographic examinations. Ventriculography is, of course, the final resource in cerebral localization.

There remains one perplexing class of cases to mention briefly. These are the cases of pseudopapilledema and pseudoneuritis.

Pseudopapilledema occurs usually in hyperopic individuals. The disc margins are blurred, the physiologic cup indistinct, and at times the veins may appear overfilled. The absence of symptoms and the usual presence of hyperopia should put the ophthalmologist on guard. Examination with the binocular ophthalmoscope reveals there is usually no actual elevation of the papilla. There are, however, a few such cases in which the disc may be slightly elevated and still the most exhaustive investigation reveals no organic lesion, the ophthalmoloscopic picture remains unchanged over years of observation, and the patients develop no symptoms. The condition has been attributed to narrowing of the porus opticus.

Pseudoneuritis optica is a somewhat similar picture, but in addition there is usually glial tissue over the disc, and it may resemble a secondary atrophy in color. The condition is due to excessive formation or

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*Woods, A. C.: Ocular manifestations of intracranial tumors. South. Surgeon, 5:91-114, 1936.

defective atrophy of the tissue which formed Bergmeister's papilla and the hyaloid system. A careful ophthalmoscopic examination usually raises suspicion of the true nature of both of these conditions, but even to the most meticulous ophthalmologist, they remain a source of worry. Fortunately both conditions are comparatively rare.

Conclusion

In this discussion I have endeavored to present a simplified approach to the etiologic diagnosis of optic neuropathies, to give a general classification of the more important causes, and to comment briefly on some of the more interesting points. There remains the question of how such cases should be handled by the ophthalmologist in actual practice. Here I think the answer is fairly obvious.

First, the ophthalmologist should have a clear concept of the various conditions which produce changes in the optic nerves.

Second, his ophthalmic examination should be precise and exhaustive and should enable him, in the majority of instances, to place the individual case in one or the other of the two large groups I have outlined early in this paper, and to classify it as a primary or secondary neuropathy.

Third, if the case falls into the second group, or if there is any question latent in his mind, he should outline the investigation to be followed. This investigation should routinely include a neurologic examination, a general physical examination with serologic and routine examination of the blood and spinal fluid, a lateral stereo of the head, and a clinical and radiographic examination of the posterior nasal sinuses.

Fourth, the ophthalmologist should remain captain of the team until the indications are definite where the patient should be referred for treatment or further investigation.

It is amazing that in the overwhelming majority of cases the information derived from the above examinations permits an immediate and exact diagnosis and establishes the underlying cause of the optic neuropathy.

To my mind the most important point in the etiologic diagnosis of optic neuropathies is that the ophthalmologist should not evade his responsibility. To content himself with the diagnosis of an optic neuropathy secondary to some systemic or intracranial disease and thereupon turn the case over *in toto* to a consultant is an evasion of duty. The neurologist, internist, and neurosurgeon are of necessity and training largely ignorant of the many and diverse causes of optic-nerve disease. While each consultant may be preëminent in his own field, the basic problem is an ophthalmic one; the investigation should be directed by the ophthalmologist; the diagnostic survey assembled by him and correlated with the ophthalmic examination. I believe it is only by this means that the correct diagnosis will be reached in the greatest number of cases.

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THE USE OF BACITRACIN IN OCULAR INFECTIONS*

PART I. TOLERANCE AND PERMEABILITY IN THE RABBIT EYE

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Following the successful application of penicillin and streptomycin in ocular infections, the reported results following the use of a relatively new antibiotic, bacitracin, in various surgical infections stimulated our interest as to its applicability to infections of the eye. Meleney and his coworkers[1, 2] have shown that in general bacitracin is effective against the same bacteria as penicillin and, in addition, report that, where a difference in susceptibility exists, the organisms are more often susceptible to bacitracin than to penicillin in a ratio of 5 to 1. Furthermore, there is no evidence that bacteria can inactivate bacitracin, as is the case with penicillin (penicillinase).

These reports seemed of sufficient importance to warrant undertaking the studies reported here to ascertain the applicability of this antibiotic to ocular infections.

A. THE EFFECT OF BACITRACIN ON THE CORNEAL EPITHELIUM

Saline solutions containing 1,000 and 5,000 units bacitracin per ml. were applied to a series of 12 normal rabbit eyes as drops at one-half hour intervals for six doses, and also in 6 other animals as a constant corneal bath for periods up to one hour. In no case was there any gross evidence of irritation. Upon staining the corneas with fluorescein, no staining areas were visible.

When bacitracin was applied to the corneas for periods up to 30 minutes as a dry powder, then washed out with water, no gross evidence of irritation was apparent. However, upon staining with fluorescein, micropunctate areas became visible. These represented but a transitory injury since, in 24 hours, the eyes were normal in all appearances, and the corneas failed to give a staining reaction.

Another method employed in the study of local toxicity is to observe the effect of the drug upon the regeneration of the corneal epithelium. In a series of 15 rabbits, 5-percent cocaine was applied to both eyes to anesthetize and to facilitate the denudation of the epithelium. The epithelium was removed by rubbing with sterile dry gauze and checked for completeness of abrasion by staining with fluorescein.

Five rabbits received in one eye, 2 drops of the saline solution containing 5,000 units bacitracin per ml., 3 times daily, while the other eye serving as a control received a similar amount of saline. The control eyes healed completely without scarring in 3 to 4 days; whereas, only one receiving the bacitracin healed by the 4th day, and the other 4 remained unhealed when observed on the 9th day. Eventual healing occurred with vascularization and opacities of the corneas. Eyes similarly treated with the solution containing 1,000 units bacitracin per ml. showed no difference in healing rate from that of the saline controls.

Since the rabbit cornea is more sensitive to irritating substances than the human cornea, it is evident that bacitracin in saline solution of a concentration of 1,000 units per ml. may safely be applied to the surface of the human eyeball under any condition. However, if the corneal epithelium is intact,

* Read before the Ophthalmic Section, New York Academy of Medicine, November, 1947. This research was done under a contract between the Office of Naval Research and Northwestern University.

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bacitracin in any concentration, or even as the dry powder, is well tolerated.

B. Permeability of the cornea to bacitracin

For these studies, penetration was observed in a group of 24 albino rabbits under various conditions: (a) where the cornea remained intact, (b) was traumatized, or (c) was inflamed as a result of induced infection.

Rabbits were first anesthetized by the intravenous injection of nembutal. The bacitracin solution was applied as a constant corneal bath by means of a plastic eyecup for periods ranging from 4 to 60 minutes. At the end of the respective periods, the excess of bacitracin was removed from the surface of the eyeball and the adnexa by thoroughly washing with a stream of normal saline. The aqueous was then withdrawn through a limbal puncture by means of a sterile 27-gauge needle. The bacitracin content was determined by the serial dilution method, using the Chanin-Strain Streptococcus hemolyticus, kindly furnished by Dr. Frank L. Meleney. The results of these experiments are shown in Table 1.

TABLE 1

Penetration of bacitracin (1,000 units per ml. saline) through the cornea

Condition of Cornea	No. of Eyes	Duration of Therapy Corneal Bath (Minutes)	Bacitracin Units* per ml. of Aqueous	Remarks
Intact	3	30	0, 0, 0	Non-irritating
Abraded (Amt.)				
100%	2	60	40, 40	Healed within 4 days
100%	2	30	20, 20	Healed within 4 days
50%	2	30	20, 20	Healed within 4 days
25%	3	4	0, 0, 0	Healed within 4 days
25%	2	30	4, 8	Healed within 4 days
Stippled	2	15	0, 0	Healed within 4 days
Stippled	4	30	0, 0.66, 1.0, 2.0	Healed within 4 days
Inflamed (Vaccinia virus)	8	30	2–16 (Av. 6.6)	
Ion transfer				
Intact Cornea	2	15	0, 0	Punctate stippling
Intact Cornea	4	30	0, 0, 0.5, 1	Corneal edema
25% Abrasion	3	4	0, 0, 0	
25% Abrasion	2	30	4, 8	Corneal edema
Aerosol O. T. (1 Drop in 1.0 ml. Bacitracin)				
0.5%	1	60	8	
0.5	1	5	0.12	Staining of cornea, chemosis, and corneal edema
0.1	2	30	4, 4	
0.05	2	30	2, 4	
0.01	2	30	0.5, 1	

* Hemolytic serial dilution method, using the Chanin-strain Streptococcus hemolyticus, kindly furnished by Dr. Frank L. Meleney

From the data presented it will be seen that bacitracin does not penetrate the normal cornea in a period of 30 minutes when applied in a concentration of 1,000 units per ml. In our previous studies on streptomycin,[3, 4] it was shown that, although penetration does not occur in the intact cornea, it readily penetrates following corneal damage.

Similar studies were therefore conducted using bacitracin. It was found that bacitra-

cin behaves in a similar manner. As shown in Table 1, the amount of penetration varies somewhat but not in an absolute manner with the degree of denudation and period of application.

In studies with the inflamed cornea, resulting from the application of the vaccinia virus, penetration in two cases with a 30-minute application of the corneal bath was similar in amount to that occurring in a 25-percent abrasion of the cornea. It is of interest to note that the infected lesion produced by the vaccinia covered about 25 percent of the corneal area.

As observed from Table 1, no detectable amount of bacitracin was found in the aqueous of an eye with intact cornea subjected to ion-transfer (iontophoresis) therapy for a period of 15 minutes. Small amounts of the antibiotic were present after 30 minutes. Application of fluorescein to the cornea following ion-transfer of 15 to 30 minutes in nearly all cases showed punctate staining.

The amount of bacitracin found in the aqueous after ion-transfer was no greater than after a corneal bath containing the same concentration of bacitracin applied for the same time to a cornea which had previously received a similar amount of damage by mechanical means. (Compare amounts for stippled cornea and ion-transfer intact cornea 15 and 30 minutes.)

It was also shown that the passage of bacitracin was no greater with 25-percent abrasion plus ion-transfer than with 25-percent abrasion plus corneal bath alone. From the above data, we conclude that the passage of bacitracin through the cornea does not depend upon ion-transfer per se so much as upon associated epithelial damage. Furthermore, since increased permeability was observed to occur with lesions produced by various means—scraping, a surface-active chemical agent, vaccinia, and during ion-transfer (iontophoresis)—we are led to conclude that the mechanism effecting an increase in penetration through a damaged cornea is essentially the same irrespective of the agent employed.

C. Effect of intraocular injection of bacitracin

Since at present bacitracin cannot be administered parenterally because of its toxicity and, as already shown, it does not penetrate the normal cornea, it was decided to study the effect of direct injection into the vitreous.

For this purpose, 0.1 ml. of a saline solution containing 100 units bacitracin was injected by means of a 27-gauge needle in the region of the equator of the eyeball, taking care to deposit the bacitracin as near the center of the vitreous as possible. The eyes were observed daily with the ophthalmoscope and with the slitlamp.

Minimal to moderate degrees of vitreous opacities were observed immediately following the injection. Usually these disappeared over the course of several weeks. In only 2 of 8 eyes were opacities observed at the termination of the experiment one month later.

At this time two small linear vitreous opacities were observed in one eye, and several fine vitreous opacities in the second. Since no histologic sections were made of these eyes, minute lesions may have escaped observation.

Lens opacities in these early experiments were present in four eyes and were attributed to injury occurring as a result of contact with the needle. In a later series of infected eyes treated by similar injection of bacitracin, rarely was a lens opacity observed. On the basis of size, it is postulated that injection of bacitracin into the human eye should be well tolerated.

In the second part of this report which will be published next month the effect of bacitracin therapy in experimental and clinical ocular infections will be considered.

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SURGERY OF CONGENITAL CATARACTS*

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The advent of the rubella cataract has served to stimulate a new interest in the surgical treatment of congenital cataracts. During the past 25 years only a few scattered papers on the subject have appeared in the literature. Of the more recent ones, that of Falls[1] is the most comprehensive. In the present paper no attempt will be made to present a statistical study but rather the procedures that have seemed most efficacious in my hands. In addition, certain types of congenital lens anomalies that warrant special consideration will be discussed.

INTRODUCTION

A thorough knowledge of congenital cataracts is essential for the intelligent discussion of the case with the patient or the patient's parents. It is also of importance in reaching a decision as to whether or not the cataract should be operated upon and the type of surgical procedure that may be indicated.

As Duane[2] points out, it is only in exceptional cases that the congenital cataracts are discovered immediately after birth, the rule being that they are not noticed until the child is some weeks or months old. This is due to the fact that newborn children have very narrow pupils, that they sleep so much, and keep their eyes closed most of the time. Moreover, they do not fix objects, an additional factor in not making it apparent that they do not see. Partial congenital cataracts may be overlooked for a longer time as the child will have sufficient vision to carry on.

Certain forms of congenital cataract show an hereditary tendency, primarily of a dominant type, although the type may not always be consistent. Therefore, lamellar, polar, spindle, and central cataracts all may occur in the same family. In some instances, however, the type may be the same in all members of the family involved. Haro,[3] for example, observed a family of 59 persons, covering four generations, in which 16 members had ring or disk-shaped cataracts. Nettleship[4] found coralliform cataract in 35 members of one family over five generations. Franceschetti[5] has listed as types with an hereditary tendency: Congenital total cataract, lamellar cataract, embryonal nuclear cataract, coralliform cataract, spear cataract, floriform cataract, axial fusiform cataract, stellate cataract and disk-shaped cataract.

PRODUCTION OF CONGENITAL CATARACTS

As Falls[1] pointed out, ophthalmologists, to a large extent, are ignorant of the primal causes of congenital cataracts, especially in regard to the mechanism of their production

* Presented at the III Pan-American Congress of Ophthalmology, Havana, Cuba, January, 1948. From the Division of Ophthalmology, University of California Medical School, San Francisco.

and the rationale of their transmission from one person to another. Mann[6] states that a certain number of congenital abnormalities can be explained as abnormal persistence of a normally transient condition.

It must also be borne in mind, however, that a greater part of so-called developmental anomalies do not represent any normal stage, but are pure aberrations of growth. The most that can be said in regard to the production of these developmental anomalies is that it is possible to deduce from their location the time at which the fibers involved were formed. Whether the opacities occurred at this time or whether they occurred as the result of a subsequent degeneration, it is impossible to say.

Intra-uterine trauma may at times produce lens changes as seen in the reduplication cataract. In addition, as Mann[7] has stated, we know experimentally that toxic substances administered to the mother during pregnancy may cause lens changes. It is known that interference with calcium metabolism and parathyroid secretion will produce the same opacities produced by avitaminosis.

The recent work of Gregg,[8] Swan and his co-workers,[9] Reese,[10] and others on rubella cataract would tend to show that infection in the mother, particularly during the early part of pregnancy, is capable of producing lens changes.

In addition, lens changes may be secondary to abnormalities of the vascular capsule which produce such changes as retrolental fibroplasia (persistence and hyperplasia of the primary vitreous).

From the above it seems apparent that some knowledge of the embryology of the lens, together with a thorough knowledge of its structure, particularly the zones of discontinuity, is essential for the proper diagnosis of the type of congenital cataract. As already stated, the correct diagnosis is essential in helping to make a decision in regard to the surgery of the case at hand.

Other anomalies are present

It is noteworthy that in approximately 50 percent of the cases of congenital cataract other ocular anomalies are present. These include strabismus, nystagmus, aniridia, choroidal and retinal changes, microphthalmus, subluxation of the lens, dissociated ocular movements, eccentric fixation, colobomas of the lens and optic nerve, muscle paresis, anomalies of the hyaloid artery system, and other changes. Falls[1] in his series of 313 cases found that 52.6 percent of the patients had other ocular defects in addition to congenital cataract.

In addition to ocular defects, a fairly high percentage of these cases have associated disturbances of a constitutional variety, either congenital or metabolic in nature. There is also a fairly high incidence of mental retardation. According to Krause[11] the mental deficiences may not make their appearance until the child is four or more years of age. The opinion has been expressed that the mental retardation is due to failure to perceive visual sensations. On the other hand all of us have seen instances of bilateral congenital blindness, uncorrectable by surgery, that have progressed very well mentally. While it is true that in many instances some of these cases do apparently show a marked improvement in their mental condition after restoration of vision, it must be kept in mind that frequently this does not occur. From what has been said it is obvious that the prognosis in the care of congenital cataracts must be guarded. As early as 1805, Ware[12] stated: "Operation is not so certain a cure for cataract in children, as in persons of a more advanced age."

General indication for surgery

The general indication for surgery in these cases is a visual acuity that has been reduced to the point of interfering with the normal use and development of the eyes. Inasmuch as most congenital cataracts are stationary it may at times be advisable to

leave the patient alone if his vision is 20/40 or better. It would seem advisable to make a general rule that patients with 20/40 vision should not be operated upon unless the visual acuity is further reduced. Consequently, it is never wise to tell a patient that he should never be operated upon, as the visual acuity may change in some of these cases. The zonular (lamellar) cataract, for example, has a tendency to increase in density so that, while the visual acuity may be adequate in youth, the vision in middle life may be sufficiently reduced to warrant surgery.

Age at which to operate

There has been a good deal of variance regarding the age at which congenital cataracts should be operated upon. In 1805 Ware[12] said, "Children, again, some of whom are born with cataracts, are in general so unmanageable that the operation becomes almost impracticable. For these reasons it is advisable to postpone it until they arrive at the age of reason and reflection, and feel by experience the necessity of submitting to it." It must be remembered this was before the days of anesthesia.

By 1830 we find that the opinion has changed. At that time Mackenzie[13] says, "In cases of congenital cataract, ought the operation to be delayed till the patient has attained an age sufficient to enable him to give his assent, or ought it to be practiced during infancy? The answer decidedly is to operate in infancy. About the age of from 18 months to 2 years, the tissues of the eye have attained a degree of resistance which enables the surgeon to operate with greater precision than at an earlier period, yet the capsule is not so tough and coriaceous as at a later period, and especially after the lens (as often happens in congenital cases) is completely absorbed."

Guthrie[14] in his lectures on the operative surgery of the eye, in 1830 states: "The proper period for operating has been and ever remains a disputed point, not as to the propriety of doing it at an early age, or within the first three years, that being fully established; but as to the best part of that time, some surgeons recommending 6 months, others 20 months to 3 years. If the child be healthy at 3, 4, and certainly 6 months, the operation ought to be performed with every hope of success. If the operation is delayed until the end of the third year, the child acquires . . . an irregular rolling motion of the eye, which it does not readily lose."

E. Fuchs,[15] in 1928, in discussing congenital cataracts said: "When I was still an assistant in the clinic, it was the rule that children with congenital cataracts were not to be operated upon until they were 10 years old. It was only later that it was discovered that the earlier the operation the better the visual result. One should not expect to obtain normal vision in such eyes as they also show other evidences of abnormal development. These eyes are usually smaller than normal and, if one waits until later to operate, the eye will have increased some in size, but the visual acuity will be much worse because the retina, due to lack of use, fails to develop normally."

Kirby[16] states that if operation is decided upon, it may well be performed early, as good results are obtained with careful needling at the age of a few months. If the lens opacities are allowed to obstruct the rays of light until after the fourth year of life, the best function obtainable after their removal will not be within the range of useful vision. He also states that in progressive congenital cataracts the visual function of the macula may be well developed in the early period of life and therefore the function will be good after the lens has been removed at a later date. Such patients obtain good vision after operation as late as 9 to 10 years of age.

Falls[1] suggests that in cases of complete bilateral cataracts, operation be performed on one eye after the patient reaches the age

of six months and on the other after the age of two years. If the cataracts are incomplete and the child has sufficient vision to get around, he feels surgery should be postponed until the 3rd or 4th year. Treacher Collins[17] prefers to wait until the child is at least 10 months old, as at that age the eye is larger and the anterior chamber is deeper.

From what has been said it is apparent that there can be no hard and fast rule as to the time of surgery. It has been my practice to operate the first eye at six months in those cases where the cataract is sufficiently dense to interfere with fixation, in the hope that the resultant fixation will prevent the establishment of nystagmus. The second eye is operated upon between the 2nd and 3rd years. In the interim, the eye has had the opportunity to develop and increase in size so that surgery is simpler. When the lens opacity is sufficient to interfere with the possibility of the child learning to read, the cataract should be removed before the school years.

Resultant postoperative vision

The prognosis as to the amount of resultant postoperative vision must be guarded. Fuchs[15] states that, "A visual acuity of one-fourth of normal certainly seems rather poor but must be considered a good result in these cases, especially where there is nystagmus, a smaller eye, and an abnormal development of the retina. One learns to appreciate such a result when one is asked to operate a case of bilateral congenital cataract after puberty. Immediately following operation the patient appears as blind as he did before surgery for he does not recognize objects, due to the fact that he lacks visual memories. This must be developed through experience but even then he will not obtain more than defective vision because of the fact that after a certain age the retina cannot entirely overcome the neglected development. One reads in romances how the congenitally blind person is operated upon and how at the first removal of the bandages he is surprised at the beauty or ugliness of his adored-ones. This must be regarded as purely poetic fantasy."

In Falls's[1] series 53.5 percent had a visual acuity of 20/100 or better; 9 percent were capable of 20/200 vision or possessed the ability to place accurately the Worth ball. For all practical purposes 17 percent were blind; 18.4 percent were capable of reading J4 to J7 print or better. It is interesting that in his series Falls found that no patient with pendular (ocular) nystagmus achieved better than 20/50 vision.

From the above it is apparent that in discussing the surgery of congenital cataracts with the parents it is well to explain in detail the visual prognosis and thus avoid a great disappointment on the part of the parents.

Surgical procedures reported in literature

The surgery of congenital cataracts has been limited to a relatively few procedures, all of which have their advocates. The ideal surgical procedure for the removal of congenital cataracts would seem to be one in which a single operative procedure would provide for the removal of at least the major portion of the lens so as to permit the remainder to absorb without further surgical interference. In addition, there should be no interference with the pupil and a minimum danger of iris incarceration or adherence to the operative wound. It is also highly desirable that, if possible, there be no interference with the posterior capsule and the vitreous. The danger of glaucoma should be minimized.

The use of visual iridectomy as advocated by Fox[18] and others in cases of incomplete cataract has been discarded. Bell[19] advocated an iridectomy as a preliminary procedure to either a later Ziegler discission or a linear extraction.

Discission

Discission in one form or another is the

most universally used operation for congenital cataract. The simple discission, repeated a varying number of times, has many advocates because of its simplicity and the fairly good results obtained. One of the disadvantages, a very real one from the parents' viewpoint, is that the procedure must be repeated a number of times. While complications are not common, as Spaeth[20] points out, they do occur and include cessation of the absorption as a result of postoperative irritation; postoperative low grade and prolonged iridocyclitis; organization of capsular tags and remnants into a dense membrane. Secondary glaucoma also occurs. As Wiener and Alvis[21] stated, discission or needling as many as 17 or 18 times has been necessary before a good opening or good visual results were secured.

In 1921 Ziegler[22] published his V-shaped through-and-through discission of the lens, which has many advocates. Wiener and Alvis[21] say that it is rarely necessary to operate these patients more than once and practically never more than twice. They feel that there is absorption of the softened lens in the anterior chamber and in the vitreous, "thus equalizing the pressure within the eye." The chief objections to the operation are delayed absorption and the presence of vitreous in the anterior chamber. Spaeth[20] says that a through-and-through incision of the lens into the vitreous is not a guarantee against the development of secondary glaucoma; instead, damage may occur to the vitreous with later development of a chronic iridocyclitis and even a retinal detachment.

Modification of discission

Recently, Moncreiff[23] has reported his modification of the discission. He makes an incision through the anterior capsule and into the cortex, and then makes multiple incisions in all directions down to the nucleus until the anterior cortex and capsule are reduced to shreds. The nucleus is then cut into several fragments. With an anterior-chamber irrigator he attempts to wash all of the cortical material from the remnants of the capsular sac into the anterior chamber. He feels this is the nearest approach to the ideal operation in these cases. The operation has only been done in both eyes of three patients and, as Moncreiff states, a large number of cases will have to be observed before the operation can be evaluated. It would seem that the possibility of glaucoma, due to the rapid swelling of all of the lens material in the anterior chamber, would be a definite risk.

Another rather frequently used procedure is the combination of discission and linear extraction. A fairly extensive discission of the anterior capsule of the lens is done. The eye is observed for several days postoperatively until the lens material is sufficiently disintegrated to permit easy removal through corneal or limbal keratome incision. Falls[1] found that this combined technique produced the best visual results. One does, however, have to keep in mind that in the older age group of children this may produce an acute glaucoma following the discission.

Modification of linear extraction

In 1932, Otto Barkan[24] reported his modification of a simple linear extraction in which the cataract extraction was done in one procedure. The chief modification consisted in several very important details, namely, the injection of adrenalin at the limbus and the making of the keratome incision inside the limbus. The absorption is rapid, and useful vision is obtained in a very short time, much sooner than with the discission. The difference in time between this and the combined method of discission and linear extraction is not very great, however, but it does not necessitate two operations. The chief objections that have been made to the procedure have been the tendency to anterior-synechia formation and the possibility of vitreous loss. The avoidance of these rather infrequent complications will be discussed later.

The intracapsular extraction also has a

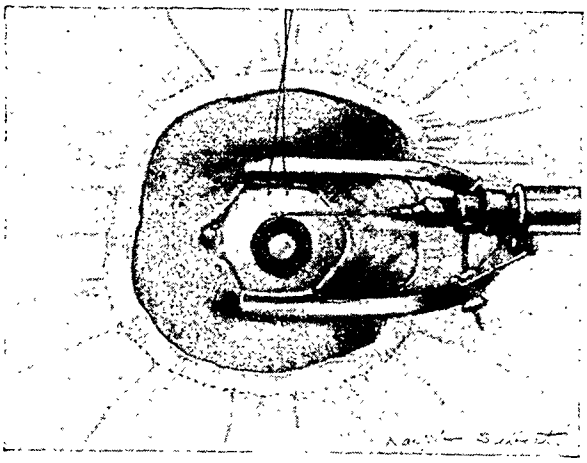


Fig. 1 (Cordes). Two drops of adrenalin (1: 1,000) are injected subconjunctivally at the limbus above. When introducing the needle, the open part should be directed toward the limbus.

very limited use in congenital cataract surgery. Falls[1] in his series limited this operation to the treatment of shrunken, dense, membranous, or hard cataracts in the very young.

Results in various operations

Horay's[25] observation on the results in the various types of operation for congenital cataract is of interest. He reported the results in 282 operations on congenital cataract. The cases were divided equally between discission, linear extraction (simple), and combined linear extraction. The age of the patient played no part in the decision as to the type of operation to be used.

From the survey it was concluded that the best results were obtained with a combined extraction, while the poorest results were obtained with the discission. The opinion that has been expressed that the operation should not be done until after the first year he felt was unfounded as the results were just as satisfactory during the first year as later in life. The failures in the patients operated upon during the first year of life were often the result of other congenital anomalies present. He concluded that an extraction, done in one sitting, was the operation of choice, irrespective of the age of the child.

Surgical procedures in congenital cataract

Except for certain types of congenital cataracts to be discussed later, I have employed a slightly modified Otto Barkan operation on all cases.

After the routine preoperative preparation and anesthesia, two drops of adrenalin (1: 1,000) are injected subconjunctivally at the limbus above (fig. 1). When introducing the needle, the open part should be directed toward the limbus. After 5 to 10 minutes the pupil is maximally dilated so as to almost disappear behind the limbus, especially above at the site of the incision. This dilation is due to a contraction of the sympathetic dilator fibers and thus is tonic, and results in maintaining the exaggerated dilation even after the anterior chamber is open, thereby preventing the iris from coming into contact with the incision before the anterior chamber is reformed. In addition, the hypotony is such that the tendency of the ocular

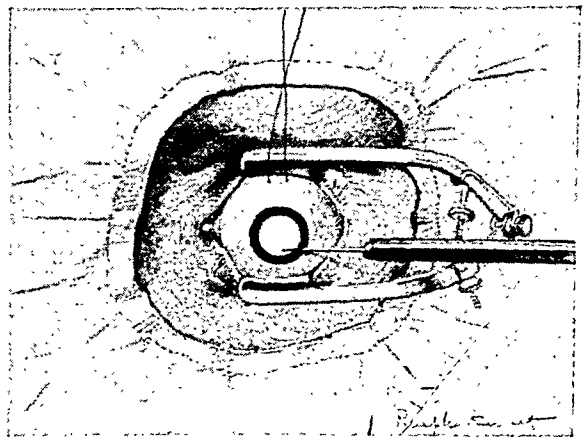


Fig. 2 (Cordes). Before making the incision, a puncture is made at the lower temporal limbus with a straight knife-needle to facilitate the injection of air into the anterior chamber after completion of the operation.

contents to prolapse is reduced to a minimum.

A suture is now placed through the superior rectus tendon. This is very helpful in fixing the eye downwards during the extraction, especially in infants where the small

area of the operative field makes it difficult to use fixation forceps.

Before making the incision, a puncture wound is made at the lower temporal limbus with a straight capsulotomy knife-needle to facilitate the injection of air into the anterior chamber after completion of the operation (fig. 2). The site of the puncture should be marked with gentian violet as an aid in finding it later. If the knife-needle is introduced into the chamber parallel to the iris surface, there will be no loss of aqueous

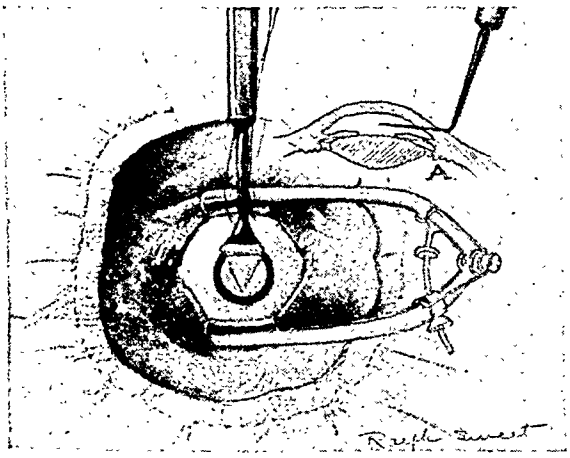


Fig. 3 (Cordes). A keratome incision is made inside the limbus and parallel to the iris plane.

and no collapse of the anterior chamber.

The incision is made 10 minutes after the injection of the adrenalin so as to allow ample time for the maximum effect. A keratome incision is made 1.5 to 2 mm. inside the limbus in the cornea. The incision is made oblique (parallel to the iris surface), thus forming a valvelike incision which tends to close more the greater the pressure within the anterior chamber (fig. 3).

The incision should be no larger than necessary for the extraction of the lens substance.

A capsulotomy is then performed with capsule forceps. As in the senile extracapsular extraction, it is desirable to obtain as large a capsulotomy as possible. In very young infants this must necessarily be small (fig. 4).

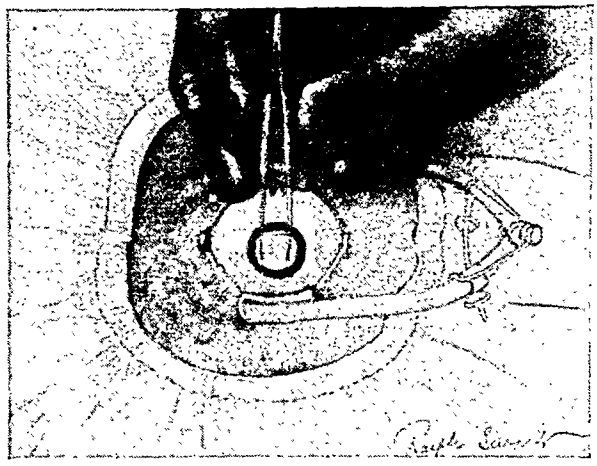


Fig. 4 (Cordes). A capsulotomy is done with Fuchs's forceps.

The lens substance is now expressed with spoons and the anterior chamber is washed out with normal saline solution (fig. 5). The wound is carefully inspected to be certain that there is no lens substance or capsule remnant in the wound.

With a small Luer syringe and a very fine needle (28 to 30 gauge), air is injected into the anterior chamber. This is done without difficulty through the small, previously made, stab puncture at the limbus below. The tip of the needle should be dulled a bit so that the point will not catch in the walls of the puncture wound. The injected air remains in the upper part of the anterior chamber for several days and prevents the iris from

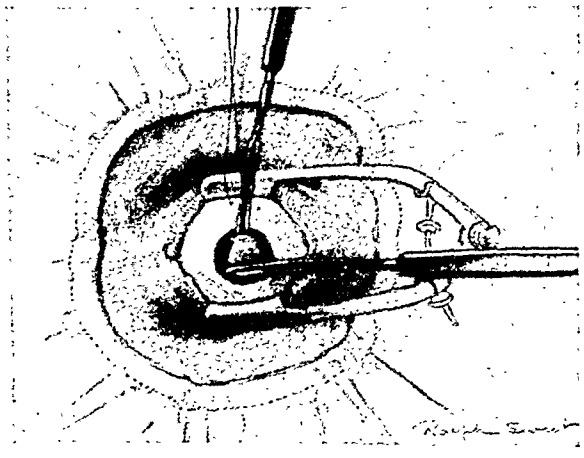


Fig. 5 (Cordes). The lens substance is expressed and the anterior chamber is washed out with normal saline solution.

coming into contact with the wound. Otto Barkan emphasizes the importance of a deep chamber before the patient leaves the operating table (fig. 6).

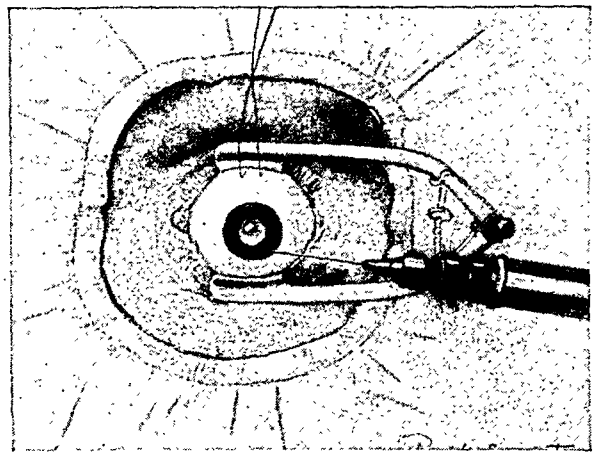


Fig. 6 (Cordes). With a small Luer's syringe and a very fine needle (28 to 30 gauge), air is injected into the anterior chamber. The tip of the needle should be dulled to facilitate the introduction of the needle into the previously made canal.

The usual postoperative atropinization is carried out.

Complications

The complications encountered are not many and can, to a great extent, be prevented. Of importance is the injection of adrenalin and the necessary wait of 10 minutes until the pupil is widely dilated so that the iris is not in the way.

The importance of the incision being parallel to the surface of the iris cannot be stressed too much, for it is this angle that produces the valvelike opening which seals firmly from the pressure within, and is a factor in preventing prolapse of the iris or opening of the wound by postoperative squeezing.

Vitreous loss is infrequent and, when it does occur, usually results from attempting to remove the last bit of lens substance. It is well to remember that when the major part of the lens has been removed there is little to absorb and this absorption occurs in a short time, even in those cases where the lens is relatively immature. It is important not to "do too much."

The most serious objection that has been made to the operation is the development of anterior synechias, or iris incarceration in the wound, with the resultant drawing up of the pupil which may at times be accompanied by glaucoma. The injection of air immediately following the operation seems to prevent this, as in no instance where this has been done has there been any iris incarceration.

Secondary glaucoma has occurred only once, and this in a 12-year-old boy whose lamellar cataract had increased in density to the extent that it caused sufficient loss of vision to necessitate surgery. No difficulty was encountered in opening the wound and washing out the lens debris. The final result in this eye was 20/30 vision.

Special consideration of certain types of congenital cataracts

Certain types of congenital cataracts warrant special consideration from the surgical viewpoint.

Posterior polar cataract. In this cataract, in addition to the posterior cortical opacity, the major opacity is confined to the posterior capsule and therefore, if a linear extraction is done, a later discission through this posterior capsule is necessary. Due to the fact that other anomalies are often present the prognosis must be guarded when surgery is considered.

Embryonal nuclear cataract. It must be remembered that in these cases the nucleus is dense and hard so that discission is very unsatisfactory. The cataract, however, causes very little interference with vision and Gifford[26] goes so far as to say that operation is never required for opacities limited to the embryonal nucleus.

Zonular (lamellar) cataract. In some of these cases, the disturbance continues until birth, or, is so unusually severe that the entire lens is opaque. Under these conditions

further growth of the lens fibers does not take place. This type of zonular cataract is usually associated with other serious congenital defects of the eye so that operative prognosis must be guarded.

Membranous cataract. In the membranous cataract, with the absorption of the lens parenchyma during intra-uterine life, the anterior and posterior capsules collapse to form a thin gray-white or chalky-white membrane. The condition is frequently bilateral and often associated with other anomalies including nystagmus and strabismus. In these cases the use of the discission advocated by Wheeler[27] has been found simple and effective.

Axial fusiform cataract. It is well to remember that in the axial fusiform cataract actual adhesion of the nucleus to the anterior and posterior capsules has been demonstrated.

Disk-shaped cataract. The surgical treatment of this cataract presents an interesting problem, due to the fact that for all practical purposes there are two types of cataract in one individual, namely a membranous (central area) and a soft cataract (the periphery of the lens). The literature contains relatively little on the subject.

Collins[28] was able to separate the central plaque in one of his patients. In both eyes the plaque fell into the lower part of the anterior chamber, where it remained without causing any reaction. Haro[3] reported his surgical experience in two cases. In one patient he attempted two discissions with rather poor results. After absorption of the lens substance, the central membrane was cut by means of de Wecker's scissors through a keratome incision. In the second case three discissions were performed but they were only partially successful. In the fourth operation, de Wecker's scissors were used to cut through the central membrane.

The first operation in these cases should be a discission through the existing lens substance and through the membrane, thus allowing the lens fibers to absorb. As Haro[3] has pointed out, in most cases the membrane is firmly adherent to the rest of the lens and is too tough to be cut with an ordinary discission needle. For this reason it would seem advisable to use the Wheeler knife-needle and to do the procedure in the manner described by Wheeler.[27] If this does not succeed it would seem that the use of the de Wecker or Berens scissors would be the next step.

Total extraction must be considered with caution as in some of these cases the central portion of the membrane is adherent to the hyaloid and extensive vitreous loss may follow this procedure as described by Malbran and Tosi.[29]

Rubella cataract. This type, which has been recognized as an entity in the last few years, deserves special consideration. It must be remembered that these cases often have other congenital anomalies and that microphthalmus is a common finding and therefore the prognosis must be guarded.

As Reese[10] has stated the anterior chamber is particularly shallow and in many cases the very dense central portion of the lens has proved resistant to the needle, sometimes separating off as a firm disk. If needling is employed this disklike opacity should be removed from within the confines of the capsule and, if possible, broken up to rest in the anterior chamber where it will absorb.

This characteristic of the embryonal nucleus in some of these cases has been observed by Goar and Potts[30] and others. In some of the cases the entire lens is opaque and here the usual operative procedure is employed. We have employed linear extraction as described above in these cases and have encountered only the complications of other anomalies seen in these cases.

Absorption of the lens substance has been slower than that of the usual congenital cataract. In most of these cases it is difficult to dilate the pupils with any mydriatic and this is especially true after operation, so

that in a certain percentage, there is an occlusion of the pupil in spite of all attempts at mydriasis. Glaucoma is one of the complications encountered.

Ether anesthesia has been used in these cases in spite of the presence of heart lesions. Goar and Potts,[30] Reese,[31] and Ellett[32] all agree that these patients stand general anesthesia well in spite of the presence of the heart lesion. Post[33] in one case used local anesthesia without difficulty. Cocaine was used as instillations as for a needling operation. The baby was firmly held and the operation performed on each eye without apparent pain to the infant and no operative difficulties were encountered.

The prognosis must always be guarded in these cases, as it is impossible to state whether or not other ocular defects are present or will develop.

Persistence and hyperplasia of the primary vitreous (retrolental fibroplasia). While this condition is, strictly speaking, not a cataract, it is associated with the lens and often is accompanied or followed by lens opacities and therefore warrants discussion here. On the theory that the condition resulted from failure of production of the aqueous, Terry[34] attempted to establish new vascular connections between the ciliary body and the episclera by scleral trephination over the ciliary body and reported some improvement in this condition.

The most important work on the subject is that done by Reese and Payne.[35] On a premise that some of these eyes might see, they made an effort to salvage 6 eyes in 6 cases. Their procedure was to remove the lens substance by repeated discissions and finally to make a vertical cut in the retrolental fibrous tissue with de Wecker's scissors.

Very little seems to happen when the lens capsule is opened, so that the capsule opening can be made extensive without fear of undue or too rapid swelling. After the lens substance had been dissipated for the most part, a central vertical incision was made through the remainder of the tissue with de Wecker's scissors. This was followed by hemorrhage in the anterior chamber with absorption in the due course of time.

In one instance they used three discissions and two incisions with de Wecker's scissors. In 2 of the 6 cases there was some vision, which it was believed came from the operated eye. While the results, according to the authors, leave a lot to be desired, the procedure may develop into one that may be helpful in these otherwise desperate cases.

Cataracts following intra-uterine inflammation. The prognosis is very bad in those cataracts with firm posterior synechias resulting from intra-uterine inflammation. Experience has shown that any operative procedure in these cases is "invariably followed by inflammation and fibrosis."[30]

Summary

In the surgical treatment of congenital cataract, it is important to remember that 50 percent of the patients have other ocular congenital anomalies and that therefore the prognosis must be guarded. In addition other general congenital anomalies are often present.

As a rule a visual acuity of 20/40 or better would seem to be a sufficient contraindication for surgery inasmuch as the wearing of the heavy disfiguring lenses is in itself a definite handicap to the growing child. In some instances, as in the lamellar cataract, the opacity may increase in density so that later surgery is necessary.

From personal experience, and from the literature, it would seem that in those cases of bilateral congenital cataract where the opacities are sufficiently dense to interfere with the development of fixation, the first eye should be operated upon at six months so that the child may develop this faculty and thus avoid nystagmus. The second eye should be operated upon between the 2nd and 4th year. When the cataracts are of

sufficient density to interfere with the child learning to read, they should be operated upon before the school age.

In discussing surgery of congenital cataracts with the parents, it is well to remember that only approximately 50 percent of the cases develop a postoperative vision of 20/100 or better.

The personal choice of operation in soft congenital cataracts is the linear extraction as modified by Otto Barkan. The important modifications are the injection of adrenalin (1:1,000) at the limbus at the site of the incision, to prevent the iris from becoming involved; and the making of the incision parallel to the iris surface and 1 to 2 mm. inside the cornea. In addition it has been found that the injection of air into the anterior chamber at the completion of the operation is an important factor in the prevention of the formation of anterior synechias or incarceration of the iris. The importance of a deep anterior chamber when the patient leaves the operating room has been stressed by Barkan and cannot be emphasized too much.

In certain types of congenital cataract, the discission as advocated by Wheeler is indicated, particularly in the congenital membranous cataract.

In the disk-shaped cataract where there are two types present (membranous central portion and peripheral soft cataract), a discission followed later by an incision through the membrane with Berens or de Wecker scissors is usually necessary.

In rubella cataract, in addition to the possibilities of other anomalies being present, it is well to remember that the absorption of the lens substance is slower than that of the usual congenital cataract and that in most instances it is difficult to dilate the pupil with mydriatics.

In persistence and hyperplasia of the primary vitreous it is possible that repeated discission of the lens substance, finally followed by making a vertical cut in the retrolental fibrous tissue may offer some hope in these otherwise hopeless cases.

The surgical treatment of congenital cataracts is a grave responsibility as the outcome of the operation is instrumental in determining the individual's future position in society. A thorough knowledge of the types of congenital cataracts, combined with a detailed study of the case in hand, is important in making the decision as to whether or not surgery is indicated. If surgery is indicated, this knowledge is useful in determining the age at which the operation is to be performed and the type of surgical procedure to be employed.

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PREVENTION AND MANAGEMENT OF COMPLICATIONS OF CATARACT EXTRACTION*

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A comprehensive review of complications of cataract extractions was published by Berens and Bogart,[1] in 1938, and this study was supplemented by Kirby[2] in his 1941 paper on the practical aspects of both operative and postoperative complications.

Statistical analyses of the results and of the complications from senile cataract extractions performed in the Wilmer Institute between 1925 and 1943 have been recorded in careful detail by Hughes and Owens.[3, 4] They were able to divide the extractions performed during that period into five main types, with each subsequent type giving better results than the preceding one: (1) Combined extracapsular extractions with corneal sections and no sutures, (2) combined extracapsular extractions with conjunctival flaps and sutures, (3) combined intracapsular extractions with conjunctival flaps and sutures, (4) combined intracapsular extractions with one (rarely two) corneoscleral sutures, and (5) intracapsular extractions with peripheral iridotomy and two (rarely one) corneoscleral sutures. The last type of extraction gave significantly better final results than any of the first four types.

The statistical comparison of these groups is subject to one criticism; namely, each of the five types of extraction was in successive general preference during five successive eras of the period covered by the study and, therefore, minor refinements in operative technique, preoperative care, and postoperative care may have accounted for some of the improvements in results. Nevertheless, the conclusions of Hughes and Owens are certainly valid in general and the procedure of choice for extracting senile cataracts is intracapsular with peripheral iridotomy and two corneoscleral sutures.

This present report purposes to supplement the studies of Hughes and Owens by elaborating upon details of cataract extraction which do not lend themselves to ready statistical analysis. In most instances, the procedures herein advocated represent current preferences of the Wilmer Institute staff as a whole, such procedures having come into general usage as a result of cumulative experience.

PREOPERATIVE MANAGEMENT

PREVENTION OF PSYCHOLOGIC COMPLICATIONS

Prior to operation the patient should be told exactly what he must go through, what are the chances of a successful extraction, and what he can expect in terms of vision provided the operation is anatomically successful.

He should understand that (1) aphakic vision is so different from phakic vision as to require an appreciable period of adjustment (longer in elderly patients than in younger ones), (2) an aphakic eye can rarely ever be used together with a phakic eye with a correcting lens for each eye, (3) an aphakic eye is devoid of accommodation, and (4) when the initial correction is obtained for his aphakic eye he will be bothered by magnification, causing objects to appear closer than they really are, by peripheral distortion, and by limitation of the effective visual field. Limitation of effective field necessitates turning the head rather than the eyes. It is a permanent handicap, probably

* From the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital and University. Presented before the Section on Ophthalmology of the American College of Surgeons, New York, New York, September 9, 1947.

the most unpleasant feature of aphakic vision.

The patient should be told of any abnormality, such as senile macular degeneration, which would impair the visual result, or of the possibility of any suspected but nonvisualized abnormality such as retinal detachment.

Choice of anesthetic

Local anesthesia is used except in special instances. Nembutal (0.1 gm.) is given by mouth two hours, and again one hour, before operation. Homatropine (2-percent solution) is instilled one hour before operation. Cocaine (4-percent solution) and neosynephrin (10-percent solution) are instilled alternately very two minutes preceding operation. About 5 minutes before operation, akinesia of the orbicularis is obtained with an O'Brien or van Lint block. My personal preference is for a slightly modified O'Brien block: This consists of injecting 4 cc. of 4-percent novocaine containing adrenalin (1:20,000) through a 2.0 cm., 25-gauge needle into both deep and superficial layers at the site preferred by Benedict, which is 1.5 cm. from the middle tragus on a line from the middle tragus to the upper lip. A retrobulbar injection of 1.5 cc. of 4-percent novocaine and 1:20,000 adrenalin is given deep within the muscle cone, using a 3.5 cm., 22-gauge needle.

A general anesthetic is indicated if the eye is unduly prominent or if there is increased intraorbital tension (resistance of the globe to being pressed back into the orbit). In these cases, a general anesthetic reduces the chance of loss of vitreous. General anesthesia is also indicated for uncooperative adults, and is of course necessary for children. Sodium pentothal is preferable in adults and ether in children.

Prevention of infection

Routine conjunctival cultures are of doubtful practical value, but care is taken that the lacrimal drainage apparatus is patent, that there is no clinically apparent conjunctivitis or blepharitis, and that there is no upper-respiratory infection.

Prevention of infection is dependent largely on the care with which the operative field is prepared, provided aseptic operative technique (including the use of drapes, gloves, gown, mask, and cap) is followed. Our present routine procedure is as follows: Two hours before operation, and again one hour before, argyrol (20-percent) is instilled (to coagulate mucous) and the conjunctival sac is irrigated with normal saline. The lashes are cut, the skin and brow are scrubbed with soap and water, the conjunctival sac is irrigated copiously with saline, and the lid margins, skin, and brows are painted with tincture of iodine followed by alcohol. Iodine is preferred because we found cultures of the skin of the lids at the close of operation rarely showed any growth when tincture of iodine was used, but frequently showed growth (usually staphylococci) when either tincture of merthiolate or tincture of metaphen was used.

Choice of operative techniques

The Parke lid speculum is most satisfactory, especially because a superior rectus bridle suture can be attached to the post on the upper arm of the speculum; more secure and dependable fixation is attained with a suture adjusted in this way than if it is clamped to the drapes or held by the assistant.

For uncomplicated cases a shallow incision, with a Graefe knife, of between two fifths and one half the circumference of the cornea is preferred. A mature or almost mature lens with a dense nucleus requires a slightly larger section than does an immature or hypermature lens. Also, in a very old patient the lens is generally larger and requires a larger incision than in a younger patient.

If there are many cornea guttata (endothelial dystrophy) there is an appreciable chance of persistent epithelial edema after operation. In these cases I believe the possibility of this postoperative complication is re-

duced by use of a small, deep section, and that such a section is indicated even though there is an increased risk of postoperative hemorrhage. Severe or prolonged diabetes, or purpura, indicates a section in clear cornea. A small incision with a knife or keratome, and enlarged with scissors, is preferable if the anterior chamber is very shallow.

If there is an elevated intraocular pressure which does not fall after the retrobulbar injection of novocaine and adrenalin, a posterior sclerotomy should be done before the incision is made. If there is an obliterated anterior chamber, either of two procedures may be used. The first, which I prefer, is the injection of air into the anterior chamber, followed by the usual Graefe section. The second, more generally used, is an incision ab externo with the Lundsgaard knife, enlarged to proper size with scissors.

If there has been an external filtering operation for glaucoma, with a filtering bleb at the 12-o'clock position, the incision may be made: (a) through the filtering bleb, (b) in clear cornea in front of the filtering bleb, or (c) below. I prefer a Graefe incision beneath a prepared flap below, with two corneoscleral sutures. In the presence of a luxated or dislocated lens, the incision is usually best made above and the method of delivering the lens varied according to the position of the luxation.

Two corneoscleral sutures appear necessary for optimal closure of the incision, and more than two are usually redundant. Sutures inserted before section (preplaced) are preferred. Corneoscleral sutures inserted immediately following section (postplaced) shortens the time required for operation, but coaptation of the incision does not appear to be as uniformly perfect as with preplaced sutures. The Lindner[5] or McLean[6] sutures give tighter closure than the Stallard[7] type of suture.

McLean sutures are preferred by most members of the Wilmer Institute staff. I personally like a slight modification of the Lindner or McLean suture: This modification consists in making a partially penetrating incision or slot in the limbus, passing the sutures through from the corneal surface, across the slot and out the scleral surface and overlying conjunctiva. The needle should be carried across the slot in a radial direction, with the point being first engaged in the cornea about 1.5 mm. in front of the slot, passing across the slot at a depth of 0.2 to 0.3 mm., and emerging from the sclera about 1.5 mm. behind the slot.

A round-pupil extraction with one peripheral iridotomy at the 12-o'clock position, is planned for all cases except those (1) with active anterior uveitis at the time of operation, (2) with an inflammatory membrane covering part of the pupillary space, (3) with marked fibrosis of the iris, (4) where a biopsy of the iris is desired, (5) where glaucoma is also present, or (6) where vitreous is already present in the anterior chamber (as with dislocated lenses). In these instances a complete iridectomy is performed. If congestive glaucoma is present, the iridectomy is made large and basal. Posterior synechias are broken loose with a spatula before the lens is delivered. If there is a postinflammatory pupillary membrane, it is separated from the lens with a spatula and excised with a blunt-pointed scissors; a radial iridotomy is performed at the 6-o'clock position before the lens is removed. Separation of inflammatory membrane from the lens is best accomplished, without rupture of lens capsule, if a smooth cyclodialysis spatula is used; this is true even if there has been a severe inflammation such as sympathetic ophthalmia.

An intracapsular extraction is attempted in every case except that of a traumatic cataract with the capsule already ruptured. Congenital cataracts in children are not generally supposed to be suitable for intracapsular extraction. However, while the zonule is quite strong, the capsule is also generally very strong, and contrary to the usual custom I prefer to attempt intracapsular extraction. The lens is grasped near the lower equator with forceps and pulled hard enough to stretch the ciliary processes and bring the

lower zonule into view; the zonule can then be stripped from the lens with an iris spatula as the lens is tumbled. No undue reaction appears to result from thus stretching the ciliary processes.

The incision

With preplaced corneoscleral sutures, it is important for the surgeon to have forceps in one hand for any necessary handling of the sutures as the section is completed. The assistant should therefore fix the globe. He should grasp the bulbar conjunctiva near the lower limbus with curved fixation forceps and pull the tips of the forceps gently downward, not pressing backward, and avoiding any pressure on the globe. A completely untrained assistant can perform this fixation without danger, if he is trustworthy. He should be directed simply to hold the fixation forceps in the one desirable position. The surgeon himself can then release the forceps after he completes the section.

Preplaced sutures predetermine the plane of the section and actually make a Graefe section easier than if no sutures are present. A sharp point on the knife is necessary for a proper Graefe incision. One with a double-edged point facilitates both engagement and counterpuncture. The knife is engaged at the limbus, in the same position as the slot for the preplaced sutures. The blade is pushed across the anterior chamber just in front of the iris until the tip begins to disappear behind the opposite limbus. The tip is then elevated anteriorly until it engages the cornea, the counterpuncture is made, and the section is completed. Care is taken to follow the slot and not to tilt the knife blade. The knife is carried past the preplaced sutures one at a time, the slot being spread at each of these points by lifting the suture close to the corneal lip as the knife goes by.

Intracapsular extraction of the lens

Extraction of the lens with capsule intact depends in large measure on the instrument with which the lens is grasped. Forceps are preferred in all cases except for dislocated lenses or where the capsule is so tense it cannot easily be grasped.

In my opinion the best forceps are Castroviejo's adaptation of Arruga tips to Sinclair's cross-section forceps. However, the presently available forceps of this type vary considerably in strength, curvature of shank, size and shape of blades ("tips"), and coaptation of blades. In the same hands, some forceps rupture a large percentage of capsules, while other supposedly identical forceps rarely break one.

If the cross-action spring closes the blades too tightly, the capsule is likely to be torn, while too little tension will often allow the capsule to slip out of the grasp of the blades. Forceps exerting a pressure of about 150 grams between the blades are most satisfactory.

The blades should have no superior lips, so the capsule can be grasped beneath the lower border of the pupil without the iris being caught. Blades about 3 mm. in length are optimal. Perfect apposition of the blades on closure, with heel and tip of each blade meeting in unison and maintaining an evenly distributed tension on complete closure, is essential.

The blades must have no sharp edges and no tiny nicks or spurs. When closed on a calling card they should slide smoothly both vertically and horizontally, with about the same resistance to sliding in either direction, and should not scratch either surface of the card. The blades should be inspected occasionally with a slitlamp for tiny defects. If such defects are found, these should be smoothed out with rouge paper or the forceps should be discarded.

In the delivery of a lens with forceps, the pupil should be moderately or widely dilated. With a moderately dilated pupil, the closed blades are inserted beneath the iris at the 6-o'clock position, opened, and closed on the capsule in a position two-thirds the distance from the anterior pole to the equator. During this maneuver the end of the forceps

handle is held with thumb and forefinger of the left hand and the opening and closing of the cross-action spring (which requires appreciable pressure) is worked with the right hand. The right hand is then readjusted so the forceps fit in it much as does a pencil, and have no tendency to wobble even with the fingers almost completely relaxed. The left hand is then removed and used to manipulate the Arruga expressor.

The forceps blades are lifted anteriorly and upward to the center of the cornea and the strength of the lower zonule is actually felt. The actual grasping of the capsule and this movement of the forceps often initiates rupture of the zonule. If it does not, rupture of the zonule is started by point pressure on the tense zonule just below the lower limbus.

Once dislocation has begun, the curved portion of the expressor is used to press the lower portion of the cornea against the junction of the lower border of the lens and the vitreous. By a combination of traction on forceps and counterpressure directed more upward than posteriorly, the lower border of the lens is tumbled upward into the incision. As the lens is tumbled, the forceps are rotated backward in order to keep the blades parallel to the grasped surface of the lens. Often a gentle side to side motion of the forceps assists in breaking the zonule along the sides as the lens is tumbled. After the lens is tumbled it is lifted out of the incision with the forceps, while the expressor, which is now actually behind the lens, is used to press the cornea upward and forward against the lens to complete delivery.

Occasionally with a very soft eye and a very anterior incision, final delivery of the lens can be facilitated by having the assistant press gently backward on the scleral lip of the incision until the lens is halfway through the incision. Also, should the upper zonule rupture before the lens is tumbled (a rare occurrence), the lens can more easily be pulled out without tumbling if the assistant retracts the upper iris with a spatula or blunt hook. However, if the assistant is not thoroughly trustworthy, it is better to exert more traction with the forceps in lieu of having him execute these maneuvers.

Use of an erisophake is indicated when the capsule cannot easily be grasped with forceps, and for dislocated lenses. One bugbear about erisophakes should be dispelled: Some surgeons fear that if the erisophake should slip, vitreous may be sucked out. Actually, formed vitreous will not pass through the lumen of an erisophake even if tremendous negative pressure is applied.

Of the various suction devices, my personal preference is for the Dimitry erisophake because of its simple light construction, and the fact that the amount of negative pressure can be varied. The more fragile the capsule, the less suction should be used. The tip or suction cup of any erisophake should have no sharp edge and should be free of nicks or spurs, just as with forceps.

For removal of a cataract which is not luxated, the erisophake is manipulated in much the same way as forceps, grasping the lens in the same position and tumbling it with a combination of traction and counterpressure. In cases of partially dislocated lenses, the erisophake is applied adjacent to the dislocation (whether above, below, or on the side) and the lens delivered either by tumbling or by sliding, depending upon the site of the dislocation. This maneuver may be assisted by the insertion of a spoon behind part of the lens after it has been lifted anteriorly with the erisophake.

Operative complications

Probably the most frequent cause of disastrous complications in cataract extractions is nervous tension on the part of the surgeon. Some degree of nervousness is a perfectly natural reaction of any surgeon faced with the responsibility of a patient's vision, but it generally decreases as self-confidence is gained.

A number of authors have emphasized the importance of nervous tension to the point

even of laying down rigid rules of conduct for the operator. However, no set rules can apply to all individuals. Some surgeons are more at ease after much sleep, others after little sleep; much physical exercise (especially shortly before an operation) usually increases nervousness, but occasionally has the opposite effect; many surgeons are made tense by caffeine and therefore do not drink coffee on operating days, while others are calmed by caffeine. These and many other factors can only be evaluated by each man.

Observation by a colleague frequently causes some nervous tension, if the surgeon has great respect for the observer's opinion, and observation by a relative of the patient will often have the same effect. The surgeon is usually more at ease if he sits down and makes himself as comfortable as possible while operating, takes advantage of every available rest to steady his hands while undertaking the more delicate maneuvers, and uses those techniques for cataract extraction he believes will in his hands give the least chances of complications. Thus a surgeon who does not feel confident with a Graefe knife can make equally satisfactory incisions, at the expense of very little additional time, by the use of keratome and scissors; and one who is not ambidextrous can use the better hand for performing the section or grasping the lens in either eye.

The complications of cataract extraction which actually become apparent during operation are as follows, in order of their importance:

A. Vitreous loss

Loss of strictly fluid vitreous is of no consequence. Such loss can generally be inferred rather than seen. It is manifested by immediate reformation of the anterior chamber as the lens is delivered. In most eyes with "fluid" vitreous only the anterior vitreous is strictly fluid (by virtue of partial collapse posteriorly of the normal vitreous structure, or sheets), and if more than a certain amount of the truly fluid vitreous escapes from the eye, formed vitreous will then begin to emerge.

Loss of any formed vitreous causes some degree of vitreous opacities, renders impossible the preservation of a round pupil, and greatly enhances the probabilities of postoperative inflammation ("uveitis"), of postoperative glaucoma, or of late detachment of the retina. These undesirable sequelae follow in more or less direct ratio to the amount of formed vitreous which is lost. By "formed" vitreous is meant any vitreous which possesses recognizable structure, as contrasted with strictly "fluid" vitreous, which is indistinguishable from aqueous except for being slightly more viscous.

The unfortunate sequelae of vitreous loss are dependent not on the eye's actually being devoid of some vitreous, but on distortion of the remaining vitreous structure and especially on incarceration in the incision of the remaining vitreous sheets, which are still attached to the posterior segment of the eye. This incarceration results in delayed complete healing of the incision, with connective-tissue proliferation (and subsequent contracture) extending from the incision for some distance along the vitreous sheets. This fibrosis may block part of the angle, irritate the adjacent ciliary body, and exert traction on the retina via the vitreous sheets.

Vitreous loss is very seldom encountered if there is no pressure on the eye. Thus in a "soft" eye there is little or no danger of vitreous loss unless there is grossly improper counterpressure on the eye, or actual instrumental removal of vitreous. Although some surgeons have expressed a dislike for a "soft" eye because of difficulty in delivering the lens, this has not been our experience.

Avoidance of pressure depends on (1) akinesia of the orbicularis, (2) akinesia of the extraocular muscles, (3) an adequate palpebral fissure, and (4) lack of excessive retrobulbar bulk.

1. Complete akinesia of the orbicularis can be attained in a very high percentage of

cases by the slightly modified O'Brien block. Closure of the lids is tested just prior to beginning the operation; should akinesia be imperfect, a van Lint injection of novocaine should be given just outside the lateral orbital margin.

2. *Complete akinesia of the extraocular muscles* is only occasionally attained with a retrobulbar injection of novocaine, but partial akinesia is the rule if the injection is given deep in the muscle cone. In a series of cases where 1 cc. of 2-percent pontocaine solution was used for retrobulbar injection, better akinesia resulted than with 4-percent novocaine. However, such injections of 20 mg. of pontocaine are probably inadvisable as a routine procedure because of the very occasional idiosyncrasy to the drug.

Adrenalin or some other vasoconstrictor should always be a part of the retrobulbar injection. Otherwise, slight edema of the posterior orbit is likely to result.

Ballooning the bulbar conjunctiva by the injected novocaine indicates the retrobulbar injection was not in the muscle cone. In such an instance, a further injection of 1 cc. more of novocaine may be given, provided the eye is not unduly prominent.

3. *A tight palpebral fissure* should be remedied at the start of operation by a large, deep lateral canthotomy. A Parke lid speculum holds the lids open better than any other speculum we have found. Also, it does not slip out of place and the blades do not press on the globe. Some surgeons insist on lid sutures in lieu of a speculum, or on a speculum which can be removed very quickly in the event of vitreous loss. The logic of this contention is not clear. When corneoscleral sutures are used, the lids must certainly be held open until the incision has been properly closed. After the incision is closed, the speed with which the speculum is removed is of no consequence.

4. *Lack of excessive retrobulbar bulk.* If the eye is very prominent, or if there is excessive intraorbital resistance, a retrobulbar injection will cause a further increase in the orbital contents with increased pressure on the globe. In such patients general anesthesia is preferable.

Orbital hemorrhage from retrobulbar injection is very rare, but may occur if the needle is inserted too close to the globe and hits the inferior oblique muscle. Hemorrhage in the orbit, manifested by proptosis and by ecchymosis of the conjunctiva, is usually evident before the operation is started. In such cases operation should be postponed.

After section has been made, if there is increased orbital pressure, it is manifested by forward prolapse of the lens-iris diaphragm against the back of the cornea. Extreme pressure even causes bulging of the iris into the incision, and spells danger of vitreous loss. When this happens, the speculum blades and superior rectus suture should be readjusted to give as little pressure as possible. As the lens is tumbled and delivered, the cornea should be kept pressed against the back of the lens with an Arruga expressor, thus holding back the vitreous. The sutures should be tightened immediately following delivery, before repositing the iris.

If there is actual loss of vitreous and the lens is delivered with intact capsule, the sutures should be tightened as quickly as possible. The iris will then either be prolapsed into the incision or folded backward. If it is prolapsed, a complete iridectomy should be performed and the pillars reposited. If it is folded backward, nothing should be done to the iris; the final pupil will be displaced upward and have the appearance of an iris coloboma, but the folding back of the iris does not in itself cause irritation.

B. Rupture of lens capsule

Rupture of the capsule during delivery makes complete removal of the lens material more difficult. Retained lens material may necessitate subsequent discission or capsulectomy, procedures far from benign. Also, the chances of postoperative "uveitis" and/or glaucoma are considerably enhanced. Reten-

tion of much lens cortex is rare except when the capsule of an immature lens is ruptured. Fortunately this is a rare occurrence. The capsules most easily ruptured are those of densely white, swollen, mature, or slightly hypermature cataracts.

When the capsule ruptures, as it will in a variable percentage of cases, the method of extraction varies according to the position of the lens when the rupture occurs. If the lens has already tumbled, it may often still be delivered in toto by taking another larger grasp with the forceps. If it has not started tumbling, the nucleus should be expressed and as much as possible of the cortex removed by irrigation. Then, if the eye is "soft," the residual capsule can usually be removed, without appreciable danger of rupturing the anterior hyaloid membrane, by sliding Arruga forceps in with the faces of the blades *parallel* to the iris plane and grasping the capsular remnants (fig. 1). Removal of capsule is then often facilitated by using two Arruga forceps, taking successive bites in the capsule as it is pulled out through the incision. If there is any pressure on the eye, with apparent danger of vitreous loss, residual capsule had best be left alone. An iridectomy is not necessary.

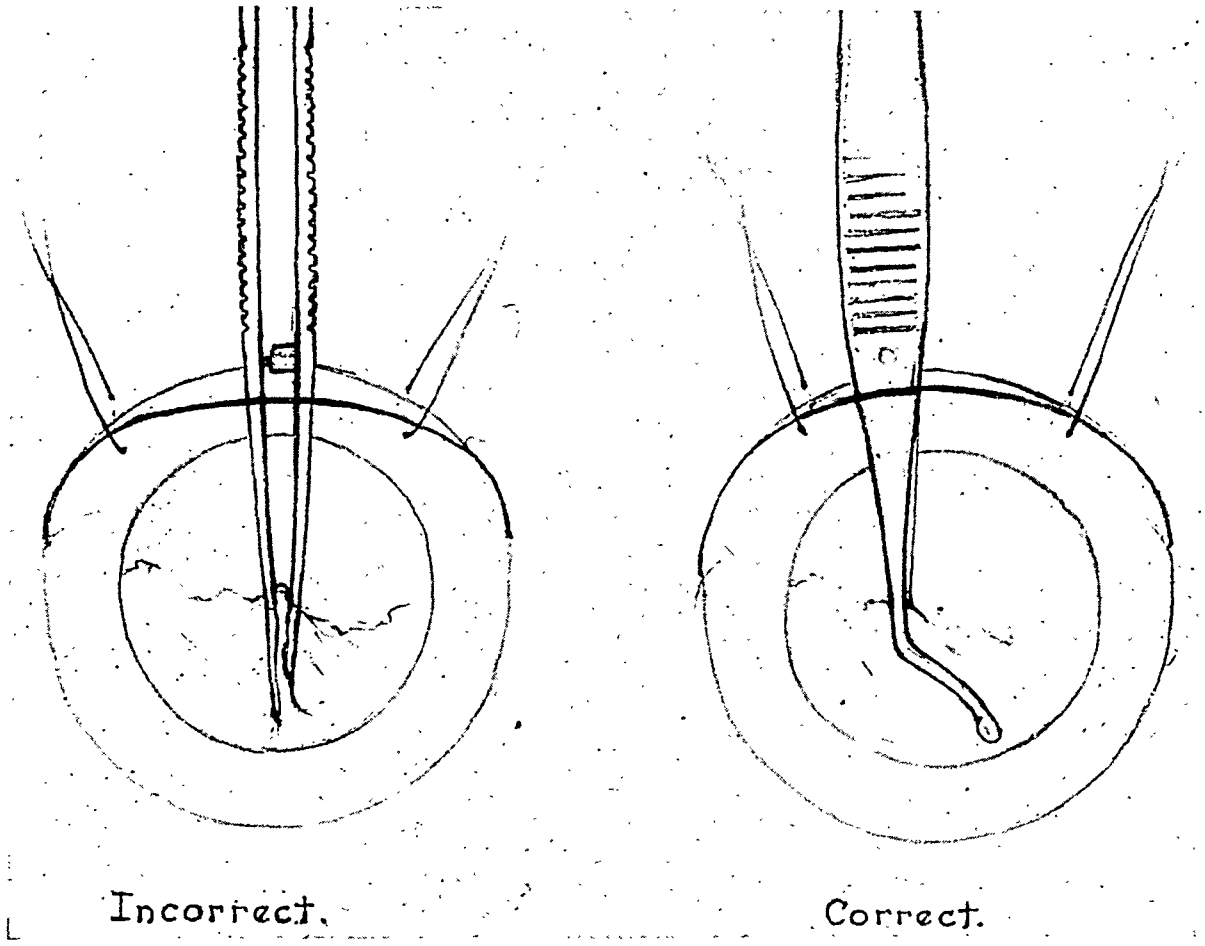


Fig. 1 (Guyton). Removal of capsular remains after rupture of lens capsule.

C. Vitreous loss plus rupture of capsule

If the lens capsule ruptures and vitreous begins to emerge at about the same time, the iridectomy usually should be completed. Lens material should then be removed by means of forceps and/or spoon, avoiding irrigation. The bulk of the lens material must be removed, but it is not advisable to

remove all lens capsule if such a maneuver can only be accomplished at the expense of much loss of vitreous. The corneoscleral sutures should then be tightened as quickly as possible, the iris pillars reposited, and judicious prayer indulged in.

D. Difficulties with section

Care should be taken immediately preceding section that the superior rectus suture has not been placed improperly and has not slipped.

With the assistant fixing the globe, it is quite rare that a suture is cut with a Graefe knife. If one or both sutures are inadvertently cut, the sutures are simply reinserted before the lens is delivered.

If the knife is tilted improperly, or if it has a defective blade which prevents it from cutting smoothly, aqueous may be lost before the counterpuncture is made and the point may become entangled with iris, back of cornea, or even lens. In this event, the knife should be removed, the chamber filled with air, and the section started over again. The same remedy should apply if a Graefe knife is carelessly inserted backward.

The anterior chamber may collapse after the counterpuncture but before the section is completed, with prolapse of iris in front of the knife (1) if the surgeon tilts the knife improperly and allows aqueous to escape too soon, or (2) if there is excessive orbital "pressure."

In the former instance, the iris can either be milked back over the edge of the knife or the chamber can be filled with saline or air with the knife in place. The section can then be completed without cutting the iris.

In the latter instance, a stream of saline directed along the knife may keep the iris out of the way or it may be necessary to remove the knife and complete the section with scissors. Stevens' scissors, inserted with the curve *downward,* are preferable for completing or enlarging a section. It is never necessary to go ahead and cut the iris with the knife.

E. Expulsive hemorrhage

An explusive hemorrhage during operation almost always results in loss of vision, with such disorganization of the globe that it should be enucleated as soon as permission can be obtained. Only extremely rarely can an eye be saved by immediately tying the corneoscleral sutures and evacuating the choroidal hemorrhage through a posterior sclerotomy several days later.

F. Partial dislocation of lens before it is grasped

Very occasionally the lens will partially dislocate at the time of the section, before the forceps are applied. This may be accompanied by spontaneous prolapse of vitreous into the anterior chamber. In this case it is best to perform a complete iridectomy and remove the lens with an erisophake and/or loop.

G. Complete posterior dislocation of lens

With extreme rarity an intact lens may dislocate completely and sink into the back of an eye. This occurs only if the vitreous is fluid. Such an eye is best closed without attempting to remove the lens. The lens can be removed later if the eye remains irritated. If removal is necessary, it may be possible to trap the lens in the anterior chamber, or it may be necessary to remove it by means of irrigation and a loop or a hook, or even by opening the eye and then turning the patient face downward while extracting the lens. If the lens capsule is ruptured, a posteriorly dislocated lens should be removed immediately.

H. Bleeding into the anterior chamber

Bleeding into the anterior chamber during operation generally occurs before delivery of the lens. The blood comes either from the incision or from a small iridodialysis. In either event, the bleeding should be allowed to stop completely and the blood removed from the anterior chamber before the

lens is delivered. Hemorrhage is rarely a result of inadvertently grasping iris with the intracapsular forceps and tearing the iris root, or from too forcible use of a spatula for reposition of the iris.

I. Incarceration of iris in incision

If the corneoscleral sutures are tightened before the iris is reposited, strands of iris are likely to be drawn into one or more of the suture tracts. The iris should be smoothed back into place before the sutures are actually tied. Care should be taken to free the iris strands with a spatula; otherwise the pupil will subsequently be "peaked."

J. Distribution of iris pigment

If considerable iris pigment is dislodged during an otherwise uneventful extraction, the anterior chamber should be irrigated gently.

Postoperative management

Eserine (¼-percent solution) is instilled once or twice, and a monocular dressing with shield is applied. If there has been rupture of the lens capsule, or if the patient has any chronic injection of conjunctiva or lid margins, an antibiotic is administered systemically as a prophylactic measure for several days. He is allowed out of bed the day of operation. Atropine (1-percent solution) is instilled the day following operation and the pupil is kept about medium size thereafter until the aqueous ray is negative.

The corneoscleral sutures are removed not earlier than the 11th postoperative day. After thoroughly anesthetizing the eye with instillations of 4-percent cocaine solution, the knot of each suture is cut with the sharp tip of iris scissors, with the scissors pointed upward, before the suture is grasped with forceps. If the patient has a tendency to squeeze the eye, removal of the sutures is delayed a week or longer. Induction of akinesia by means of an O'Brien block is occasionally advisable.

If vision in the other eye is very poor, a temporary lens is prescribed within two weeks after operation.

Postoperative complications

A. Infection, uveitis, lens sensitivity

These three complications are grouped together because a clear-cut distinction between them is not always possible.

A purulent infection will rarely develop around a corneoscleral suture. It is manifested by infiltration around the suture and is an indication for immediate removal of the suture, plus antibiotics. Failure to remove the suture promptly may lead to purulent endophthalmitis.

Purulent endophthalmitis may occur without relation to sutures, apparently from introduction of bacteria into the eye at the time of operation. Only a few years ago almost all eyes with postoperative purulent endophthalmitis were lost. The majority are now saved by the use of antibiotics.

The terms postoperative "uveitis" or "iritis" indicate merely a nonpurulent intraocular inflammation. Such inflammation may result either from undue traumatism, imperfect healing, or a very low-grade infection. Antibiotics are rarely beneficial for these nonpurulent inflammations, but foreign-protein therapy often appears to help.

Lens sensitivity may develop if there is retained lens cortex. There is considerable evidence that the development of sensitivity is dependent on a low-grade infection, but this is not altogether clear. Lens sensitivity does not develop until at least six days after operation. It is manifested by marked inflammation of the anterior segment, with gradual formation of a cyclitic membrane. The patient usually shows a positive skin reaction to 0.1 cc. of 2-percent lens protein injected intracutaneously. Such a skin test should be read 48 hours after injection.

If development of lens sensitivity is recognized early, the eye should be opened and the retained lens material removed as completely as possible with forceps, regardless of vitreous loss. In any event, the patient should

be desensitized. For this purpose, injections of 0.1 cc. of 2-percent lens protein plus staphylococcus toxin are given twice a week. The concentration of staphylococcus toxin employed depends on the patient's reactivity to test doses; a 1:100 dilution is most frequently used. Desensitization is carried out for at least six weeks prior to extracting a cataract from the other eye, as prophylaxis in case its capsule ruptures.

B. Glaucoma

Glaucoma following cataract extraction may result from postoperative uveitis or from extensive anterior synechias. Such synechias may result if the anterior chamber remains flat for a few days during the healing period. Collapse of the chamber is uncommon with the use of two corneoscleral sutures, but it very occasionally does occur, usually with an associated combined detachment, at any stage before the sutures are removed and especially at the time they are removed. If it remains collapsed for as long as three days, it should be reformed with air.

If postoperative glaucoma cannot be controlled with drugs, the operation of choice should usually be a cyclodialysis.

C. Anterior-chamber hemorrhage

A postoperative anterior-chamber hemorrhage usually results from rupture of newly formed capillaries in the healing incision. It may occur at any time within 2 or 3 weeks after operation, usually in 4 to 6 days. Such hemorrhages almost always clear completely, but some blood usually seeps into the vitreous and absorbs rather slowly. Blood should be evacuated from the anterior chamber only if it fills the chamber, has definitely clotted, and shows no appreciable absorption after 3 or 4 days.

D. Detachment of retina

A simple detachment of the retina is considerably more common in an aphakic than in a phakic eye. Hughes and Owens found it occurred 10 times as often after marked loss of vitreous as after no vitreous loss, but no more often following intracapsular extractions than following extracapsular extractions. The prognosis for reattachment of the retina in an aphakic eye is not as poor as is widely believed. Almost 30 percent of such retinas can be reattached with one diathermy operation, and almost 30 percent of those reoperated can be reattached with a second operation.[8]

E. Prolapse of iris

Iris prolapse is extremely rare if two properly placed corneo-scleral sutures are used. It is no more frequent with merely a peripheral iridotomy than with a full iridotomy. If an iris prolapse is small and is completely covered with conjunctiva, it need not be repaired. If it is large or not covered with conjunctiva, it should be excised as soon as it occurs and an additional corneoscleral suture inserted.

F. Capsular remains, occlusion of pupil, displacement of pupil

If the lens ruptures and there is retained capsule, the capsular remains may be dense enough to require a discission or capsulectomy as soon as absorption of lens cortex is obviously complete. Even more frequently, a retained posterior capsule which is initially transparent may in later years develop Elschnig bodies and require a discission.

Postoperative uveitis may result in an occluded or displaced pupil, or incarceration of iris or vitreous in the incision may cause the pupil to be grossly displaced. In such instances, a central pupillary opening may have to be made with a discission knife or with scissors.

G. Rupture of anterior hyaloid membrane

Over 50 percent of patients who have round-pupil intracapsular extractions develop a break in the anterior hyaloid membrane some months after operation. The incidence is lessened if the pupil is kept me-

dium-sized and mobile, instead of widely dilated, during convalescence. Usually the rupture causes no symptoms, but occasionally it produces transient signs of mild iritis and vitreous opacities. In such a case, the pupil should be kept dilated for a few weeks.

H. Miscellaneous

Gaping of the incision and/or filtering bleb is so rare with two corneoscleral sutures as to be of no real significance. We have never seen epithelization of the anterior chamber following an extraction with even one corneoscleral suture.

Striate keratitis rarely persists more than a few days after operation, but persistent striate keratitis and/or epithelial edema occasionally results if there was preëxisting endothelial dystrophy of the cornea, undue traumatism to the posterior surface of the cornea, or loss of vitreous. Epithelial edema may sometimes be partially alleviated by the use of a 5-percent sodium-chloride ointment.

Development of drug sensitivity, especially to atropine, is annoying but seldom of real importance; local use of one of the antihistamine compounds, such as 2-percent pyribenzamine ointment, is of value in controlling the reaction. Excessive astigmatism can result from improper coaptation of the incision. Sympathetic ophthalmia is extremely rare.

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CENTRAL CONTROL OF INTRAOCULAR PRESSURE BY ACTIVE PRINCIPLES*

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In a previous publication[1] we submitted experimental evidence to indicate the presence of a diencephalic center or centers which exercise a regulating control of intraocular pressure. The nature of this regulation is the subject of the present paper.

It was noted in some of our preliminary investigations that spinal fluid appeared to exert a variable action upon intraocular pressure. Exposure of the animal either to light or to darkness was one of the environmental factors which determined the change. A cyclic variation of tension in man during day and night has been observed by Thiel,[2] Schoenberg,[3] and others. The tension was found to fall during the day and to rise at night. Duke-Elder[4] suggested as possible causes the effect of extraocular muscles, the pumping action of the ciliary muscle on the scleral spur, redistribution of blood, and change in its osmotic value.

Exposure of eyes to light has been shown to result in a fall of tension, whereas, darkness induced an increase. The mechanism for this effect has been ascribed to constriction and dilatation of capillaries.[4] On the basis of these, as well as our, observations, we decided to investigate the relationship of light and dark exposure to changes in intraocular pressure and to diencephalic centers.

MATERIALS AND METHODS

Rabbits and ducks were the subjects used in these experiments. The intraocular pressure was determined tonometrically. Two of the rabbits had congenital hydrophthalmus. All the other animals were normal and varied from 14 months to 2 years of age. The animals were exposed for 4 hours to bright daylight in addition to a 300-watt bulb placed 50 cm. from the cage. In producing dark adaptation, the animals were kept for 12 to 15 hours in total darkness. Volumes of 0.5 to 0.7 ml. of spinal fluid from rabbits and 3 to 6 ml. from people with light and dark adaptation were injected intravenously into rabbits. Intraocular pressure was determined at 10-minute intervals for 1 hour. In a small number of experiments, aqueous humor from rabbits' eyes was injected intravenously, and crude water extracts of the anterior and posterior lobes of rabbit pituitary gland was administered subcutaneously. These rabbits were exposed either to light or to darkness.

In order to determine the variations of tension to light and to darkness, 10 normal rabbits were placed in total darkness and then exposed to light on 26 occasions. The intraocular pressure was determined under similar conditions in two normal ducks and in two hydrophthalmic rabbits.

RESULTS

The intraocular pressure was increased in normal rabbits transferred from total darkness to bright light. In most instances, the increase consisted of 3 or more millimeters of mercury, which was considered a significant change.[5]

In normal ducks, the intraocular pressure decreased upon exposure to light from darkness. The decrease was of 3 or more millimeters mercury. The ducks reacted in a manner similar to man. A reverse reaction had taken place in rabbits (Table 1).

In rabbits with congenital hydrophthalmus, there were no significant changes in tension upon exposure to light. The tension became increased in 3 out of 16 experiments.

When spinal fluid was obtained from rab-

* From Toledo Hospital Institute of Medical Research. This work was supported by a grant from the Snyder Ophthalmic Foundation.

† Research Ophthalmologist of the Snyder Ophthalmic Foundation.

TABLE 1

CHANGES IN INTRAOCULAR PRESSURE DUE TO LIGHT ADAPTATION*

Type of Animal Tested	Number of Animals	Number of Experiments	Range Tension in Darkness in mm. Hg	Range Tension in Light in mm. Hg	Difference in Tension between Dark and Light	
					Number of Experiments	Tension
Normal rabbits	10	52	10 to 28	19 to 31	41 11	+3 to 8 0 to +2
Hydrophthalmic rabbits	2	16	11 to 25	11 to 23	7 6 2 1	0 − 3 +10 + 3
Normal ducks	2	15	15 to 23	11 to 17	1 5 9	− 2 − 3 −4 to −7

* Conclusion: In adapting itself from darkness to light, the intraocular pressure rises in normal rabbits, is unaffected to some extent in rabbits with congenital hydrophthalmus, and is decreased in normal ducks

bits exposed to bright light and the fluid was injected intravenously into other rabbits, the tension became elevated 3 or more millimeters of mercury in most of the animals. On the other hand, spinal fluid obtained from rabbits kept in total darkness produced a reduction of tension.

Spinal fluid from people exposed to bright

TABLE 2

EFFECT OF INTRAVENOUS INJECTION OF SPINAL FLUID UPON INTRAOCULAR PRESSURE OF RABBITS*

Nature and Source of Spinal Fluid	Number of Experiments	Range of Tension in mm. Hg Before Injection	Range of Tension After Injection of Spinal Fluid	Difference in Tension Before and After Injection of Spinal Fluid	
				Number of Experiments	Tension
From rabbits exposed to light	14	15 to 25	15 to 29	9 3 2	+3 to 7 +1 to 2 0
From people exposed to light	6	21 to 31	16 to 25	1 4 1	−3 −6 −8
From people exposed to darkness	14	15 to 24	19 to 29	1 2 6 3 2	+7 +5 +4 +3 +2
From rabbits exposed to darkness	22	18 to 29	16 to 24	2 9 7 2 2	−5 −4 −3 −2 0

* Conclusion: Spinal fluid contains active principles which increase or lower intraocular pressure. Exposure to light or darkness is a factor which determines an excess of one or the other of the active principles. Spinal fluid from people has a reverse effect to that from rabbits.

light reduced the intraocular pressure in rabbits. Fluid obtained from people kept in darkness induced an elevation of tension in rabbits (Table 2).

Crude water extracts of the anterior lobe of the pituitary gland were injected into rabbits subcutaneously. The anterior-lobe extract of animals kept either in darkness or exposed to light showed an increase in tension in most of the experiments. There was no selective action. On the other hand, extracts of the posterior lobe of rabbits exposed to light increased the tension while extract of animals kept in darkness decreased it (Table 3).

The aqueous humor was removed from a number of rabbits kept either in darkness or in bright light. The humor was injected intravenously into other rabbits. No significant changes in tension took place.

Discussion

The experiments outlined in this paper indicate that there is a secretion of two active principles, probably by the posterior lobe of the pituitary body. One of the principles serves to raise and the other to lower intraocular pressure. The principles are secreted into the spinal fluid, apparently in in such quantities as to produce a balanced action upon tension. The experiments also indicate the influence of light and darkness in inducing greater secretion of one or the other of the active principles.

TABLE 3

EFFECT UPON THE INTRAOCULAR PRESSURE OF CRUDE EXTRACTS OF ANTERIOR AND POSTERIOR LOBES OF THE PITUITARY BODY REMOVED FROM RABBITS EXPOSED EITHER TO LIGHT OR TO DARKNESS*

Nature of Crude Extract of Pituitary Body	Number of Experiments	Range in mm. Hg of Intraocular Pressure Before Subcutaneous Injection of Crude Extract	Range in mm. Hg of Intraocular Pressure After Injection of Crude Extract	Difference in Tension Before and After Injection	
				Number of Experiments	Tension
Anterior lobe of rabbits exposed to light	10	15 to 24	20 to 26	1 3 1 4 1	+7 +5 +4 +3 +1
Anterior lobe of rabbits exposed to darkness	8	18 to 27	22 to 29	1 3 2 2	+10 +5 +3 −2 to −4
Posterior lobe of rabbits exposed to light	12	17 to 25	20 to 28	1 1 4 3 1 1 1	+7 +6 +5 +3 +2 +1 0
Posterior lobe of rabbits exposed to darkness	14	18 to 27	15 to 25	1 2 3 3 3 2	−6 −5 −4 −3 −2 −1

* Conclusion: These experiments with crude extracts suggest that the posterior lobe of the pituitary body secretes active principles which alter intraocular pressure in response to exposure to light or darkness.

Based in part on experiments reported previously,[1] as well as on the work in this paper, and partly on investigations still to be published, the mechanism of action of the active principles upon intraocular pressure has been formulated.

The mechanism consists of secretion of active principles, probably by the posterior lobe of the pituitary body. It is not unlikely that other areas in the region of the posterior lobe may be concerned with production of these principles. The active principles are thrown into the spinal fluid of the third ventricle and affect the autonomic diencephalic centers. The stimuli travel in the diencephalon and along the autonomic fibers to the eyes,[1] inducing among other effects either a dilatation or constriction of capillaries depending on the predominance of the type of active principle. Other investigators had demonstrated repeatedly[6-8] that a rise in intraocular pressure is associated with dilatation of capillaries and dark adaptation, whereas, a fall in tension follows capillary constriction and light adaptation. Feigenbaum[9] and others showed that changes of intraocular pressure in response to exposure to dark or light are not related to pupillary motility. Others workers failed to find any relationship to accommodation.

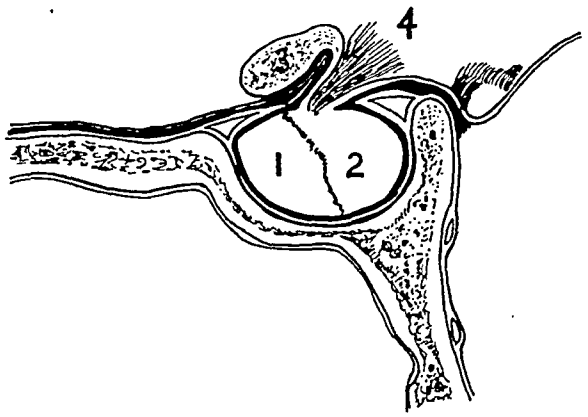


Fig. 1 (Schmerl and Steinberg). Anatomic relationship of the optic chiasma to the pituitary gland. (1) Anterior lobe of hypophysis. (2) Posterior lobe of hypophysis. (3) Optic chiasma. (4) Infundibulum. (After Gray's *Anatomy*, Philadelphia, Lea and Febiger.)

The mechanism of conduction of light and dark impulses from the retina to the posterior lobe may be explained on the basis of anatomic contiguity between the optic apparatus and the posterior lobe of the pituitary body (fig. 1) which, together with the tuber cinereum and the mammillary bodies, compose the hypothalamus.

Summary

Spinal fluid contains active principles, one of which increases and the other reduces intraocular pressure. Exposure of eyes to light or darkness is one of the factors which determines the quantitative secretion of one or the other of the active principles. On the basis of suggestive experiments, it is postulated that the active principles are secreted by the posterior lobe of the pituitary gland. These experiments indicate the probability that some forms of glaucoma may be induced by a disorder of the secretory mechanism of the active principles.

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THE USE OF PLACENTAL EXTRACT IN THE TREATMENT OF HERPETIC KERATITIS AND SUPERFICIAL PUNCTATE KERATITIS*

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In therapeutics, the use of a homologous substance is rare. Most medications are plant extracts, minerals, or tissues of heterologous origin, rather than human tissue. An easily obtainable homologous tissue, one which contains a great number of important factors, is the human placenta. The placenta contains hormones, vitamins, enzymes, and antibodies in addition to many other factors. A tissue extract made from many pooled placentas contains a great variety of all these substances.

FILATOV'S WORK

Filatov[1] and his co-workers have reported the use of various types of tissues and tissue extracts. His work based on his theory that:

Tissues, which have been stored and treated under certain conditions, showed impaired viability, but these tissues became rich in substances which stimulate biochemical processes and regeneration. These substances have been called biogenic stimulators. The exact nature of these stimulators is unknown to us so far. These substances, when introduced into a diseased organism stimulate the regenerative processes of the organism and the pathologic processes diminish or disappear.

Filatov has reported the use of such extracts in a great variety of conditions. He has stated that they are especially valuable in such ocular diseases as retinitis pigmentosa, keratoconus, and optic atrophy.

The purpose of this paper is to make a preliminary report on the production and clinical uses of placental extracts. The work on which this paper is based has already occupied a year and a half, but it can be regarded only as ground work. Much remains to be done. To date we have been concerned with the following problems:

1. To break down the tissue extract into its component factors.
2. To determine, if possible, the nature of the biogenic stimulator.
3. To corroborate the work of Filatov.
4. To determine the effects of the use of tissue extracts on conditions not previously treated by this method.

PART I: PREPARATION OF PLACENTAL EXTRACTS

The technical method of the preparation of aqueous placental extract used in this investigation is essentially based on the method proposed by Filatov for the extraction of biogenic stimulators from homologous tissue. The biochemical work of making the various extracts was done by Dr. Edgar L. Milford of the Lederle Laboratories. An attempt was made to obtain uniform extracts in order better to evaluate the clinical results. The placental extract was first broken down into four factors:

* From the Eye Clinic of the New York Eye and Ear Infirmary. Read at the New York Society for Clinical Ophthalmology, May 5, 1947.

1. Aqueous extracts—containing water-soluble vitamins and hormones and most likely the biogenic stimulator.

2. Lipoid extract—containing cholesterin and lecithin.

3. Immune-gamma globulin—containing many antibodies found in human blood, and because of its pooled nature containing a greater variety.

4. Tissue coagulant—containing a factor which lowers the blood-clotting time.

Preparation of aqueous placental extract

Normal full-term placentas are transferred immediately after expulsion under aseptic precaution to sterile containers and placed in a freezer at 2°C. to 4°C. Only placentas from women with negative tests for syphilis and free from toxemia of pregnancy or any other disease transmissible by blood are used. The placentas are kept at 2°C. to 4°C. for two weeks prior to processing. After removal of blood clots and umbilical cord, the placentas are coarsely ground. The ground tissue is mixed with sterile distilled water in the proportion of 500 cc. per 450 gm. of placental mass. The mixture is stirred for one-half hour and then heated to 37°C., and the heat is maintained at that point for one hour. The mass is stirred constantly during the heating process. With the use of a hydraulic press at 70-tons pressure, the liquid portion is separated from the finely ground placental pulp and from coagulin formed during heating. The partly clarified extract is then sterilized by filtration through a 10-pound Mandel filter. This method of sterilization was judged less likely to effect the active principle than tyndallization in the event that the principle was thermolabile.

The stability of the extract being unknown, it was thought best to store the extract under conditions which have proved effective in minimizing the potency loss of other unstable biologic products. It was, therefore, concentrated into a dry powder, which was stored at 4°C. and used as the standard source of all therapeutic preparations in the investigation.

The aqueous extract found most satisfactory for clinical use was prepared by using 1 gm. of powder for 100 cc. buffered saline. The mixture was shaken and then dialized under aseptic precautions against three changes of saline. The protein content after sterile filtration was 4.9 percent. The extract was preserved by the addition of small quantities of phenol, which on comparative clinical studies was shown to have no effect on its potency. The clinical results obtained and reported in this paper are based on this dialized preparation.

It is interesting to note that the apparent effects of the extracts are consistently much greater when the placentas are first solidly frozen and stored for two to three weeks prior to processing than when the placentas are processed immediately after delivery. This seems to be in accord with Filatov's findings as to the importance of so-called unfavorable but not fatal conditions, such as storage at low temperature, in the development of biogenic stimulators.

The extract was also tested for its titers of immune antiviral and antitoxic bodies, before and after drying and heating. The overall diphtheria antiviral antibodies and influenza-A and B strains were less in the heated and vacuum-desiccated extract than in the original. Comparative fractional precipitation tests with ammonium sulfate showed that heating under the conditions described removed practically all the low beta globulins; whereas, gamma globulins and albumin were not affected.

It is also of interest to note that, despite prolonged dialysis against buffered saline, no appreciable loss of effect was found. This indicates that the active principle is probably in a colloidal condition or bound to a colloidal carrier.

Further attempts will be made to fractionate this standard extract with the view of recovering the active principle in some one fraction, which will be submitted to chemical

studies. The results obtained will be published at some later date.

Preparation of the lipoid extract

The lipoid extract was prepared in two fractions—ether and acetone soluble and acetone insoluble. The ether-acetone soluble fraction, which probably contains cholesterin, Factor A, was suspended in almond oil in 25-percent strength. This mixture was sterilized by passing it through a Sietz filter. The ether-acetone soluble fraction, found to contain mostly lecithin, was not used clinically because of the severe reactions it caused when injected intramuscularly in rabbits.

Preparation of immune globulin

This process will be described in detail in a paper to be published in the Journal.

To summarize briefly. Gamma globulins comprise about 11 percent of the plasma proteins and are found primarily in Fraction II, to a smaller extent in Fraction III.

Clinical interest in gamma globulin lies not in its physical constants, but in the fact that many of the antibodies elaborated by the defense mechanisms of the body are concentrated in this fraction.

Preparation of placental-tissue coagulant

The placental tissue coagulant is prepared essentially according to the method published by McKhann[2] in the *Journal of Pediatrics* for the treatment of hemophylia.

After placental tissues have been subjected to exhaustive saline extraction to obtain the immune globulin, the residue is extracted with cold phenolized saline at a temperature of 10°C. The pH of the mixture is adjusted to 9 with N/1NaOH, put through a homogenizer and allowed to stand in a cold room at 10°C. for 12 hours. The coarse placental tissue is separated from the extract with the use of a hydraulic press. The effluent is clarified by centrifugation through a Sharpless centrifuge. The clarified extract is precipitated at its isoelectric point (pH 5) by addition of N/5 hydrochloric acid, drop by drop, under constant mechanical stirring. The precipitate formed is allowed to settle in the cold room. It is suspended twice in acidified cold distilled water (pH 5.2). When the supernatant is colorless, the final precipitate is collected by centrifugation, then dissolved in weak sodium-hydroxide solution containing 0.5-percent NaCl The pH of the coagulant solution is adjusted to 7.5. This solution is centrifuged and sterilized by being passed through a medium Berkefeld filter.

The final coagulant solution in 1-cc. quantity will clot 1 cc. of reclarified horse plasma, with a control time of 10 minutes, in one minute. This test is used for determining the potency of the coagulant. The protein content of the final extract is about one percent.

Part II: Clinical report

This report presents the results of the work done with the various placental extracts in the treatment of a variety of ocular diseases. Twenty-four patients were treated at various times with some one or several of the extracts described in Part I of this paper. The results obtained indicate that the aqueous extract may be of value in the treatment of virus diseases of the cornea. Indications also exist that immune globulin may prove of value in the treatment of uveitis.

Aqueous placental extract in superficial punctate keratitis

Gratifying results were obtained with the use of aqueous extract in both superficial punctate keratitis and in herpetic corneal lesions. Six cases were treated in this group. It would seem to me most valid to assume that the presence of the biogenic stimulator in the aqueous extract gave impetus to the regenerative processes of the cornea. The assumption that the results were obtained because of the presence of antibodies in the placental extract seems to me untenable. The use of the concentrated gamma globulin failed to produce any improvement.

Four patients with superficial punctate

keratitis were treated with the aqueous placental extract described in Part I. The patients responded very favorably. Of the patients in this group, three had a permanent recovery after the injection of 3 to 5 full doses of the aqueous extract. They showed no recurrences upon subsequent examinations over a period of a year. These patients had previously failed to respond to local therapy, foreign-protein therapy, or administration of vitamins—all of which had been used over a period of one month. The third patient required more extended therapy but is now symptom free for as long as four months at a time.

The dosage of the aqueous extract depends upon the concentration. As of this writing, 2 cc. of concentrated solution is given intramuscularly.

Case reports

Case 1. Mrs. C. G., aged 45 years, consulted me first on April 25, 1946, complaining of recurrent attacks of pain of the right eye following an injury three months previously. A diagnosis of superficial punctate keratitis was made. The patient was treated locally until June 10, 1946, with some improvement but with frequent recurrences. She then received three full doses of the aqueous extract and by the 24th of June, the cornea no longer stained. Subsequent examinations did not show any staining nor reveal any recurrence.

Case 2. Mr. R. M., aged 42 years, consulted me on June 1, 1946, giving a history of recurrent attacks of pain, photophobia, and blurring of the vision of the left eye, of several months' duration. A diagnosis of superficial punctate keratitis was made. The patient received local therapy until June 17, 1946, without any improvement. Aqueous placental extract therapy was then instituted, and he received four full doses. By July 8, 1946, his lesions had healed and subsequent examinations revealed no other lesions.

Case 3. Miss R. B., aged 16 years, was referred from the service of Dr. Raymond E. Meek of the New York Eye and Ear Infirmary. The patient had first consulted clinic on April 26, 1946, giving a history of lesions of one year's duration. A diagnosis of bilateral superficial punctate keratitis was made. Prior to the injection of placental extract, she had received every local therapy known or suggested—foreign proteins, vitamins, iontophoresis, and thyroid extract because of her low basal metabolism. Her lesions disappeared for the first time after the injection of three full doses of the aqueous placental extract. The recovery in this case has not been permanent, but the patient has been symptom free for as long as four months. When she does have a recurrence, she receives one or two injections of extract and again remains symptom free for several months.

Case 4. Miss M. M., aged 30 years, consulted me first on October 1, 1947, with a history of recurrent attacks of redness of both eyes lasting from 4 to 5 days and occurring 3 to 4 times a month. She had received various types of local therapy including a series of desensitization injections by another ophthalmologist for a period of one year. Two injections of 1 cc. of the aqueous placental extract healed the condition within 48 hours. Since this case is rather recent no definite conclusions can be drawn so far, but it does suggest that this therapy is effective in producing rapid healing of corneal lesions.

Aqueous placental extract in herpetic keratitis

In both of the cases treated for herpetic corneal lesions, the lesions were completely healed after several full doses of the concentrated extract. These patients had previously failed to respond to any local therapy including the use of ether. One of these cases was referred by another ophthalmologist specifically for treatment with this extract. The patient had failed to respond to a course of treatments which extended over a period of six months and included iodine applications to the cornea and repeated curettage.

Case reports

Case 1. Mr. S. R., aged 70 years, consulted me on November 18, 1946, giving a history of local treatment for herpetic keratitis for 5 to 6 months. The treatment had been unsuccessful and he had had many recurrences. The first injection was given on November 14, 1946. On November 25, 1946, there was no longer any staining, and since then there has been no recurrence.

Case 2. Mr. M. A., aged 54 years, consulted me on March 23, 1946. A diagnosis of herpetic keratitis was made. Local treatment was given until September with constant recurrences. He was then given a series of placental-extract injections and, on September 24th, there were no staining areas. Two months later, this patient had a recurrence which was again treated with the extract. This cleared up shortly and to date there has been no further recurrences of the condition.

Other experiments with placental extracts

Aqueous placental extract was used in the treatment of retinitis pigmentosa. It cannot be said that the results obtained in this disease were as good as those reported by Filatov and his co-workers. They are, nevertheless, worth reviewing here.

Retinitis pigmentosa

Six cases of retinitis pigmentosa were treated over a period of one year. All received intramuscular injections of the aqueous placental extract and the lipoid extract.

Careful visual fields were done, and the visual acuity was recorded for each of the six patients prior to the use of these extracts. These examinations were repeated at frequent intervals during the course of the treatments. Whereas, Filatov reported increased visual acuity and enlargement of the visual fields as a result of his treatments, not one of the patients treated by me showed either one of these improvements at any time. What they did seem to show after injections of the extract was an apparent arrest of the deterioration. Although this is no criterion, since many patients continue for years without change, it has some significance. Two of the patients reported here had been under my care for at least a year prior to treatment with placental extracts and had shown exceedingly rapid deterioration of both visual fields and visual acuity. Examination showed an arrest of the disease upon treatment. These two patients, whose subjective evaluations are trustworthy, report also some improvement in night vision.

An attempt was made to treat all these patients with lipoid extract. The use of this extract was based on Filatov's findings that cod-liver oil injections were as effective as aqueous placental extract. If this is correct, it would indicate that the active principle would be of a lipoid nature rather than of a protein nature. The lipoid extract was prepared to test this assumption. However, the local reactions upon injection were so severe, that the use of the lipoid extract had to be discontinued until it could be refined.

Other conditions treated

In the hope that the presence of the biogenic stimulator might be of some benefit, the placental extracts were tried on four types of eye conditions whose treatment is unsatisfactory. Placental-extract injections were given in cases of old corneal opacities, tuberculous episcleritis, diabetic retinopathy, and macular edema as a result of angiospasm of a branch of the central retinal artery. None of the patients treated for these conditions showed any improvement or change in their condition as a result of the injections.

An important question to be answered is whether the effects obtained with the placental-extracts injections can be ascribed to the foreign protein in the extracts. The evidence would seem to contradict this possibility. Each of the patients who showed improvement upon injections of placental ex-

tracts, had previously received foreign-protein therapy without any improvement. It might be noted that the aqueous extract contains only 4.9-percent protein; whereas, foreign proteins are usually used in much higher concentrations. It is most likely, therefore, that the results obtained are due to some other factor, which is probably the biogenic stimulator.

Use of placental-tissue coagulant

One more placental extract at least warrants mention at this point—placental tissue coagulant, which lowers the blood clotting time. Its use has been demonstrated by McKhann in the treatment of hemophylia. Since hemorrhage is a well-known complication in surgery on diabetics, it was my theory that such an extract should be useful in this connection. I have used it prior to surgery, in two cases, with good results. The clotting time was lowered from 4½ to 1½ minutes in one case and from 3½ to 1½ minutes in the other. Both operations, a cyclodialysis and a cataract operation, were performed with a minimal amount of hemorrhage. Further use of placental-tissue coagulant has been temporarily suspended, however, until the side effects can be examined and studied in greater detail.

Summary

The preparation of aqueous placental extract, lipoid extract, and placental-tissue coagulant is described. A preliminary report on the use of aqueous placental extract in the treatment of herpetic keratitis and superficial punctate keratitis is given. The favorable results obtained in the treatment of these diseases indicate the need for further clinical investigation with a larger group of cases.

The favorable treatment of retinitis pigmentosa with placental extract, as reported by Filatov, was not corroborated by the results obtained.

Old corneal opacities, tuberculous episcleritis, diabetic retinopathy, and vascular changes in the retina, did not respond to treatment with placental extract.

Placental-tissue coagulant was used preoperatively to lower the blood-clotting time in diabetics.

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END RESULTS IN RETINAL DETACHMENT

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The retina as a whole is not involved in retinal detachment, but a cleavage occurs between the two primitive retinal layers, with the pigment epithelium remaining in position attached to Bruch's membrane, while the inner retinal layers become separated from it.

The retinal pigment epithelium originates from the outer neurodermal layer of the embryonic optic cup. The remaining layers of the retina arise from the embryonic inner neurodermal layer. Thus, in retinal separation, the inner layer becomes displaced from the outer layer, allowing the potential space to become an actual space.

CLASSIFICATION OF DETACHMENTS

All retinal detachments may be classified as secondary and the cases of idiopathic detachment are probably caused by inflammatory or degenerative changes. Terry,[1] in examining microscopic sections of eyes, classified separated retina into four general types: (1) Retinal separation with typical hole in retina, arising from trauma. It may be associated with mild uveitis. (2) Retinal separation that arises from exudation under the retina. (3) Retinal separation with uveal melanomas. (4) Retinal separation with myopia.

INJURIES CAUSING DETACHMENT

The types of injuries causing retinal detachments are: (1) Direct injuries to the eye, including perforating wounds, intraocular foreign bodies, and contusions. (2) Indirect injuries to the eye, such as blows and contusions on the head.

Duke-Elder[2] states that the choroid is more easily ruptured than the healthy retina, and the normal eye can stand the most severe trauma involving even rupture of the sclera and the loss of vitreous without the occurrence of a detachment. We have seen a great many more tears of the choroid in war injuries than tears of the retina.

Severe inflammatory lesions have been recognized as etiologic factors in retinal detachment for a long time. It is only comparatively recently that a mild equatorial and anterior choroiditis has been considered as a precipitating factor in retinal detachment. In these cases, the detachment is due either to the formation of exudative subretinal fluid, to traction by fibrous tissue, or to shrinkage of the globe. In war injuries, we have seen severe vitreous hemorrhages which, by contracting fibrous bands, produce detachments as a late sequela.

INCIDENCE OF RETINAL HOLES

Gonin,[3] in his latest papers, obtained an 87-percent incidence of holes in retinal detachment, and it was his opinion that retinal holes were almost invariably found in retinal detachments, if sufficient time were spent in looking for them. Duke-Elder, in summing up the significance of retinal holes, states that the hole iself is not sufficient to cause the detachment. Other factors —disease, degeneration, and severe trauma —play a part in retinal detachment. The consensus of opinion today is that a retinal hole exists in nearly every case of retinal detachment except those caused by intraocular tumor. Retinal tears or holes may be single or multiple and of varied form and size.

TYPES OF RETINAL HOLES

The types of retinal holes usually seen in retinal detachment are:

1. Crescentic, horseshoe-shaped tears, the convexity is always turned toward the optic nerve and usually occurs in the upper half of the globe.

2. Round holes, occurring either singly or

in groups, are generally in the temporal half of the globe, usually in the supratemporal quadrant.

3. Irregular slits and fine sievelike perforations are usually seen near or at the periphery.

4. Dialysis or disinsertion at the ora serrata almost always occurs at the lower part of the globe—most frequently in the inferior and inferior temporal quadrants. Subsequent detachment spreads slowly backward and upward with delayed involvement of the macula and visual disturbance.

In war injuries, when the patient suffers severe, violent trauma, more than one hole is often found in retinal detachment. In several cases that we observed the retina was lacy, ripply, shrivelled, and sievelike, with many holes.

Retinal holes have been known to heal spontaneously by glial proliferation, as reported by Samuels.[4] However, the general tendency is for the hole to become larger and the retinal detachment to become progressive.

Mechanism of detachments

The mechanism of some of the detachments is fairly clear. This is true principally of those detachments due to a tumor pushing the retina inward; organization of fibrous tissue pulling the retina inward; tearing of the retina by sudden traumatic distension; wrinkling up of the retina in a shrunken globe.

Two other groups in which the mechanism is more or less clear are: (1) Exudative detachments which are not typically associated with a retinal hole, and (2) serous detachments in which a hole is characteristically present.

In spontaneous retinal detachments, the essential factor is the preceding inflammation or degeneration of the retina, vitreous, or choroid. In some of our traumatic cases, the retinal separation was secondary to gross ocular disorganization and was an incident in severe progressive ocular disease.

Clinical symptoms

The significant clinical symptoms of retinal detachment are:

1. The complaint of seeing "spots in the eyes," with the appearance of muscae volitantes, suggestive of degenerative changes in vitreous or peripheral choroiditis.

2. The symptom most commonly looked for is photopsia, the sensation of flashes of light, indicative of slight movements of the retina. The flashes of light are more significant when they are constantly projected from a single region of the retina.

3. If the detachment is large or central, vision will become blurred or completely lost. However, if the detachment is shallow and localized away from the macula, it may give rise to no symptoms and vision may be good. Usually the patient complains of a cloud or a curtain appearing in front of the eye.

4. An area of visual-field defect corresponding to the area of detachment is present. The red reflex is altered and appears gray over the detached area. As the eye is examined with an ophthalmoscope, it is noted that there is a change in the normal color of the fundus as the area of detachment is approached and that this area is out of focus with the rest of the fundus. The detached retina appears as a gray or bluish-gray veil with few or many folds; or it may assume the proportions of a large balloon and obscure the disc. The vessels seen rising angularly over into the area of detachment lose their normal light streak and appear as dark, almost black, tortuous cords.

All authorities agree that a retinal hole or tear is the rule. The tears, holes, or rents are characterized by their sharp borders and the visible red choroid. If no retinal hole is found, it may be because the hole is located too far peripherally or is hidden by a fold. Retinal holes usually do not occur in cases of choroidal tumor. Gifford,[5] however, in 1936, reported a case of choroidal tumor with a hole.

TABLE 1

SUMMARY OF 15 CASES OF RETINAL DETACHMENT

Patient (Name and Age)	Age of Detachment	Previous Surgery	Etiology	Holes	Vision Before Surgery	Vision After Surgery	Visual Fields
G.J. 19 yrs.	3 months	none	inflammatory	none	20/100 J-5	20/100 J-5	improved
R.B. 23 yrs.	36 months	none	degenerative	dialysis	H. M. J-0	20/100 J-4	improved
M.J. 35 yrs.	7 months	yes	trauma	yes	5/200 J-0	10/200 J-0	improved
B.J. 23 yrs.	5 months	none	inflammatory	none	5/200 J-0	5/200 J-0	improved
H.A. 32 yrs.	2 months	yes	trauma	dialysis	20/400 J-0	20/400 J-0	improved
R.Z. 23 yrs.	2 months	none	trauma I.F.B.	dialysis	L. P.	L. P.	improved
F.R. 24 yrs.	10 months	yes	blast	none	20/20 J-1	20/20 J-1	improved
R.H. 21 yrs.	11 months	none	inflammatory	yes	20/80 J-1	20/70–3 J-1	improved
F.L. 19 yrs.	3 months	yes	trauma	yes	L.P.	C. F. in temp. field	improved
C.O. 26 yrs.	5 months	none	trauma	dialysis	L.P.	10/400	improved
P.P. 24 yrs.	5 months	none	trauma I.F.B.	yes	L.P.	L.P.	improved
S.R. 29 yrs.	2 months	none	trauma	dialysis	Poor L.P.	sclerectomy clear L.P.	improved
J.E. 21 yrs.	26 months	yes	trauma I.F.B.	dialysis	L.P.	sclerectomy 20/100 J-5	improved
W.M. 25 yrs.	7 months	none	trauma I.F.B.	yes	10/200 J-0	enucleated	
E.J. 23 yrs.	6 days	2 I.F.B. removed	trauma	none	L.P.	enucleated	

LOCALIZING POSITION OF TEARS

The position of a retinal tear may be localized ophthalmoscopically by estimating the number of disc diameters 1.5 mm. from the tear to the disc or ora serrata. This is a gross approximate method and easily done. Each disc diameter is 1.5 mm. and the ora serrata is considered to be 8 mm. from the limbus of a globe measuring 24 mm. on its anteroposterior axis.

Drawing of the fundus with details and localizing the retinal hole in relation to retinal blood vessels is another helpful method.

Stine's method,[6] with tables for retinal localization, is a more accurate method. The patient uses a Schweigger perimeter at 19 cm. and looks at his own eye in a mirror, or uses a finger (propioceptive) if the macula is damaged. He looks at the tear by means of a giant scope and draws until he is beyond the range of the arc. The arc is rotated until it intercepts the ophthalmoscopic beam, the reading on the perimeter arm is noted, to-

gether with the angle through which it is turned. Tables for localization of retinal tear on the globe are then consulted.

Case reports

All of the patients with retinal detachments herein reported were operated on by different members of the eye staff of the Eye Center, Crile General Hospital.

The operative procedure consisted of making a large conjunctival flap, with good exposure of sclera. The area of detachment was outlined with methylene blue, and the scleral area so outlined was treated by means of a single-point, insulated-tip electrode which produced micropunctures. In many places the punctures were enlarged to insure adequate drainage of the subretinal fluid.

Drainage holes stay open longer, and the retina is more likely to fall back into position, when a special diathermy current (coagulation and cutting) is used. Partial drainage is thus established early in the operative procedure, and the retina is more easily caught by the adhesive choroiditis. Multiple diathermy punctures give adequate drainage; whereas, surface coagulation with two or three diathermy punctures may give inadequate subretinal-fluid drainage. In war injuries, where the retina often is shrivelled and has multiple holes, the entire affected area should be treated, in an effort to close all the retinal tears and cause adhesions of the retina around the holes.

Case 1

History. G. J., aged 19 years, was inducted into the Army on September 18, 1943. Each eye had normal vision, and there was no history of eye injury or disease. On March 15, 1945, the right eye became blurred. He was hospitalized on March 24, 1945, overseas. He was given bed rest and binocular bandadges were applied for three weeks. He was evacuated to Crile General Hospital on May 20, 1945.

Findings. Detachment of retina (inflammatory type), right eye, inferior temporal quadrant, with inactive chorioretinitis in the same area. No tear or disinsertion was found. In spite of conservative therapy, the detachment persisted. Vision was: O.D., 20/100, J5; O.S., 20/15, J1.

Operation. On July 20, 1945, a barrage was done between the 6- and 10-o'clock positions, and surface coagulation was applied between the 8- and 10-o'clock positions.

Result. October 20, 1945. The retina was flat. Vision was: O.D., 20/80, J5; and there was definite visual-field improvement.

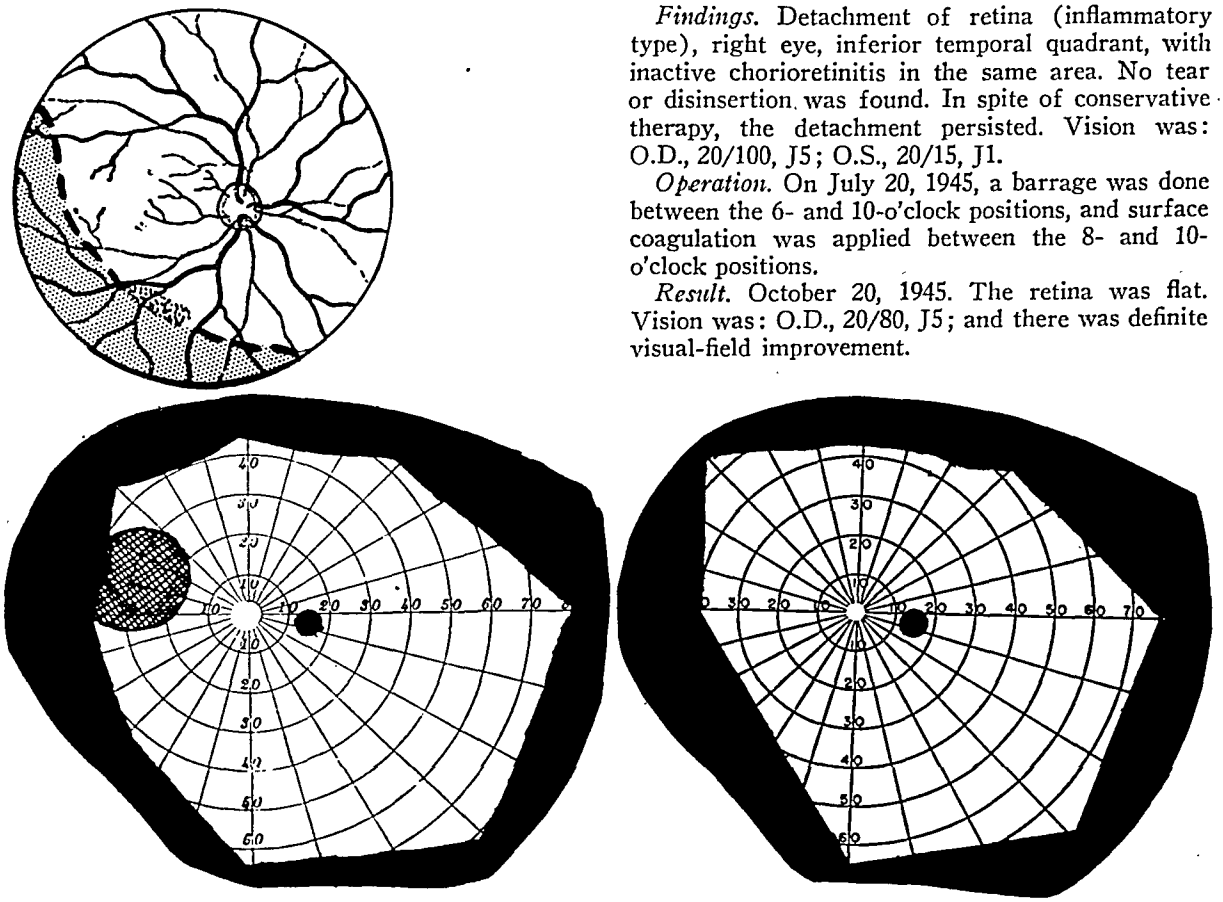


Fig. 1 (Croll and Croll). *Case 1.* Detachment of the retina (above), inferior temporal quadrant, right eye. Before surgery (left) vision was 20/100; fields for 3-mm. and 1-mm. white. After surgery (right) field for 3-mm. white; vision, 20/80.

CASE 2

History. R. B., aged 23 years, was rejected, in April, 1942, by the Navy for defective vision. He was inducted into the Army in September, 1942. In April, 1944, he tried to fire a carbine, sighting with the right eye, but he couldn't see with the right eye. He neglected to report this ocular condition until November, 1944. He returned from Iran on January 20, 1945.

Findings. There was a massive detachment in the right eye, with disinsertion of retina, involving the inferior temporal and nasal quadrant, right. Striae retinae were present above the macula. There was atrophy of the retina of the left eye in the inferior nasal quadrant, corresponding to the area of detachment in the right eye. Vision was: O.D., hand movements; O.S., 20/20, J1.

Operation. On March 20, 1945, an extensive barrage was done with a Liebel-Flarsheim single-insulated diathermy tip, from the 4- to the 9-o'clock positions. The power setting was 19.

Result. On July 17, 1945, the retinal disinsertion was still visible, but the retina adjacent to this was flat and adhered to the choroid. Vision was: O.D., 20/100 (marked improvement); definite visual-field improvement.

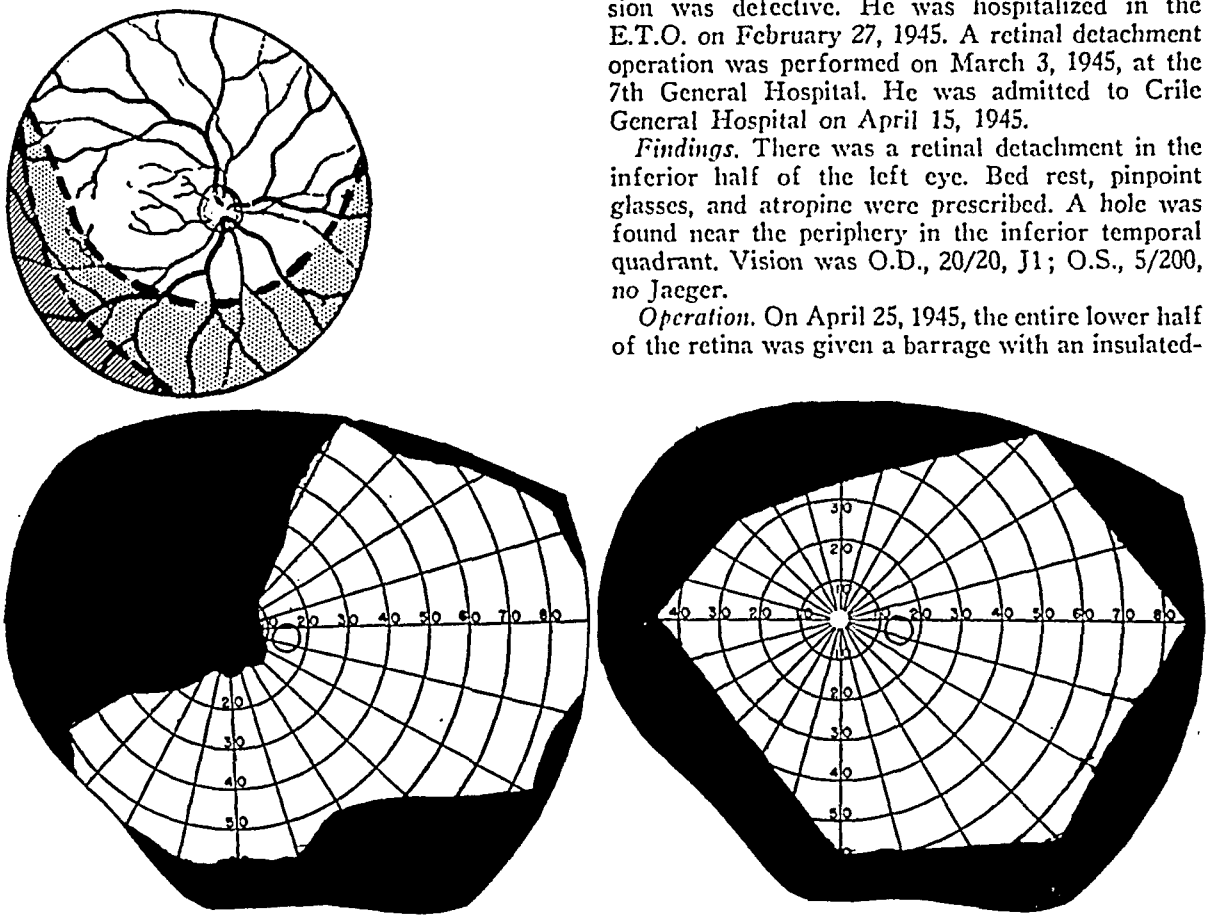


Fig. 2 (Croll and Croll). *Case 2.* Massive detachment (above) in the right eye, with disinsertion of the retina. Before surgery (left) vision was counting fingers at 2½ feet. After surgery (right) vision was 20/100 with correction. Visual field for 3-mm. white.

CASE 3

History. M. J., aged 35 years, during September, 1944, received a blow to the left eye from a fist. In December, 1944, the patient complained of flickering and jumping lights before the left eye. Vision was defective. He was hospitalized in the E.T.O. on February 27, 1945. A retinal detachment operation was performed on March 3, 1945, at the 7th General Hospital. He was admitted to Crile General Hospital on April 15, 1945.

Findings. There was a retinal detachment in the inferior half of the left eye. Bed rest, pinpoint glasses, and atropine were prescribed. A hole was found near the periphery in the inferior temporal quadrant. Vision was O.D., 20/20, J1; O.S., 5/200, no Jaeger.

Operation. On April 25, 1945, the entire lower half of the retina was given a barrage with an insulated-tip electrode. The retinal hole was sealed.

Result. On July 17, 1945, the retina was flat, and the adhesive choroiditis was holding well. Vision was: O.S., 10/200; with correction, 15/200. Visual fields showed definite improvement.

CASE 4

History. B. J., aged 23 years, had normal vision when he enlisted in September, 1940. There was no history of trauma. In November, 1944, the right eye became blurred and vision was only light perception. He arrived at Crile General Hospital on March 31, 1945, from the E.T.O.

Findings. There was detachment of the retina, right eye, with iridocyclitis and secondary glaucoma. No tear or disinsertion was found. There was increased intraocular pressure. A choroidal

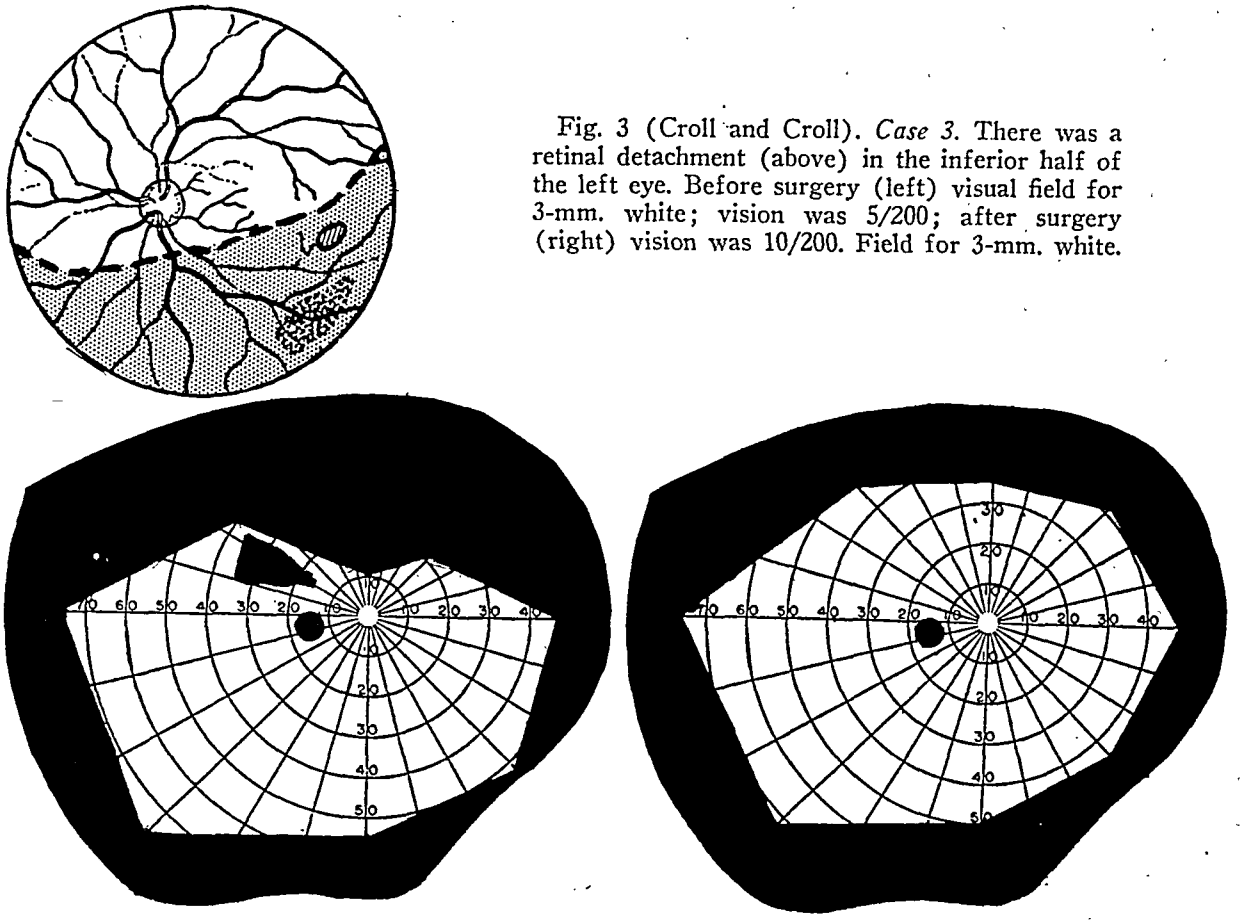


Fig. 3 (Croll and Croll). *Case 3.* There was a retinal detachment (above) in the inferior half of the left eye. Before surgery (left) visual field for 3-mm. white; vision was 5/200; after surgery (right) vision was 10/200. Field for 3-mm. white.

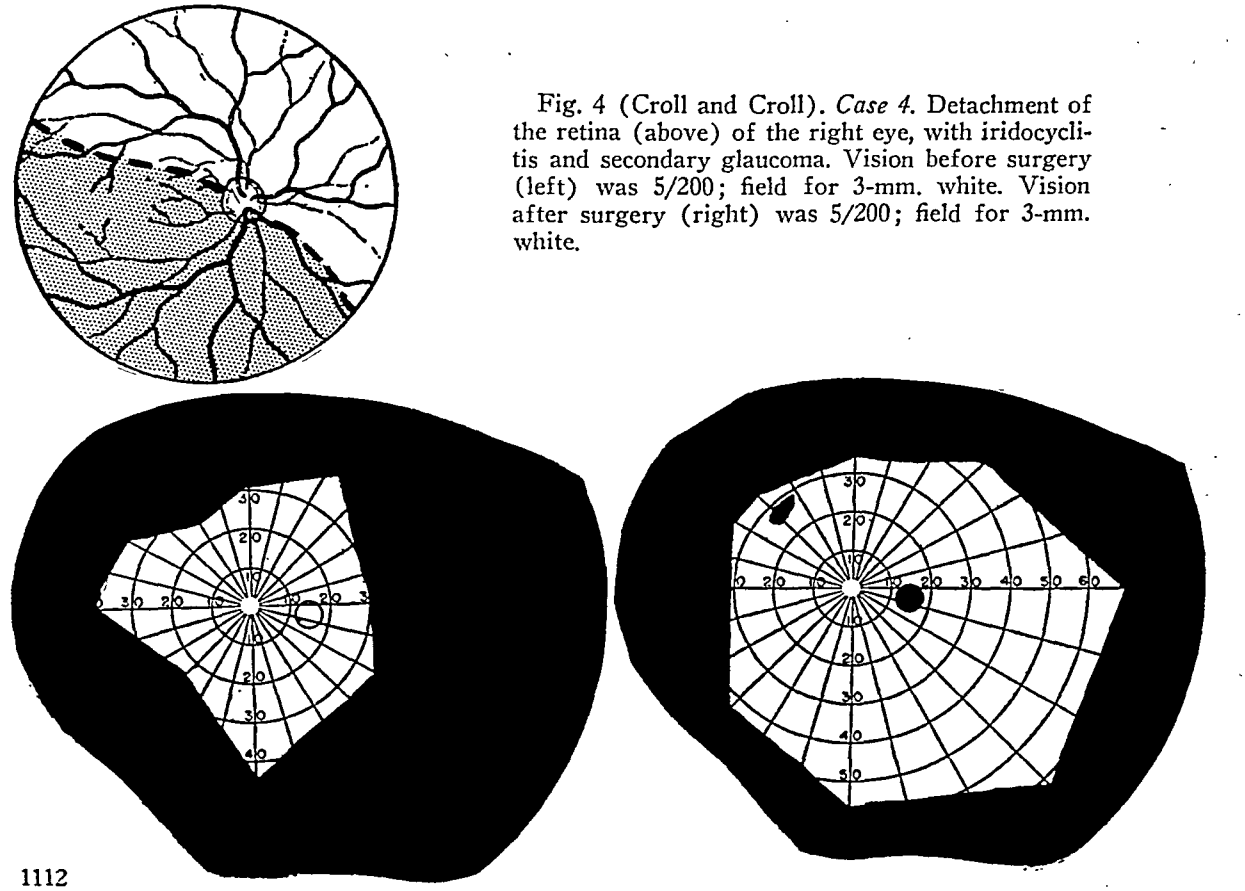


Fig. 4 (Croll and Croll). *Case 4.* Detachment of the retina (above) of the right eye, with iridocyclitis and secondary glaucoma. Vision before surgery (left) was 5/200; field for 3-mm. white. Vision after surgery (right) was 5/200; field for 3-mm. white.

tumor was considered. After treatment—paracentesis, atropine, foreign protein—a good red reflex was obtained by transillumination. Vision was: O.D., 5/200; O.S., 20/15, J1.

Operation. On April 27, 1945, an extensive barrage was done inferiorly between 3- and 9-o'clock positions with a Liebel-Flarsheim single, insulated diathermy tip. Power setting was 20, using a special retinal detachment current.

Result. On July 17, 1945, the retina was flat and the progressive detachment was cured. The eyeball was preserved. Vision was: O.D., 5/200, no Jaeger. There was marked improvement in the visual fields.

CASE 5

History. H. A., aged 32 years, was injured by fragments from mortar shell in France on February 2, 1945. On February 3, 1945, a multiple cautery procedure was done at an evacuation hospital. He was an ambulatory patient, then in bed for four days only, and again ambulatory. He was evacuated to Crile General Hospital, March 31, 1945.

Findings. In the right eye was a bullous, nearly complete retinal detachment, with retinal disinsertion between the 7- and 9-o'clock positions. There was a choroidal rupture through the macula. Vision was: O.D., 20/400, with head tilted to left; O.S., 20/15, J1.

Operation. On April 4, 1945, a large triangular laceration of the sclera was found at the 6-o'clock position, in front of the insertion of the inferior rectus muscle. It was sutured before diathermy punctures were applied over the sclera between the 5- and 10-o'clock positions.

Result. On July 15, 1945, the retina was flat and the progressive detachment was cured. The eyeball was preserved. Vision was: O.D., 20/200, with head tilted to left. There was marked improvement in the visual fields.

CASE 6

History. R. Z., aged 23 years, was wounded in action on October 18, 1944, in Italy. Mortar fragments penetrated his right eye. He had noted floating spots in right eye since injury. On July 27, 1945, a curtain came down over field of vision, from the temporal side of the right eye. He was admitted to the 17th General Hospital and was placed in bed for one month. Pinhole spectacles were prescribed. He was evacuated to the United States and arrived at Crile General Hospital on August 29, 1945.

Findings. An extensive retinal detachment was present in the lower half of the right eye. There was edema of the macula and a disinsertion from the 6:30- to the 8-o'clock positions. An intraocular foreign body less than 0.25 mm. in size was present in the inferior temporal anterior vitreous. It showed no motion with magnet application. There was slight

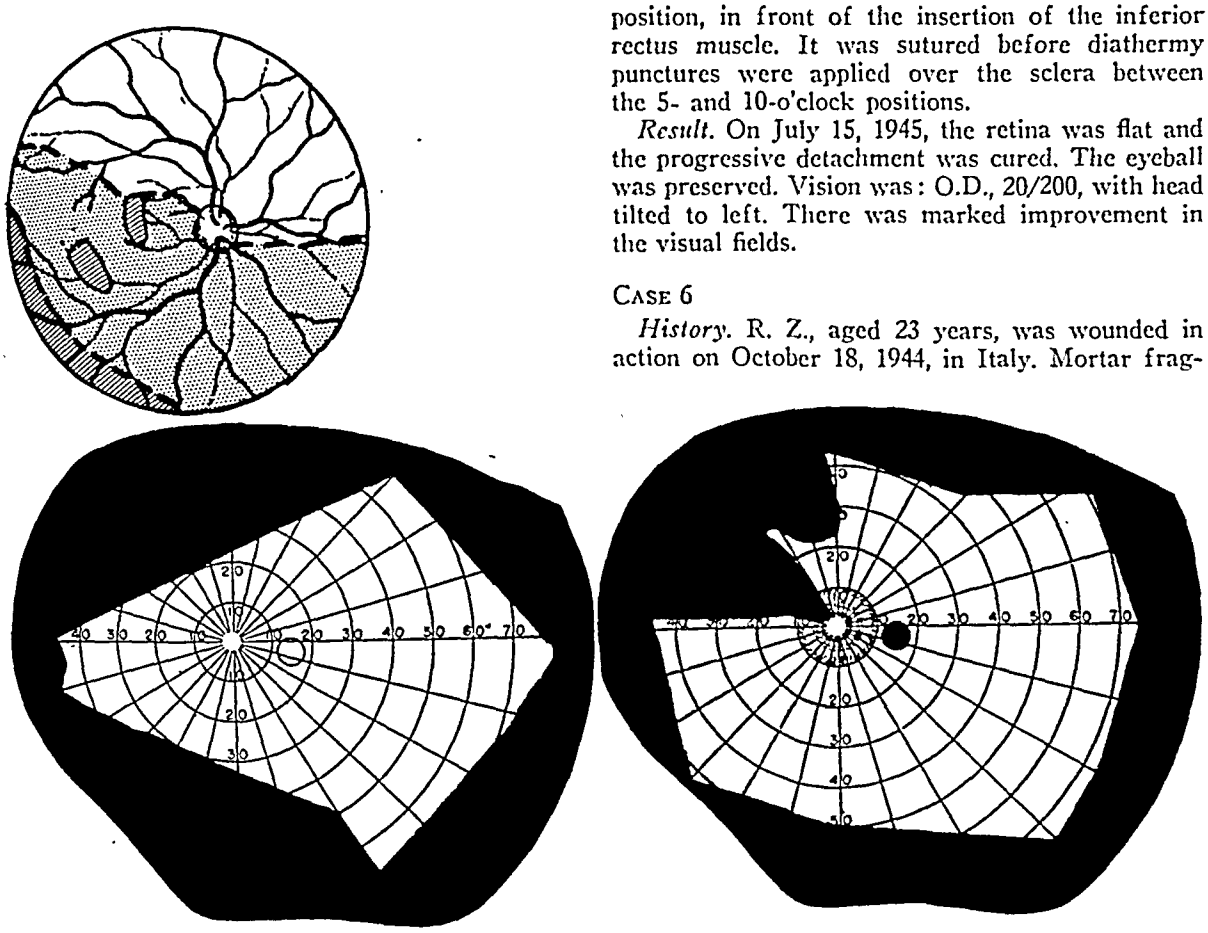


Fig. 5 (Croll and Croll). *Case 5.* In the right eye was a bullous, nearly complete retinal detachment. Before surgery (left) the target was an ophthalmoscope light and vision was light perception only. After surgery (right) vision was 20/200+ with correction. Target, 3-mm. white.

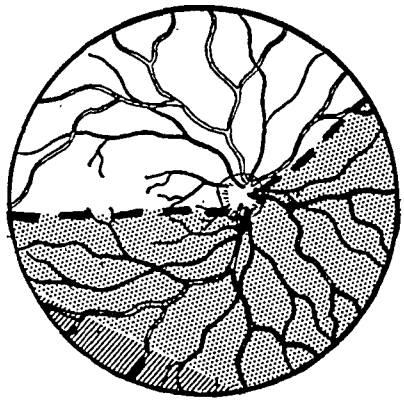
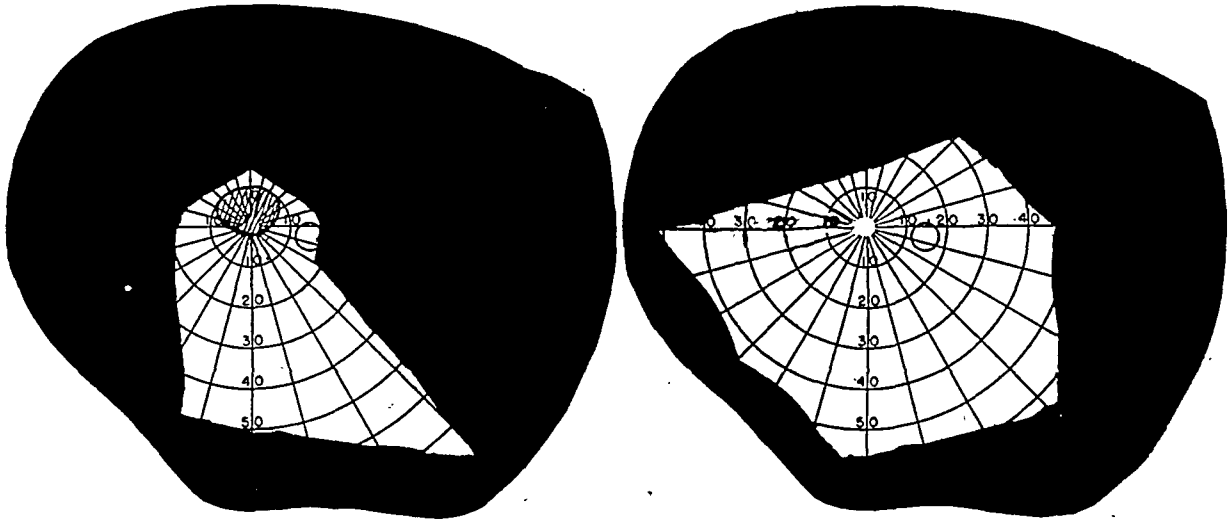


Fig. 6 (Croll and Croll). *Case 6.* An extensive retinal detachment (above) was present in the lower half of the right eye. Before surgery (left) visual field for 6-mm. white; vision was light perception. After surgery (right) field for 6-mm. white; vision was light perception.



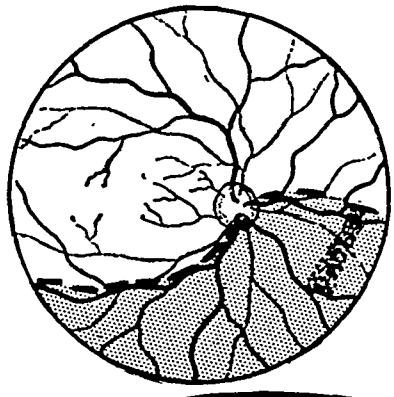
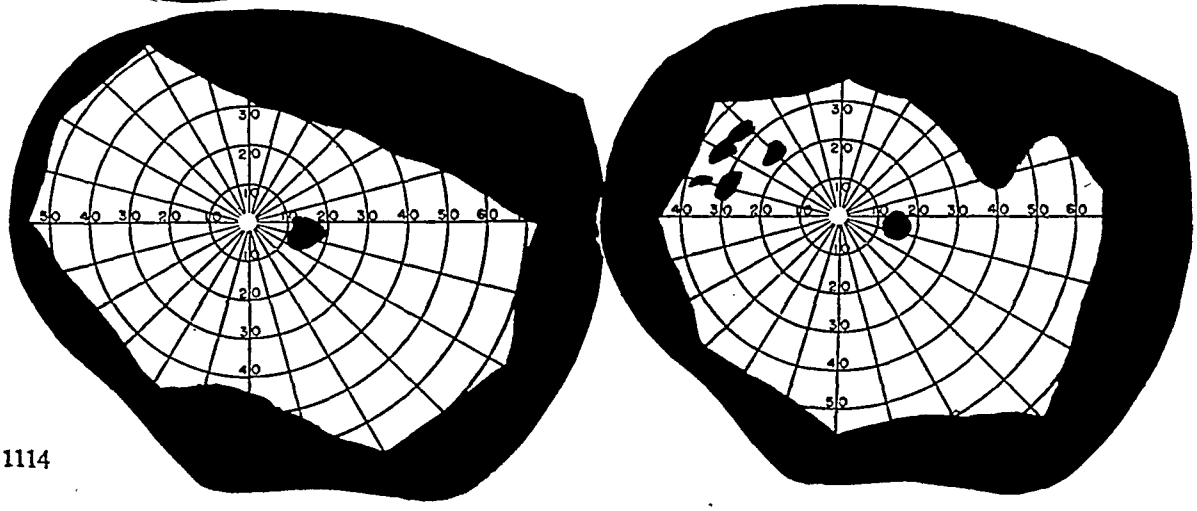
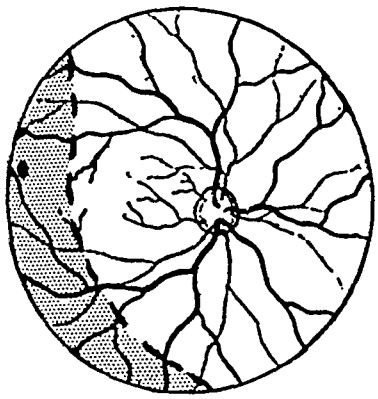


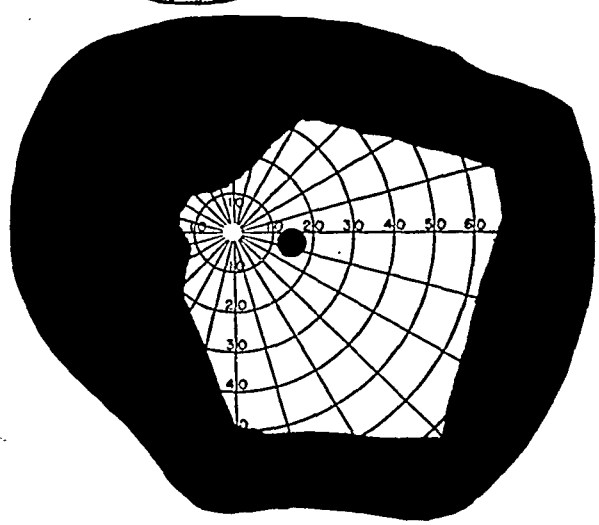
Fig. 7. (Croll and Croll). *Case 7.* The retina (above) was in position everywhere except at the extreme inferior nasal quadrant, right eye. Before surgery (left) vision was 20/100, correctible to 20/20; target for field was 3-mm. white. After surgery (right) vision was 20/100 correctible to 20/15. Field for 3-mm. white.



siderosis of the iris and lens capsule. Vision was: O.D., light perception; O.S., 20/20, J1.

Operation. One September 12, 1945, an unsuccessful attempt was made to remove the foreign body. An extensive barrage was done on the area of detachment, the inferior half nasally up to the 2-o'clock position.





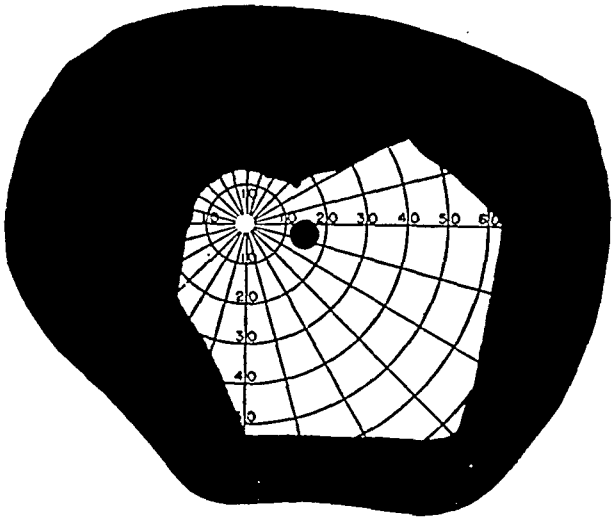


Fig. 8 (Croll and Croll). *Case 8.* While the patient was in bed, the retina, right eye (above), would flatten and the fields would become normal. When he was up for short periods, retinal detachment would recur. Before the second operation (left) vision was 20/80, correctible to 20/60. Target—3-mm. white. After surgery (right), vision was 20/80, correctible to 20/70+3. Target—3-mm. white.

Result. The retina was in good position, the extensive detachment cured and the eyeball preserved. Vision was light perception. The visual field showed improvement. The intraocular foreign body (nonmagnetic) was still retained.

CASE 7

History. F. R., was 24 years of age. While on Omaha Beach, one of our own demolitions exploded 20 yards from the patient. The blast was sufficient to throw patient over, even though he was lying down. On December 10, 1944, six months later, he first noticed a dark spot over the upper right eye. He was operated on March 1, 1945, at the 67th General Hospital and arrived at Crile General Hospital on April 4, 1945.

Findings. The retina was in position everywhere except at the extreme inferior nasal quadrant. No tear or disinsertion was seen. On April 24, 1945, the patient complained of flashes of light. There was definite deterioration of the field. The fundus showed a progressive detachment. Vision was O.D., 20/100, corrected to 20/20; O.S., 20/20.

Operation. On April 25, 1945, with a Liebel-Flarsheim single insulated diathermy tip, an extensive barrage was done from the 4:30- to the 9-o'clock positions. Power setting was 20.

Result. On July 18, 1945, the retina was flat, the progressive detachment cured, and a complete reattachment had been obtained. Vision remained 20/20. The visual fields were slightly improved.

CASE 8

History. R. H., aged 21 years, had normal vision in each eye in May, 1944. In August, 1944, the right eye became blurred, and he saw spots and flashes. There was no history of ocular injury. He was hospitalized in the E.T.O., and given bed rest, atropine, and pinpoint glasses for two weeks.

Findings. While the patient was in bed, the retina would flatten and the fields would become normal. When he was up for short periods, a retinal detachment of the right eye would recur. He was observed for several months. Before the first operation, no hole could be found, but after the first operation, a hole was found. Vision was: O.D., 20/80, corrected to 20/60; O.S., 20/20, J1.

Operation. On July 2, 1945, a surface coagulation of the sclera, from the 11- to 6-o'clock positions, was done. The sclera was light brown on completion. The detachment increased because there was insufficient drainage from two diathermy punctures, and only one half of the retinal hole was treated. On

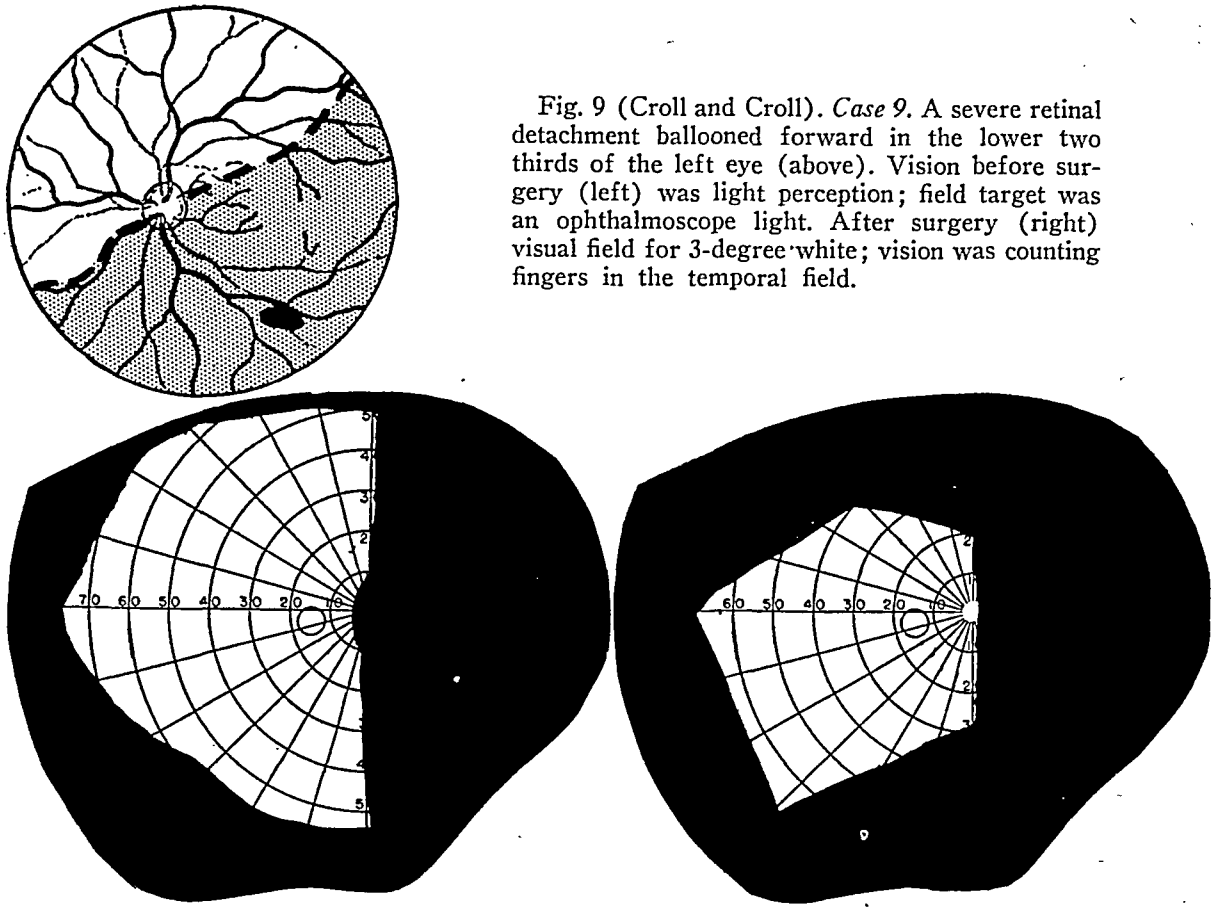


Fig. 9 (Croll and Croll). *Case 9.* A severe retinal detachment ballooned forward in the lower two thirds of the left eye (above). Vision before surgery (left) was light perception; field target was an ophthalmoscope light. After surgery (right) visual field for 3-degree white; vision was counting fingers in the temporal field.

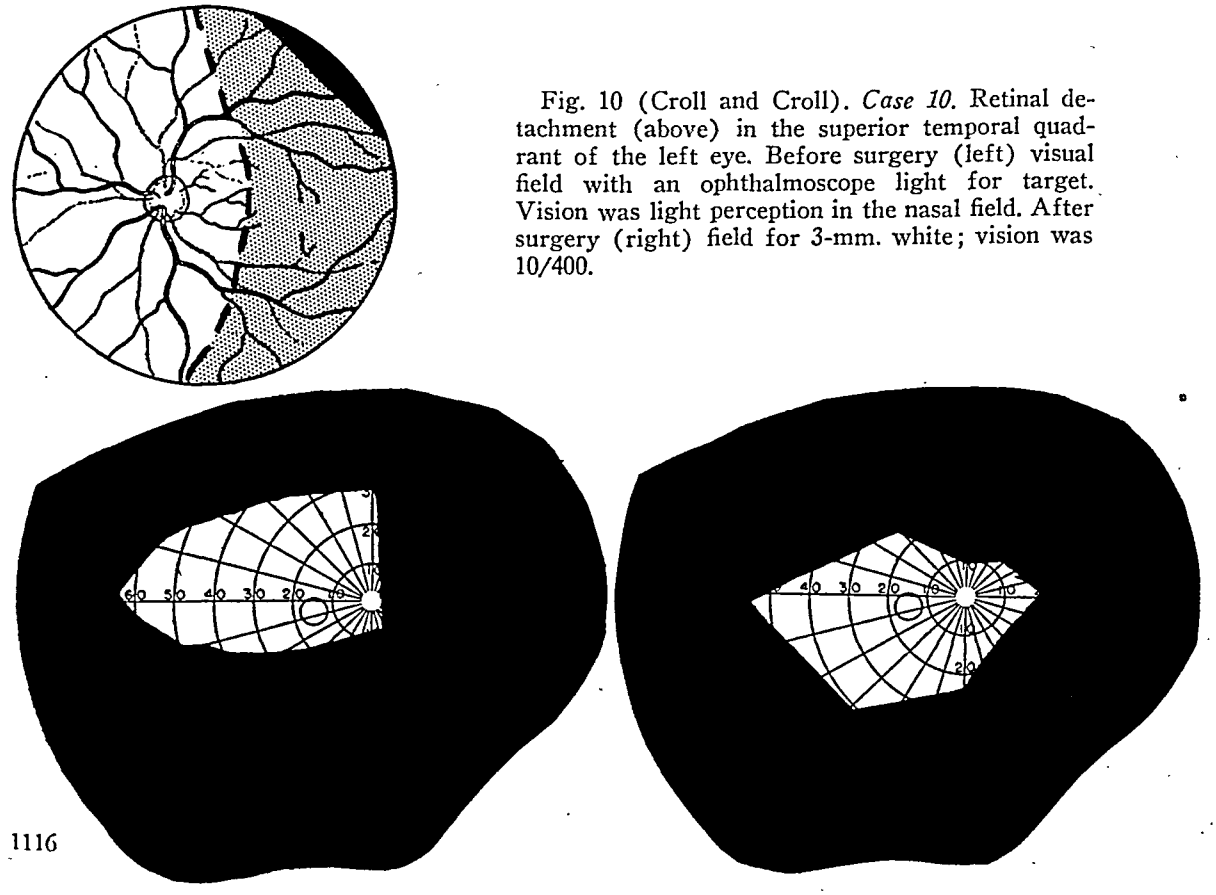
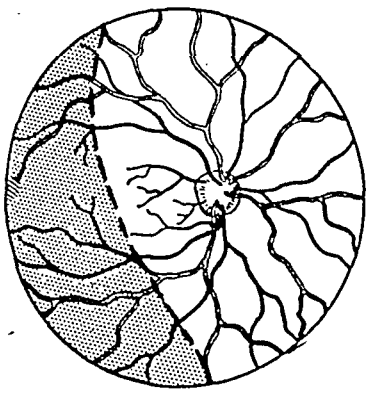


Fig. 10 (Croll and Croll). *Case 10.* Retinal detachment (above) in the superior temporal quadrant of the left eye. Before surgery (left) visual field with an ophthalmoscope light for target. Vision was light perception in the nasal field. After surgery (right) field for 3-mm. white; vision was 10/400.

July 25, 1945, the operation was repeated, an extensive barrage being used. The retinal hole was sealed.

Result. On September 20, 1945, the retina was in good position and completely reattached. Vision was: O.D., 20/80, corrected to 20/70+3. There was a slight contraction of the visual fields.



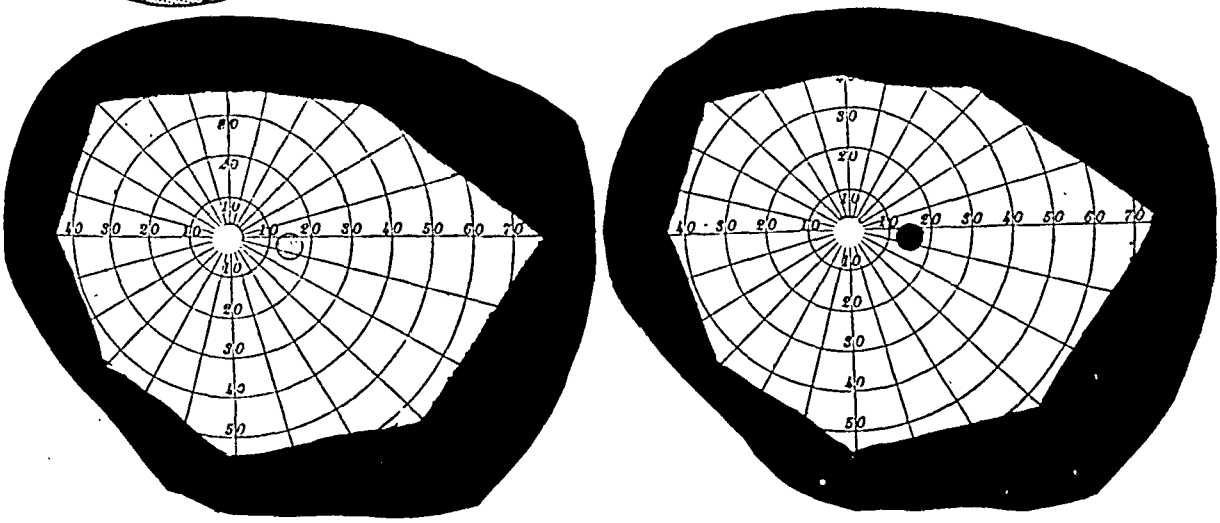


Fig. 11 (Croll and Croll). *Case 11.* Retinal detachment (above) of the right eye. Before surgery (left) vision was 20/30; field for 3-mm. white. After surgery (right) vision was 20/30; field for 3-mm. white.

CASE 9

History. F. L., was 19 years of age. On April 23, 1945, his left eye was injured by a fist in Germany. He was given bed rest for three weeks. When he was allowed up, the detachment of the retina recurred. On May 25, 1945, an operation for retinal detachment was done at the 15th General Hospital, Belgium, and the patient said that vision was poor following surgery.

Findings. A severe retinal detachment ballooned forward in the lower two thirds of the left eye. A retinal tear was present, inferiorly, at the 5-o'clock meridan, near the periphery. Vision was: O.D., 20/15, J1; O.S., light perception.

Operation. On July 5, 1945, a barrage of diathermy punctures was made from the 9- to the 3-o'clock positions. The area between the 4:30- and 6:30-o'clock positions was also treated with surface coagulation.

Result. On September 20, 1945, the retina was flat and completely reattached. The eyeball was preserved. Vision was: O.S., counted fingers in the temporal field. There was a slight contraction of the visual field.

CASE 10

History. C. O., aged 26 years, was wounded in action when a mortar shell exploded close to him on July 23, 1944.

Findings. There was a retinal detachment in the superior temporal quadrant of the left eye, with disinsertion from the 1- to the 3-o'clock positions. The macula was destroyed. Vision was O.S. poor light perception in the nasal field; O.D., 20/20, J1.

Operation. On January 10, 1945, a surface coagulation was done, but the detachment recurred. On April 9, 1945, an extensive diathermy barrage was done over the area of detachment.

Result. The retina was flat and completely reattached, and the eyeball preserved. Vision was: O.S., 10/400, with a slight improvement in the visual field.

CASE 11

History. P. P., aged 24 years, was wounded, March 8, 1945, in action in Germany by a fragment from a booby trap. A fragment was removed from the right eye at the Battalion Aid Station, and the sclera was closed with two silk sutures. At the 187th General Hospital, a diagnosis of retinal detachment was made. He arrived at Crile General Hospital on August 6, 1945.

Findings. A retinal detachment of the right eye was found in the extreme temporal quadrant, and there were vertical folds from the 7- to 11:30-

o'clock positions. Macular edema was present. A retinal tear was found at the 9-o'clock position in the far periphery. The vitreous contained about five small foreign bodies, which showed no movement on magnet application. X-ray films were negative for foreign bodies. Vision was: O.D., 20/30, J1; O.S., 20/20, J1.

Findings. There was a retinal detachment in the inferior nasal temporal area of the right eye, with a disinsertion between the 3- and 7-o'clock positions. An observer looking at the inferior aspect of the retina could see a shrunken retina with massive vitreous hemorrhage. Vision was: O.D., poor light perception in the nasal field only; O.S., 20/20, J.I.

Operation. On June 9, 1945, a resection was made of a crescent-shaped piece of sclera, 19-mm. long and 3-mm. wide, extending from the 3- to the 8-o'clock positions, clockwise, beginning 11.5 mm. behind the limbus. A diathermy barrage was done around the operative site, thereby shrinking the scleral shell to fit the shrunken retina.

Result. On August 20, 1945, the retina was in a better position, although details were still obscured by the absorbing vitreous hemorrhage. Vision was: clear light perception nasally and slight light perception, temporally. The visual fields were improved.

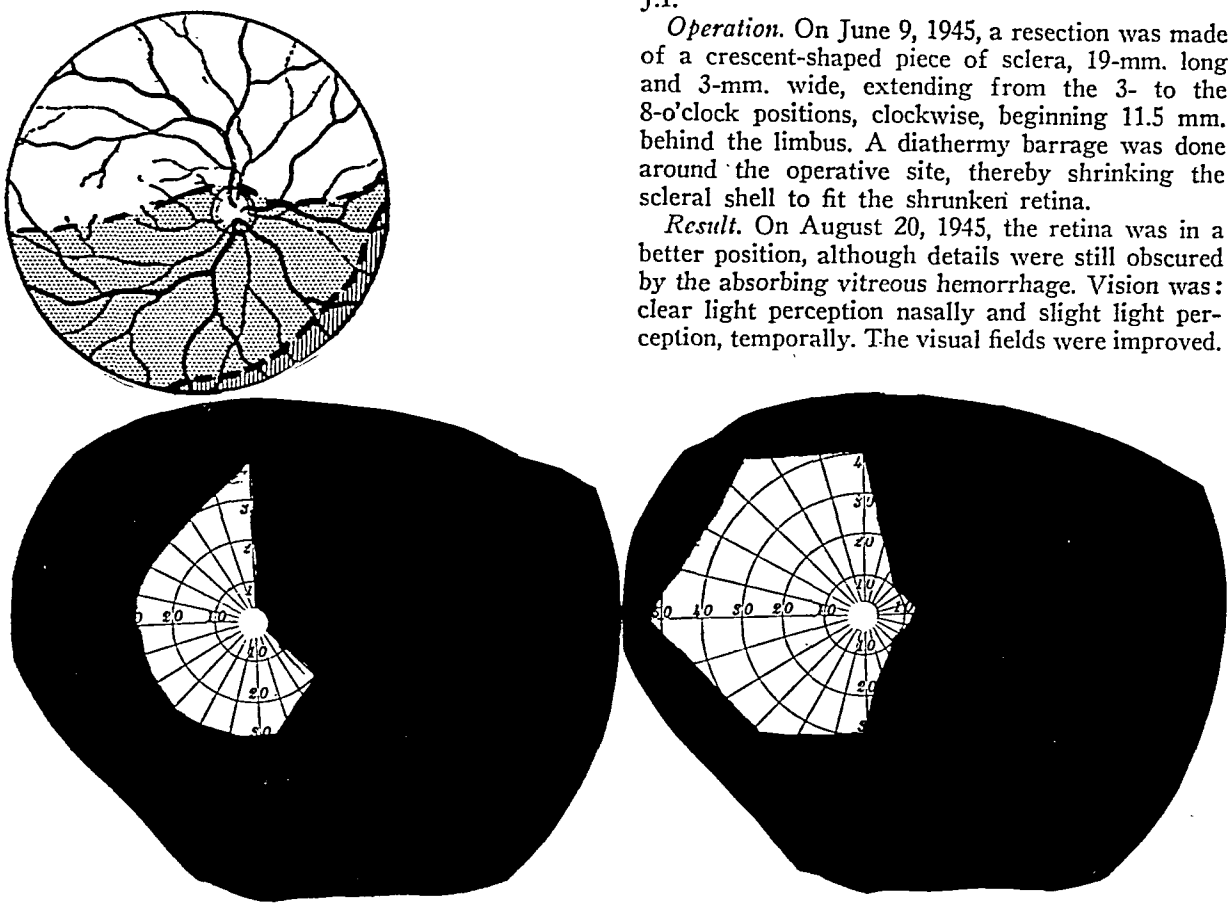


Fig. 12 (Croll and Croll). *Case 12.* Retinal detachment (above) in the inferior nasal-temporal area of the right eye. Before surgery (left) vision was light perception in the nasal field: target, ophthalmoscope light. After surgery (right) vision was clear light perception in the nasal field and slight light perception in the temporal field; target, ophthalmoscope light.

Operation. On August 14, 1945, a barrage was done from the 6:30- to 11:30-o'clock positions and the area from the 8:30- to 11-o'clock positions was treated by surface cautery, with a ball electrode over the area of the retinal tear.

Result. The retina was in good position and completely reattached. Vision was: O.D., 20/30, J1. The visual fields were unchanged. The nonmagnetic foreign bodies were still retained.

CASE 12

History. S. R., was 29 years of age. On April 4, 1945, in England, a grenade exploded close to him. He immediately lost nearly all vision in the right eye. Bed rest, pinhole glasses, and eye drops were prescribed.

On August 27, 1945, muscle surgery was performed for divergent strabismus, and anterior and posterior uveitis developed. On September 13, 1945, the right eye was enucleated to avoid possible sympathetic ophthalmia. It was feared that the scleral resection area had broken open, but on removal of eye, the area was found to be well healed.

CASE 13

History. J. E. was 24 years of age. On April 16, 1943, a bullet fragment ricocheted into his right eye. He was hospitalized at Walter Reed Hospital where an unsuccessful attempt was made to remove an intraocular foreign body. On April 1, 1945, while in Germany, he noted defective vision in the right eye. On May 1, 1945, he was operated on for retinal

detachment at the 52nd General Hospital, and another unsuccessful attempt to remove the foreign body was made.

Findings. A retinal detachment was present in the right eye. There were two large bullous areas above with a larger bullous area, lateral, and disinsertion from the 6- to the 10-o'clock positions. The retina was shrunken. Vision was: O.D., light perception only; O.S., 20/60, J1, correctible to 20/20, J1.

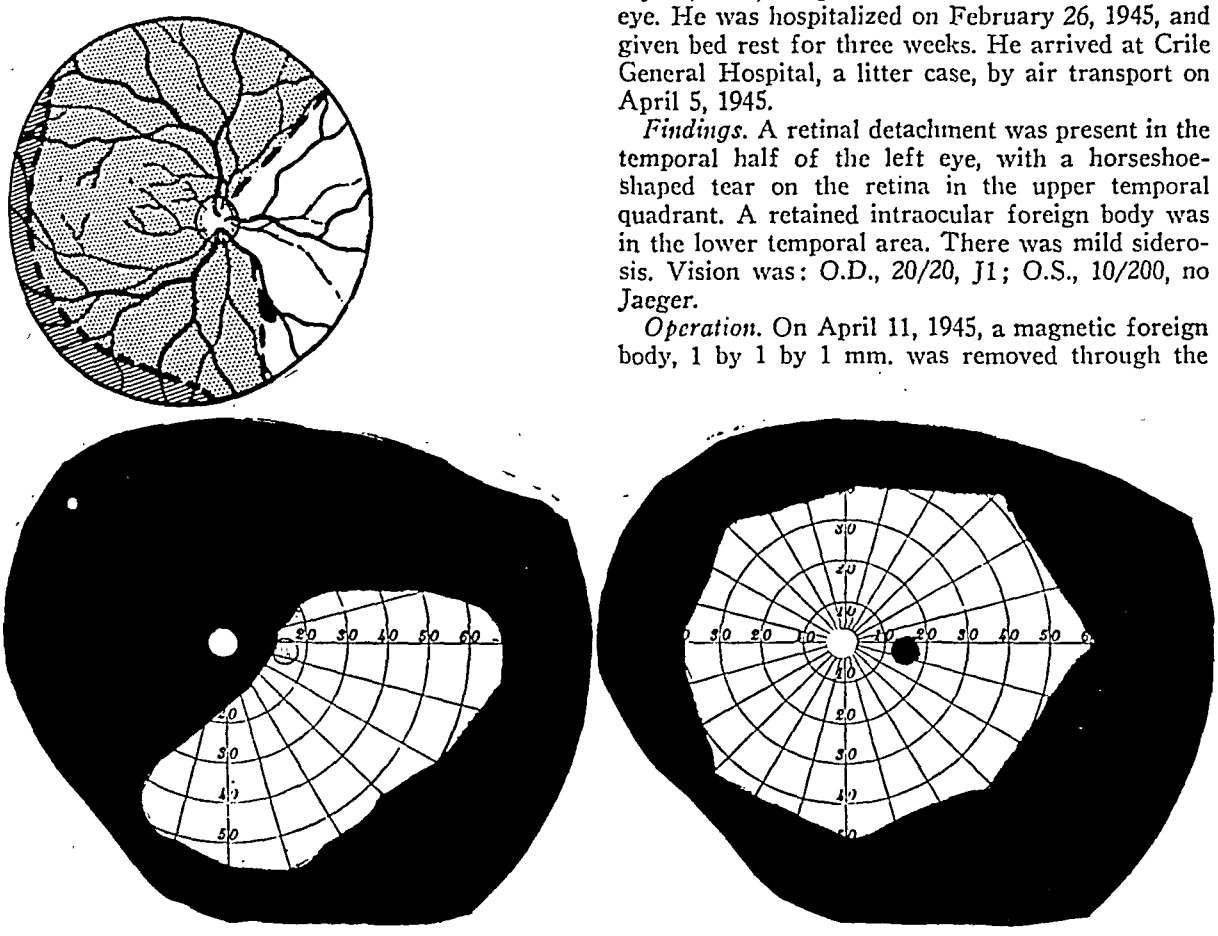


Fig. 13 (Croll and Croll). *Case 13.* Retinal detachment (above) of the right eye. Before surgery (left) vision was light perception; the target, ophthalmoscope light. After surgery (right) vision was 20/100; target, 3-mm. white.

Operation. On June 28, 1945, an eyeball shortening procedure of Müller[7] was done, with excision of a crescent-shaped piece of sclera, 20-mm. long and 2.5-mm. wide, extending from the 5- to the 10:30-o'clock positions, beginning 11.5 mm. behind the limbus. A diathermy barrage was done around the operative site. A fundus examination, immediately after surgery, showed the retina to be flat.

Result. On October 20, 1945, the retina was flat and completely reattached. The progressive detachment was cured. Vision was O.D., 20/100. There was definite visual-field improvement. The patient still had a retained foreign body, probably from the lead bullet (non-magnetic?).

CASE 14

History. W. M., aged 25 years, in September, 1944, was fixing a tire in Finchaven, New Guinea, when something struck his left eye. About February 25, 1945, the patient noticed a veil over his left eye. He was hospitalized on February 26, 1945, and given bed rest for three weeks. He arrived at Crile General Hospital, a litter case, by air transport on April 5, 1945.

Findings. A retinal detachment was present in the temporal half of the left eye, with a horseshoe-shaped tear on the retina in the upper temporal quadrant. A retained intraocular foreign body was in the lower temporal area. There was mild siderosis. Vision was: O.D., 20/20, J1; O.S., 10/200, no Jaeger.

Operation. On April 11, 1945, a magnetic foreign body, 1 by 1 by 1 mm. was removed through the pars-plana approach; then an extensive barrage was done with a single, insulated diathermy tip from the 6-to 12-o'clock positions.

Result. Plastic cyclitis developed, with posterior synechias. The anterior chamber was loaded with cells; fundus details were obscured. The patient did not respond to typhoid, penicillin, or atropine therapy. On May 8, 1945, the left eye was enucleated. There was no sympathogenic involvement of the right eye. Microscopic slides of left eye showed cyclitis with a cyclitic membrane, and detachment and gliosis of retina.

CASE 15

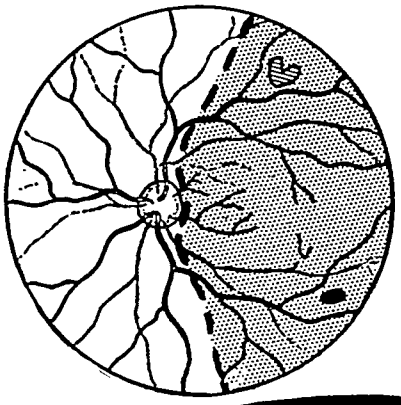
History. E. J., aged 23 years, was injured by a detonator-cap explosion in Germany on April 24, 1945. On April 30, 1945, he was operated on at the 203rd General Hospital and a foreign body was

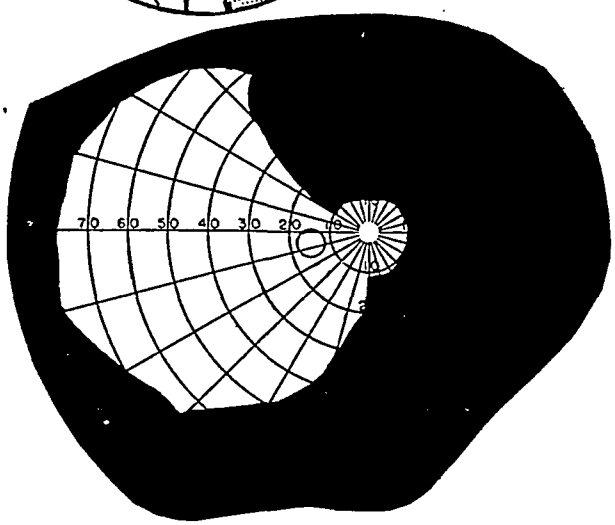
removed. He arrived at Crile General Hospital on May 25, 1945.

Findings. There was poor light reflex and a massive vitreous hemorrhage of the left eye. Two intraocular foreign bodies were removed by the pars-plana approach, one temporal and one nasal, on June 11, 1945. The vitreous cleared. On August 23, 1945, the patient helped to lift a piano and a curtain closed over his left eye. Field and fundus examinations the next morning showed an almost total retinal detachment. Vision was: O.S., light perception only; O.D., 20/20, J1.

Operation. On August 29, 1945, after five days' rest in bed, an extensive barrage was done over the temporal half of the retina.

Result. The eye did poorly, and was enucleated on October 2, 1945.





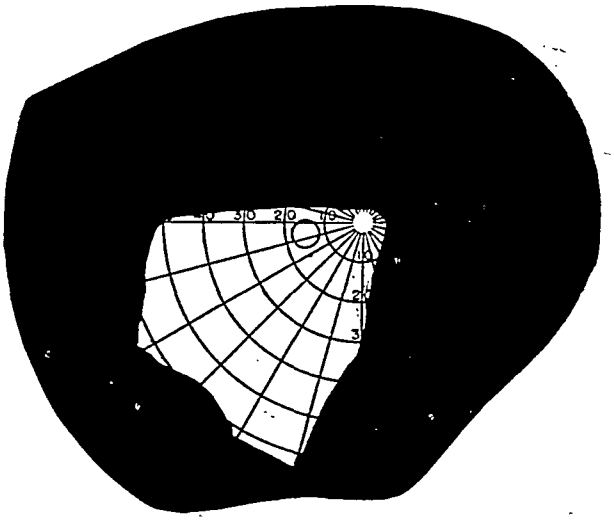


Fig. 14 (Croll and Croll). *Case 14.* A retinal detachment (above) was present in the temporal half of the left eye, with a horseshoe-shaped tear on the retina. Before surgery (left) field for 5-mm. white; vision, 10/200, not correctible. After surgery (right) field for 6-mm. white; vision, light perception only.

COMMENT

Areas of dialysis were present in six cases and peripheral holes in five, and no hole was seen in four cases. Extensive barrage was done over the affected area because of the severity of the injuries. The use of a combination of coagulation and cutting current, rather than coagulation current, is preferred to obtain delayed healing of micropunctures, thus resulting in adequate drainage and reattachment of the retina. In cases of spontaneously reattached retinas in young and active patients, recurrent detachments resulted when the patients became ambulatory, necessitating surgery. Scleral resection was done in two cases of severe retinal detachment, with good results.

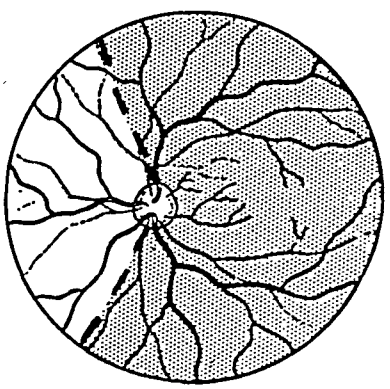


Fig. 15 (Croll and Croll). *Case 15.* Poor light reflex and massive vitreous hemorrhage of the left eye.

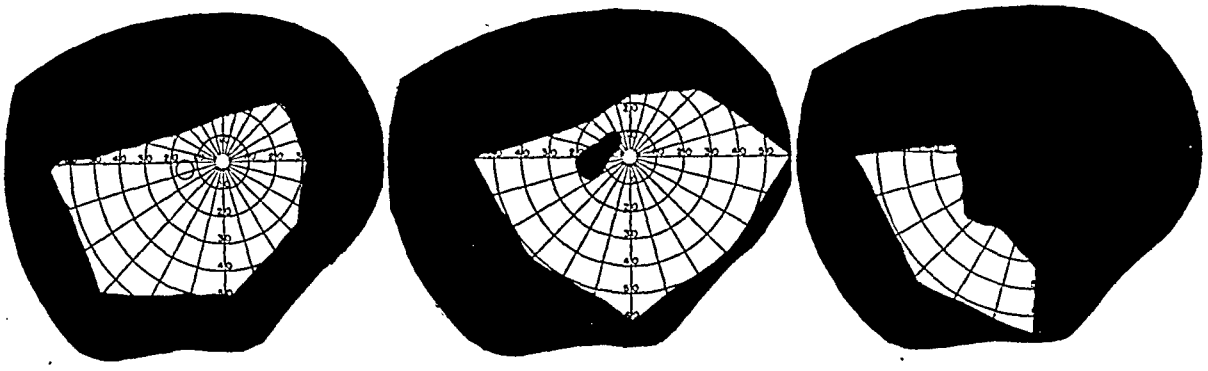


Fig. 16 (Croll and Croll). *Case 15.* Before surgery (left) visual-field target was ophthalmoscope light. (Center) Field for 3-mm. white after removal of two intraocular foreign bodies; vision, 20/400. (Right) Sudden and almost complete detachment after lifting piano. Target used was 18-mm.

Acknowledgement is made to Lieut. Col. G. C. Struble, Maj. H. G. Scheie, Maj. J. D. Sleight, and Captain Hoyt for allowing us to present these cases and to Sgt. Helen Hellebo who performed the visual-field studies and prepared the enclosed field records.

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THE FUNCTIONAL ORGANIZATION OF THE THIRD-NERVE NUCLEUS IN THE CAT*

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In 1942, Szentagothai showed by means of a modified Horsley-Clarke stereotaxic instrument, and a technique of direct stimulation of the oculomotor nerve nucleus that the representation of the striated ocular muscles within this nucleus for the cat and the dog is rather different from the one usually admitted.

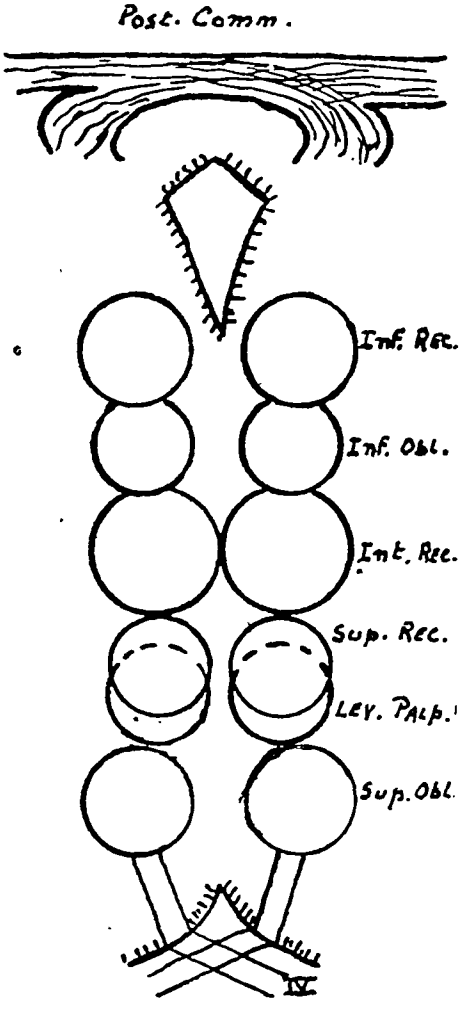


Fig. 1 (Danis). Functional organization of the third-nerve nucleus of the cat and the dog according to Szentagothai.

In 1943, Bender and Weinstein repeated this type of experiment on the monkey (Macaca Mulatta). Their conclusions were similar with those of Szentagothai.

According to these authors, the distribution of the radicular cells corresponding to the different eye muscles would be on the following pattern: going from the rostral to the caudal end of the third-nerve nucleus one would have the radicular cells for the inferior rectus, the inferior oblique, the internal rectus, and the superior rectus. The cells connected with the levator palpebrae would be grouped at the posterior end of the third-nerve nucleus against the fourth-nerve nucleus (fig. 1).

Szentagothai was unable to find any functional organization of the nucleus in a dorso-ventral direction. Bender and Weinstein believe that the different cell groups have more or less the shape of commas whose tails come under the head of the next anterior group. This arrangement would explain the fact that stimulation at different depths on the same dorsoventral axis gave different ocular movements.

None of these authors was able to show an organization of the nucleus in the transverse plane.

This type of experiment does not allow one to determine with certainty whether the innervation of the ocular muscles is crossed, direct, or mixed; it shows, however, that the majority of cells innervates the ipsilateral muscles.

These researches give a scheme of the functional organization of the third-nerve nucleus that is very different from those commonly published in ophthalmic and neurologic textbooks. The scheme more often

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reproduced for man is the one of Brouwer. This scheme is partly the extension to man of the experiments of Bernheimer on the monkey.

Bernheimer and all the other authors who have studied the localization of the eye muscles within the third-nerve nucleus have used the technique of retrograde degeneration (rabbit: van Biervliet, Bernheimer, Bach, Schwabe; cat: Abd-el-Malek Shafik, Latumeten). Szentagothai has also extirpated isolated eye muscles. The distribution of the retrograde degeneration in the third-nerve nucleus confirmed his results obtained by localized electrical stimulation.

The technique of retrograde degeneration is not in this case very reliable because the tigrolysis is sometimes very difficult to distinguish from normal variations, and has by itself given results as divergent as those obtained by Bernheimer and by Bach.

As the investigations of Szentagothai and of Bender and Weinstein are the only two mentioned in the literature which have used this precise technique of localized stimulation of the third-nerve nucleus, we thought it would be interesting to repeat these experiments. For technical reasons we chose the cat.

Further research will have to be done to show that our results, in broad lines in agreement with those of Szentagothai and of Bender and Weinstein, can be extended to man and other species.

Technique

Under barbiturate anesthesia, the head of the cat is held in the Horsley-Clarke apparatus illustrated in the paper of Talbot and Marshall. The posterior and lateral parts of the calvarium are chipped off to the junction with the tentorium cerebelli behind, and to the frontal bone rostrally. After incision of the meninges, the two occipital lobes are progressively drawn apart exposing the superior colliculi whose posterior aspects are covered by the anterior and medial end of the tentorium cerebelli. This bony nib is resected to give a clear approach to the superior colliculi. Bleeding is sometimes important when one approaches the brain stem; this can be greatly reduced by ligating the sinus longitudinalis superior and the vein of Galen. No animals died during the experiments.

When the anatomic landmarks of the superior colliculus are clearly visible, the stimulating apparatus is put in place. We have used a unipolar electrode formed by a sharpened steel needle. The needle is electrically insulated with varnish except at the extreme tip.*

The electrode is driven in vertically (that is to say in a plane perpendicular to the plane: external auditory canal-infra-orbital margin) at various distances from the midline and going from the posterior limit of the superior colliculus forward over about 4 mm. If the distance from the midline exceeds 1 mm. the needle going downward does not meet the nucleus. When the needle is presumed to be in the region of the third-nerve nucleus, which, as an average, is 6 to 7 mm. below the level of the sulcus between the superior colliculi, the electrical stimulus is applied at different depths and the eyes are observed.

As stimulus we have applied threshold (7 volts) and suprathreshold potentials of spike form at 60 per second, cathodally.

To locate exactly the points stimulated, we have used a technique consisting of passing through the electrode as anode a direct current of 10 to 20 microamperes during 10 seconds. The exposed tip of the electrode deposits in the nervous tissue some iron that can readily be shown later (fig. 2) as a spot about 0.2 mm. in diameter.

We find that in this type of experiment, recording very slight movements of the eye elicited by threshold stimulus, it is better to take out the orbital hooks of the Horsley-Clarke apparatus. These hooks strongly compress the inferior eyelid and conjunc-

* Tygon paint, U.S. Stoneware Co., Akron, Ohio.

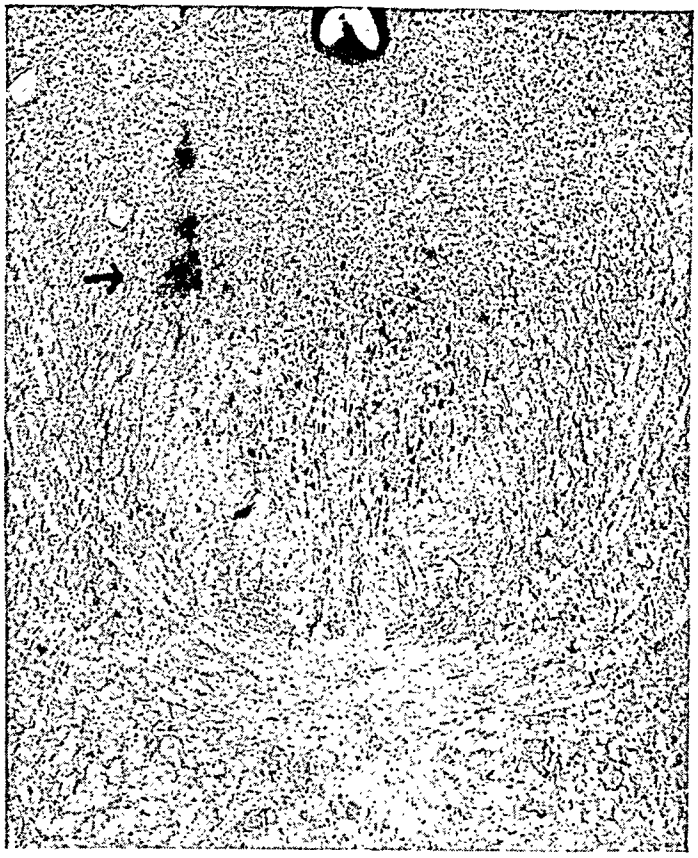


Fig. 2 (Danis). Frontal section at the anterior end of the third-nerve nucleus of the cat. (Gallocyanin stain, ×20.) The arrow indicates the iron blue mark. The dark line above this mark corresponds to the needle track. On the section it appears brownish.

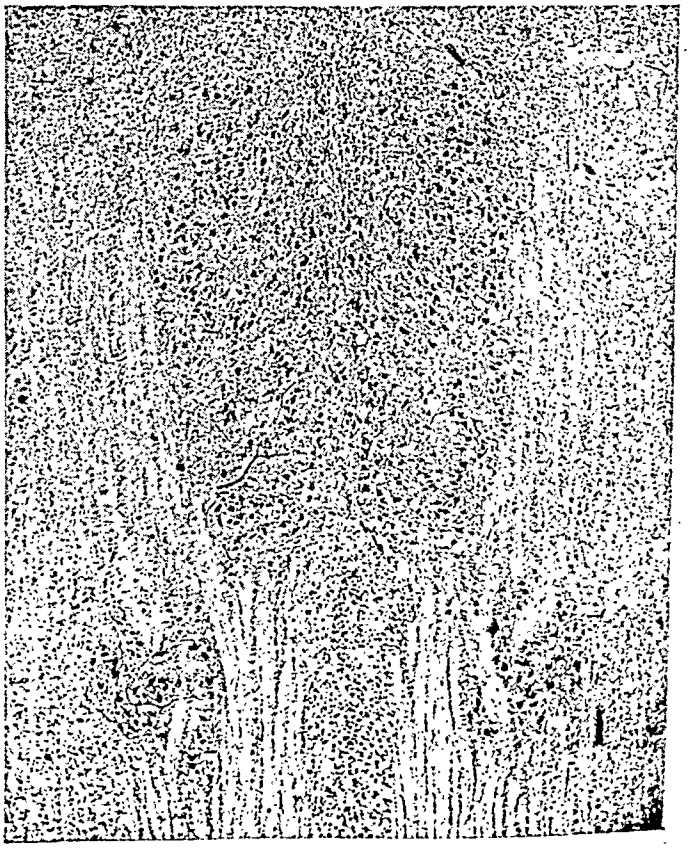


Fig. 3 (Danis). Horizontal section of the third-nerve nucleus of the cat. The section is parallel to the floor of the aqueduct of Sylvius. (Gallocyanin stain.) One can see the two lateral columns more or less fused on the midline. On the midline in the anterior part, the nucleus of Edinger-Westphal. Posteriorly and a little more laterally than the third-nerve nucleus, the two fourth-nerve nuclei. (× 24.)

tiva against the orbital rim and may, therefore, hinder completely free motion of the eyes. Before putting the stimulating apparatus in place, we replaced the orbital hooks by a frontal band which pressed the head down against the maxillary pieces to obtain a firm fixation.

At the end of the experiment the animal was killed and fixed by perfusion.

The brainstem is sectioned frontally in a plane approximately parallel to that followed by the electrode. Serial sections are made at 50 microns with the technique of Marshall, then submitted to a Prussian-blue test and stained with gallocyanine.

Anatomy

We will not give a detailed description of the oculomotor-nerve nucleus in the cat. This can be found in the papers of Abd-el-Malek Shafik, Bach, Beauvieux, Benjamin, Crouch, Latumeten, LeGros Clark, Levinsohn, Monakow, Panegrossi, Spitska, and Winkler.

The general structure is best seen on a horizontal section parallel to the floor of the aqueduct of Sylvius (fig. 3). The nucleus is formed by two columns of large multipolar cells, in anteroposterior direction under the floor of the aqueduct of Sylvius lying on the dorsal aspect of the posterior longitudinal bundle. In their anterior portion the two columns are clearly separated by a space containing the small-cell nucleus of Edinger-Westphal. In agreement with Bach, Benjamin, Brouwer, Latumeten, Levinsohn, Spitzka, and Winkler, and contrary to Beauvieux and Panegrossi, this nucleus was always seen to be present and well developed in the cat. In their posterior portion, the two masses get thicker laterally and dorsoventrally, and the central space is occupied by cells similar to those of the lateral columns; at this level there is no clear anatomic limit between the right and the left nucleus (LeGros Clark). At the posterior end, the two nuclei are once more clearly separated from each other. Like the other authors, we have not the impression that these medial cells are organized in a group anatomically distinct from the lateral nuclei, equivalent to the nucleus of Perlia.

Like Bach and MacLean, we have not found with enough constancy a subdivision of the lateral column in a dorsal and a ventral part, on different slides of the same or different animals, to justify a subdivision into two groups, ventral and dorsal, contrary to Abd-el-Malek Shafik, Monakow, Panegrossi, Spitzka, and Winkler.

On frontal sections the two columns have a V shape, opening upward. In the anterior part, the branches of the V are separated from each other; as one goes toward the posterior end the two branches tend to meet in their medial and inferior part as if by filling the space with cells similar to those of the lateral nucleus. These cells constitute the central group described on the horizontal sections.

Results

I. Points of stimulation

In a given animal, going on any transverse line from the right to the left, we have never seen any modification of the type of ocular response. If at a given level one obtained an elevation of the eye, at all other points of positive stimulation on the same transverse line and the same depth, the response was an elevation. The same applies to adduction of the eye or depression.

If one takes care to use a minimal stimulus, one will obtain a unilateral response—except when the needle is on the medial plane or so near that it is difficult to exclude a bilateral stimulation.

As far as the possibility of a contralateral innervation is concerned, our experiments do not allow us to exclude definitely this possibility, but it is certainly of little importance. In the large majority of cases the ocular response is ipsilateral, and the few cases where a contralateral response was obtained corresponded to stimulation on the midline. Because the needle is so near

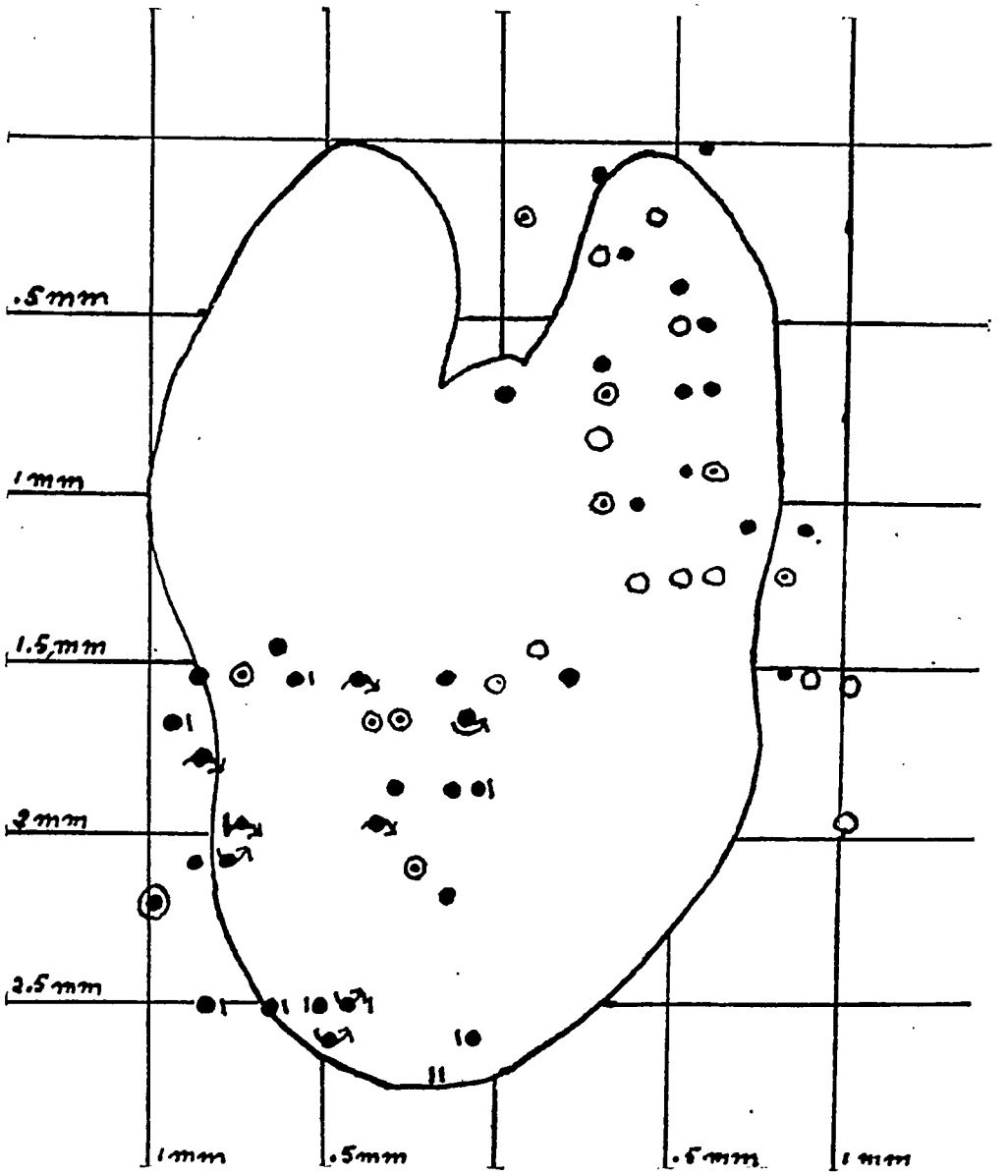


Fig. 4 (Danis). Horizontal projection at the depth of the nucleus (above the fibers level) of responses obtained in different cats (8):

• Represents an elevation of eye if on the left part of the drawing, a depression if on the right side (the point on the midline corresponds to a depression.

○ Represents a movement of pure adduction of the eye.

⊙ Represents a mixed movement of the eye, adduction with elevation if on the left part of the drawing, adduction with depression if on the right side.

\ Indicates an elevation of the upper eyelid.

Indicates if the elevation was associated with an intorsion.

Indicates if the elevation was associated with an extorsion.

This drawing gives the location of the points of stimulation in the antero posterior and the transverse plane.

the midline, the experimental conditions do not permit a discrimination between a contra- or bilateral innervation or a stimulation of the contralateral cells.

This agrees with the descriptions of Abd-el-Malek Shafik and Beauvieux. For these authors there are more direct than crossed fibers, the crossed fibers being located the nearest to the midline.

In Figure 4 the location of the different points of stimulation is given on a horizontal section. The fact that on the same anteroposterior level two different responses are sometimes seen is due to the

fact that it is a composite drawing of the points of stimulation recorded in eight cats and reduced to the same scale.

II. Types of response

As far as an organization in a dorsoventral direction is concerned, which was defended by Latumeten for the cat and Le Gros Clark for all the species as a general rule, we have been unable to find any definite proof.

We shall in connection with the work of Bender and Weinstein mention here a special point of technique. In their paper Bender and Weinstein describe the ocular responses obtained in the anterior part of the nucleus by stimulating points in dorsoventral direction: first depression of the eye, underneath adduction, still deeper elevation of the ipsilateral eye; between these three regions they obtained mixed responses: depression and adduction between the two first ones, elevation and adduction between the two deeper.

We have obtained the same type of responses in the anterior part of the cat's nucleus, but each time we have seen that the two inferior marks were in the efferent fibers of the third nerve while the point for depression of the eye was within the nucleus. The anteroposterior organization of the nucleus and the disposition of the radicular fibers must be kept in mind. The axones of the cells go downward, forward, and slightly outward to emerge at the inferoventral aspect of the peduncle. Thus the fibers pass under the cells anterior to those from which they are originated. This tends to be more marked on the Horsley-Clarke apparatus. The electrode being perpendicular to the orbitoaural plane forms with the longitudinal axis of the brainstem an angle of about 110° toward the rear. This explains furthermore that in front of the nucleus, the electrode can stimulate fibers without going through the nucleus. This can simulate a nuclear response if a careful location of the point of stimulation is not done (fig. 5).

This interpretation of some of the results of Bender and Weinstein, as applied to the cat, seems to be confirmed by the fact that in the anterior part of the nucleus, three different ocular movements could be obtained on the same dorsoventral axis and in always the same sequence—depression, adduction, elevation; in the middle part two responses only could be obtained—adduction and elevation; and in the posterior part only one—elevation.

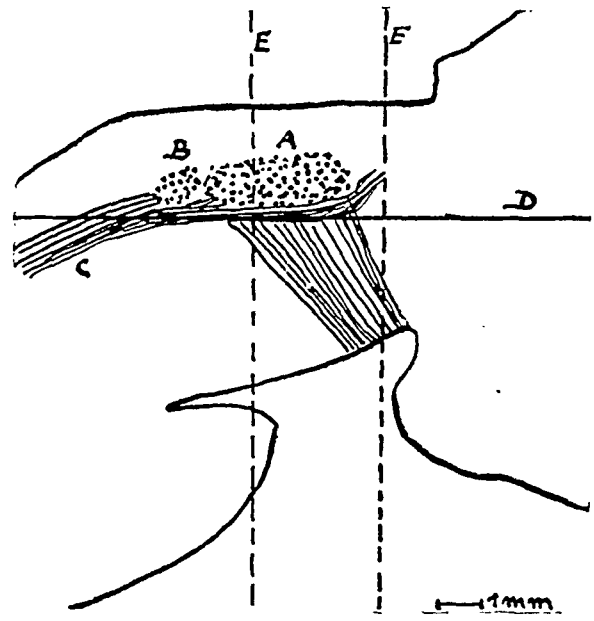


Fig. 5 (Danis). Sagittal section of the brainstem. The roof of the aqueduct of Sylvius is not represented. Composite drawing to show on the same plane the disposition of the third-nerve nucleus and the direction of the nerve fibers: (A) third-nerve nucleus; (B) fourth-nerve nucleus; (C) posterior longitudinal bundle; (D) horizontal plane of the Horsley-Clarke apparatus corresponding to the orbitoaural plane in the animal; (E) direction of the electrode.

In no instance, basing ourselves only on landmarking by the technique mentioned above, have we been able to obtain two points located on top of each other and still within the nucleus that would give different ocular responses. In some instances one could obtain at one point a sort of mixed response that could be attributed to the combined stimulation of two different muscles; but this always happened in zones that were at the common limit of two zones, disposed

anteroposteriorly, where one obtained a pure response of one or the other type.

III. Analysis of results

If in the interpretation and the mapping of the results, one remembers the features that we have mentioned, so as to retain only the points of stimulation located in the nucleus and not under it, a very definite organization of the third-nerve nucleus appears in the anteroposterior direction. Going from the rostral to the caudal end, one has successive points giving depression of the eye (isolated or sometimes with extorsion), then pure and extreme adduction of the eye, then elevation of the eye. The elevation of the eye when the stimulation is carried into the posterior part of the nucleus is accompanied by an elevation of the upper lid. An isolated elevation of the upper lid is only seen when the extreme posterior part of the nucleus is stimulated.

We have already mentioned that in certain cases a mixed response was obtained, depression of the eye with adduction or elevation with adduction. Plotting at the same scale the results obtained on different cats, one sees that these mixed responses fall at the margin of the zones where simple responses of one or the other type were obtained (figs. 4 and 6). It seems, therefore, that one can attribute these responses to a double stimulation due to the fact that the electrode is at the junction of two territories with different functions. Our technique shows no well-cut limit between two territories functionally different.

In their principal lines these results confirm those of Szentagothai and of Bender and Weinstein.

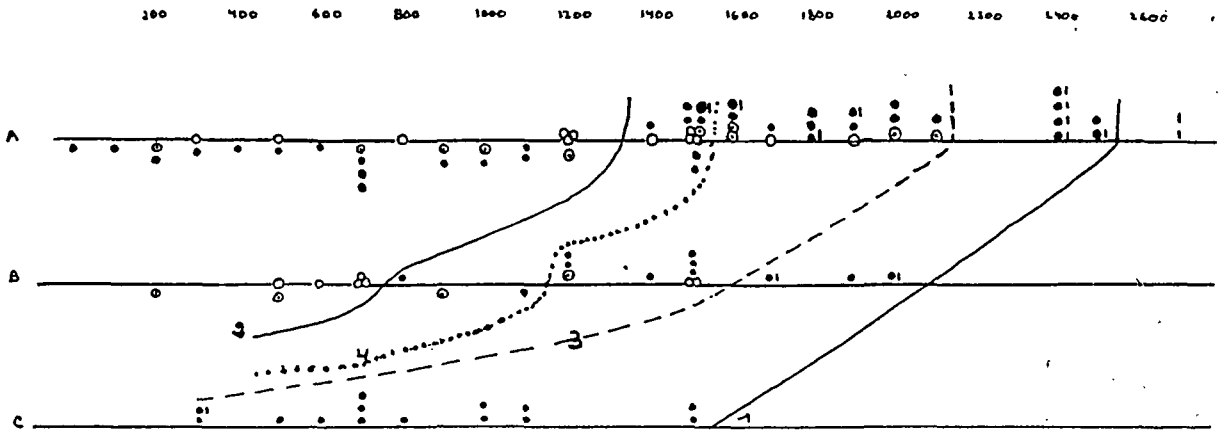


Fig. 6 (Danis). Anteroposterior projection of the point of stimulation observed in eight cats (only the points shown on Figure 4 are recorded) and reduced to the same scale. The numbers on the upper line indicate in microns from the anterior pole of the nucleus the level of the stimulation in the anteroposterior direction. The three horizontal lines correspond to three different levels in depth, the upper one corresponding to the intranuclear stimulations. In this projection the position of the stimulation in regard to the midline is not taken in account. All the points on the same horizontal line correspond to stimulation at the same depth in different animals. The number of points at a given level on a horizontal line corresponds to the number of different points of stimulation. All the points on the same vertical line correspond to the same situation of the electrode, and the horizontal line indicates their respective level in depth and the response obtained. For every point on (C) and (B) there is point on (A).

● Indicates an elevation of the eye or a depression, if it is above or under the horizontal line respectively.

○ Indicates a pure movement of adduction.

⊙ Indicates a mixed movement of adduction with elevation if above the horizontal line, or depression if under the horizontal line.

\ Indicates an elevation of the upper lid.

1 and 2 indicate the posterior and anterior limit of the zone where an elevation of the eye is obtained; 3 indicates the posterior limit of the zone where an adduction could be obtained; 4 indicates the posterior limit of the zone where a depression could be obtained.

We have, however, obtained rather different results as far as the localization of the inferior oblique is concerned. Bender and Weinstein localized with some doubt the radicular cells of this muscle in the anterior part of the nucleus between the ones for the inferior rectus and the ones for the internal rectus. They base this opinion on the fact that, at this point, stimulation gives an isolated extorsion of the ipsilateral eye (in 4 monkeys out of 24 experimented on). Szentagothai gives the same localization for the territory in front of the one for the internal rectus, but this was nearly always accompanied by a slight depression of the eye. In no cats have we obtained elevation of the eye by stimulation of points between the territories for the internal rectus and the inferior rectus. In all cats the same sequence of movements was obtained, going from the caudal to the rostral end of the nucleus—elevation, adduction, depression.

We believe that the inferior oblique must be localized behind the internal rectus in the

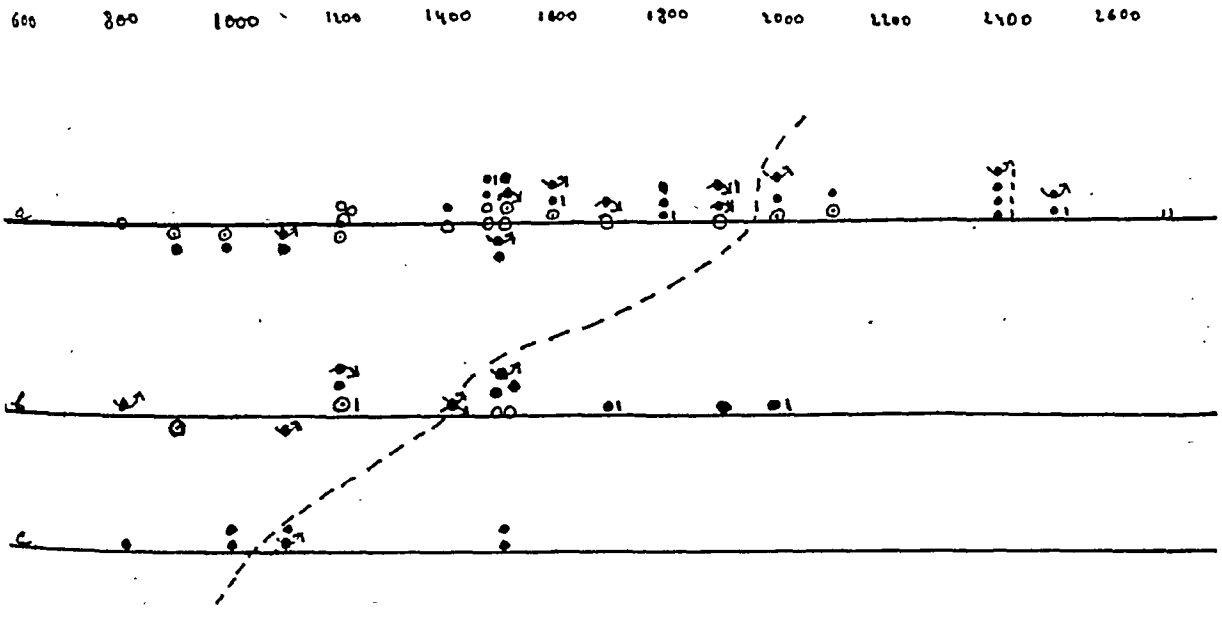


Fig. 7 (Danis). Same projection as Figure 6 to show the distribution of the movement of elevation with intorsion and of elevation with extorsion.
↷ Elevation with intorsion (superior rectus).
↷ Elevation with extorsion (inferior oblique).

inferior oblique (fig. 1) in the cat, basing his opinion on the same criteria, isolated extorsion of the eye.

This argument does not seem decisive because at this level we are at the posterior limit of the zone for the inferior rectus, a muscle which also gives an element of extorsion in the depression of the eye (this was also found by Bender and Weinstein). It seems, therefore, doubtful to use the extorsion of the eye as only criterion to differentiate the action of the inferior oblique from the inferior rectus.

We too have obtained extorsion in the vicinity of the superior rectus and levator palpebrae because, in this zone, we could obtain three types of elevation—elevation with intorsion (superior rectus), pure elevation (it was impossible to see any torsional component in this movement), and elevation with extorsion (inferior oblique). We may analyze a representation (fig. 7) which superimposes the results obtained at similar anteroposterior levels in three different cats. Of the seven points for the inferior oblique (elevation with extorsion) five are well posterior to the average locus for the superior rectus (elevation with intorsion). These

few data show the center for the inferior oblique is even behind that for the superior rectus.

Conclusions

In general our results on the cat are in agreement with those of Szentagothai and of Bender and Weinstein done respectively on the cat and dog and on the monkey. However instead of localizing the inferior oblique in the anterior part of the nucleus between the inferior rectus and the internal rectus, we locate it behind the internal rectus in the vicinity of the superior rectus and probably between the superior rectus and the levator palpebrae, near its antagonist the superior oblique.

1. With the technique used there is no functional organization of the third-nerve nucleus in the transverse nor in the dorsoventral direction. The latter we regard as a confusion of nuclear and fiber organization.

2. The majority of cells send fibers to the ipsilateral muscles. A contralateral innervation was not seen, but the hypothesis of a weak crossed innervation is impossible to deny by this method.

3. The functional organization of the third-nerve nucleus follows the following plan, going from the caudal to the rostral end: inferior rectus, internal rectus, superior rectus, inferior oblique, levator palpebrae. This does not correspond to a discrete anatomic organization, for the experiments with stimulation show that these zones merge into each other.

These experiments give a functional organization of the third-nerve nucleus in the cat that differs from those proposed on the basis of retrograde degeneration, by Abd-el-Malek Shafik and Latumeten, for the cat, and by Brouwer for man. This scheme in its broad lines resembles the one demonstrated by Szentagothai for the cat and by Bender and Weinstein for the monkey.

Of the other experimenters using the technique of retrograde degeneration, Monakow, Bach, and van Biervliet proposed a roughly similar arrangement of the third-nerve nucleus with the depressor muscles in the rostral part and the elevator muscles in the posterior part. All three authors also put the inferior oblique behind the internal rectus in the vicinity of the superior rectus, but only van Biervliet localized, in the rabbit as we do in the cat, the inferior oblique behind the superior rectus.

The author wishes to acknowledge his indebtedness to Dr. Samuel A. Talbot, whose help, interest, and criticisms have permitted the realization of this work.

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ESSENTIAL PROGRESSIVE ATROPHY OF THE IRIS*

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Essential progressive atrophy of the iris is a relatively uncommon disease. Duke-Elder[1] characterizes it as a unilateral disease of unknown etiology that is marked by a slowly progressive atrophic change in the tissues of the iris, which leads to the complete disappearance of large portions of the iris and ultimately ends in blindness from absolute glaucoma.

Since Sugar[2] reported his case in 1945, Arruga[3] and Cyukrasz[4] have each added a new one, the latter author reporting a bilateral case in which cyclodialysis successfully relieved the glaucoma. This paper brings the total cases reported in the literature to 51. Undoubtedly more cases have existed and it is hoped that some of these will be reported. The writer has had the opportunity to follow a case of this disease for over 10 years and the case history is being submitted as an addition to the current literature.

The iris atrophy and the glaucoma are both the outstanding clinical observations in this entity.

CASE REPORT

History. Miss N. S., aged 22 years, was first seen by me on June 5, 1934, with the complaint that the pupil in her right eye had "dropped down." There was no history of trauma or disease. Her vision had not been affected. Examination disclosed a pear-shaped pupil, which was eccentrically displaced down, giving the impression of a congenital coloboma of the iris. Uncorrected vision was 20/50 in the right eye, and 20/200 in the left eye. She had a myopic error and correction improved vision in the right eye to 20/30; the left eye to 20/20.

Examination on June 14th and 19th of the same year revealed no change; the media were clear and the fundi were normal but there were deep physiologic cups in the discs. The patient was advised to return at frequent intervals. In October, 1934, she had a bilateral salpingo-oophorectomy, the pathologic records of which could not be obtained.

Course: She failed to return for observation until March 14, 1939, five years later. On that day she stated that one week previously she noticed that there were two pupils in her right eye. Examination showed the displaced pupil below and a large gap in the superior iris. The gap had many strands of iris tissue in it. The nasal portion of the iris was gray, while the normal iris tissue was dark brown. The true pupil reacted to light, especially in its upper portion.

Vision was: O.D., 20/100, correctible to 20/40 with a −1.50D. sph.; O.S., 20/100,

* From the Long Island College of Medicine and the Brooklyn Eye and Ear Hospital. Presented before the Brooklyn Ophthalmological Society, October 23, 1947.

correctible to 20/20—1 with a —1.25D. sph. The peripheral fields were normal at this time. Tension was; O.D., 23 mm. Hg; O.S., 15 mm. Hg (new Schiøtz). Wassermann test was negative; nose and throat examinations were essentially negative; but a positive Mantoux reaction was obtained.

On April 18th, the iris atrophy had extended farther nasally and the gap had increased in size (fig. 1). The lower margin of the true pupil was adherent and immobile. The patient was warned to expect

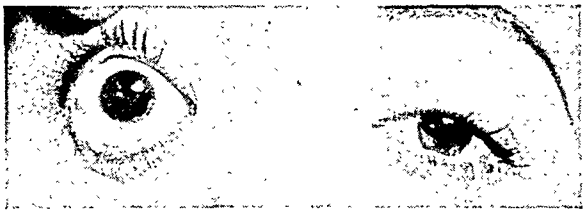


Fig. 1 (Lasky). *April 18, 1939.* The iris atrophy had extended farther nasally and the gap had increased in size.

trouble and to report at the first sign of pain or inflammation in the eye.

We next saw her on September 7, 1939, (fig. 2). By then she had developed more visual loss and had some redness of the eye with a vague feeling of disturbance. The tension was found to be: O.D., 35 mm. Hg; O.S., 20 mm. (new Schiøtz), and the peripheral field of the right eye showed a moderate general contraction with an angular defect in the inferior nasal quadrant. The blind-spots were normal. Pilocarpine solution (1 percent) was prescribed for use every four hours in the right eye.

Surgery. On September 16th, she returned complaining of a heavy dull pain in the right eye. Tension proved to be: O.D., 56 mm. Hg; O.S. 18 mm. Operation was advised and the patient consented. In view of the deterioration of vision and poor prognosis in this ailment, it was decided to do a Lagrange sclerectomy with as large an opening as possible. The procedure was accomplished without any difficulties on September 21st, and a large dark bleb resulted. Tension became: O.D., 23 mm. Hg; O.S. remained at 18 mm. No changes were noted in the iris or pupil of the right eye. The eye gradually became white, and a good bleb, partially filled with black pigment, was present. The fundus was clearly seen but the view was distorted due to a large astigmatic error, which appeared following the operation.



Fig. 2 (Lasky). *September 7, 1939.* By now the patient had developed more visual loss and had some redness of the eye with a vague feeling of disturbance.

There was occasional pain in the right eye despite normal tension. The bleb became progressively darker and more prominent. Iris atrophy continued to progress and there was a grossly evident anterior synechia formation at the 6- to 7-o'clock region of the limbus. On February 17, 1940, almost five months after the Lagrange sclerectomy, the tension of the right eye rose to 48 mm. Hg, (new Schiøtz), so an Elliot trephining operation (2 mm.) was performed temporally to the previous opening. However, this proved adequate for only six months A second Elliot trephination (2 mm.) was done at the 3-o'clock limbus position. After this procedure, the tension remained at 35 mm. Hg (new Schiøtz).

Because of the failure of these various operations, it was decided to abandon the anterior-segment procedures and to do a

posterior sclerectomy. On November 8, 1940, a 2-mm. button of sclera was removed from the infero-temporal quadrant of the globe in the region of the equator. This procedure was accompanied by the loss of a small amount of vitreous. A large bulbous area appeared beneath the conjunctival flap. It remained boggy for about two months and gradually became reduced in size. The tension did not return to normal limits until the operative area had become well healed with a flat well-formed bleb. On January 18, 1941, tension was: O.D., 13 mm. Hg (Schiøtz).

Outcome. The patient was not seen again by me until November 5, 1941. At this time the vision was: O.D., 1/200; O.S., 20/50; correctible to O.D., 20/30 with a −1.0D. sph. ⊂ −8.0D. cyl. ax. 70°; O.S., 20/20 with a −1.0D. sph. Tension was: O.D., 25 mm. Hg (Schiøtz). The original pupil was displaced to the 7-o'clock limbal area. The Lagrange filtration was marked by a large irregular black bleb. The two Elliot trephinations could hardly be discerned. The site of the posterior sclerectomy was flat but thickened. The lens and vitreous were clear allowing a view of a normal fundus, although it was a greatly distorted picture due to the large astigmatic error.

The situation was relatively unchanged on March 8, 1942. Vision in the right eye was still 20/30 with correction, and tension was 20 to 25 mm. Hg (Schiøtz).

On April 15, 1947, the patient presented herself again for an examination and the following findings were elicited. Vision was: O.D., 15/400, unimprovable; O.S., 20/30, improved to 20/20 by −0.75D. sph. Tension was: O.D., 27 mm. Hg; O.S., 15 mm. Hg (Schiøtz). (She stated that tension in the right eye had been 25 to 27 mm. Hg (Schiøtz) at all times since 1942.) The left eye was normal in all respects. The right globe (fig. 3) showed very little evidence of the posterior sclerectomy, just some conjunctival thickening. At the site of the Lagrange sclerectomy, there was a large irregular bleb that was tense and well filled with black-stained material. The Elliot trephination on the nasal side was flat and sealed. The iris was adherent anteriorly from the 6- to 7-o'clock position at the limbus; the entire upper portion was missing except for a few long strands that tapered from the iris below to the anterior lens surface above; the



Fig. 3 (Lasky). *April 15, 1947.* The iris was adherent anteriorly from the 6- to 7-o'clock position at the limbus; the entire upper portion was missing except for a few long strands that tapered from the iris below to the anterior lens surface above.

remnant of iris had a serrated edge and hung like a hammock from the 8- to 3-o'clock position. The pupil was somewhat triangular with the base above; this base still reacted to light. There were no deposits on the posterior surface of the cornea. The aqueous was clear.

The lens was studded on its anterior and posterior surfaces by numerous pigment particles ("bird-in-flight" type) that were especially dense near the nasal equator. A posterior cortical lens opacity was present below. Beneath the site of the nasal Elliot trephination a notch in the lens edge was clearly visible. The vitreous seemed clear and the fundus appeared to be normal except for a pale disc.

Comment

The general consensus of opinion at present is that the glaucoma is secondary to the

formation of peripheral anterior synechias, Lloyd.[5] However, various other theories have been advanced; such as Feingold's[6] conception of irritating substances formed as a result of iris tissue destruction; Kreiker's[7] idea that iris tissue debris occluded the chamber angle; Licsko's[8] coupling of the latter with loss of iris surface for resorption of aqueous. Rochat and Mulder[9] first advanced the thought that the anterior synechias are the agents responsible for the glaucoma. Rones[10] points out that many instances occur in which large segments of iris are lost by operation or trauma and glaucoma does not necessarily supervene.

Iris atrophy has been a moot question. De Schweinitz[11] believed it to be due to a local abiotrophy. Feingold suggested that a congenital vascular disturbance of the smaller iris circle caused the atrophy; Sugar explained that a lack of involvement of the sphincter militates against this view. Kreiker believes that in adult life the cytolitic process that occurs in embryonic life, causing the resorption of the pupillary membrane, suddenly becomes newly active and attacks the normal iris tissue. However, I am inclined to concur with Rochat and Mulder in their belief that the iris tissue atrophy is secondary to the constant, progressive stretching of the iris as it is pulled to one side of the anterior chamber. As has been described in the present case, there has been formed a mass of anterior synechias not only in the chamber angle below but also recently above to the visible cornea; there is a constant inexorable traction force. The longer the eye survives, the more anterior synechias form and the greater is the iris tissue destruction.

The true cases of "essential" atrophy of the iris have all been notable for the absence of any posterior synechias, iris inflammation, or any signs of an inflammatory process other than the anterior synechias that are a constant feature. The answer to the problem appears to lie in the presently unknown factor which initiates the first localized anterior synechia. In this case the extensive migration of iris pigment to the posterior surface of the lens, as well as to the anterior surface, indicates the marked degree of mobilization of this substance in the "essential atrophy."

One Nevins Street (17).

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SENILE MACULAR LESIONS*

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ATROPHY OF THE CHOROID

The choriocapillaris and the pigment layer of the retina, with the lamina of Bruch between them, are referred to frequently as the tapetum. This is a convenience sanctioned by use and the fact that to the ophthalmoscopist they are a single tissue. The tapetum returns the light from the ophthalmoscope to the examiner's eye and hides the deep choroidal vessels.

In older persons the tapetum becomes depigmented and, as a rule, exposes the sclerosed choroidal vessels which finally become opaque. This atrophic process begins in the nasal periphery and may or may not involve the macula in the late stages.

In addition to exposure of the choroidal vessels, a sheen or watered-silk effect spreads over the macula, interfering somewhat in the examination of that part of the fundus. This sheen is due to changes in the internal limiting membrane. It is surprising how far atrophy of the tapetum may go with but moderate effect upon the vision other than contracted fields and enlarged blindspots. Perhaps this may be explained by the work of Cohen and Verhoeff disclosing normal caliber of the retinal and choroidal vessels despite advanced changes in their vessel walls. A more advanced stage of this atrophy is featured by a denser sheen over the macula, a meaty fundus background with undulating finer retinal vessels, indicating a wrinkling of the tissue beneath. The vision now is definitely lower and retinal changes can be seen with red-free light (fig. 1).

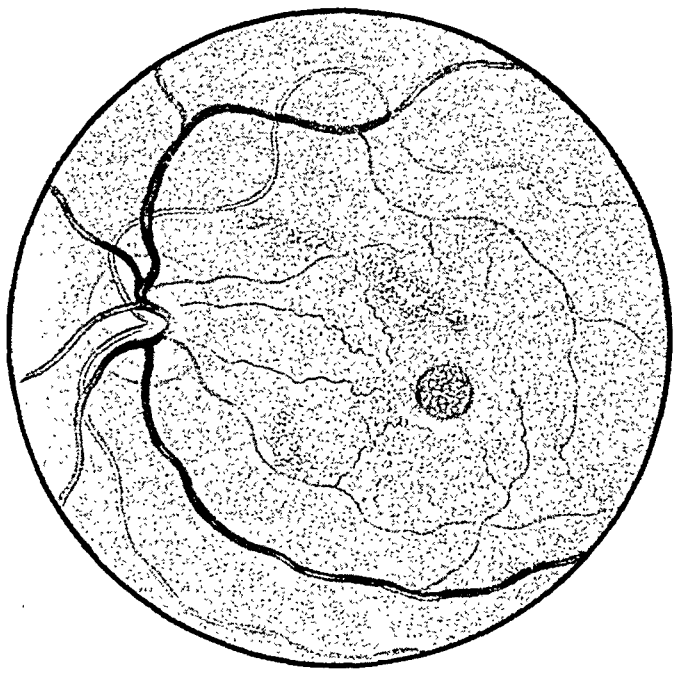


Fig. 1 (Lloyd). Early stage of choroidal atrophy in a woman, aged 61 years. There is a hole in the macula after a slight injury. Vision is 20/40.

*Read in part at the 82nd annual meeting of the American Ophthalmological Society, San Francisco, California, June, 1946.

The atrophic process may spread over the entire fundus exposing the deep sclerosed vessels everywhere except at the macula and, as long as this patch of choroid remains, vision is very good indeed in *good light.* If the patch beneath the macula disappears, the patient is blind. Some of these

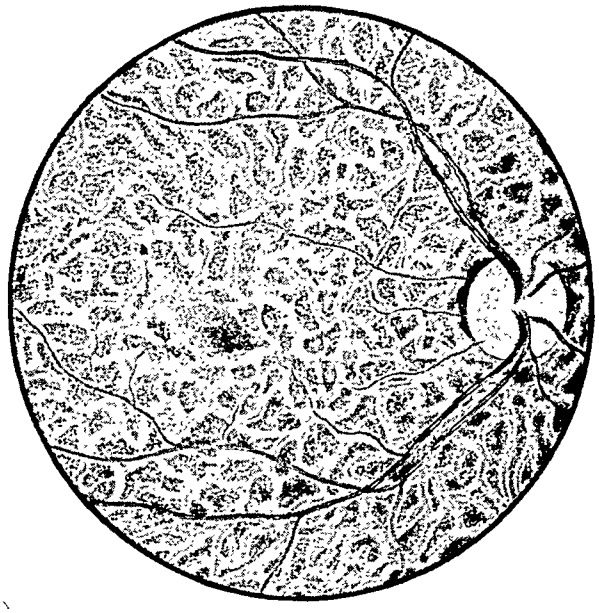


Fig. 2 (Lloyd). Advanced choroidal atrophy with surprisingly good vision in strong light (20/25 and 20/33). The patient, a woman, aged 64 years, showed night blindness and ring scotomas.

patients do not complain of night blindness, but some cannot see in poor light, and some also have ring scotomas (fig. 2). This unusual fundus picture may be referred to as progressive choroidal atrophy (fig. 3); or it may be designated by the term, choroideremia. None of these eyes have come to the laboratory as far as I can learn, and the cases are so few that essential details are lacking. No family incidence has been shown in this group, distinguishing these cases from those in which one or more members of a family have pigmentary retinitis or night blindness with fundus pigment and secondary posterior capsular cataract.

General choroidal atrophy may be contrasted with two more localized forms, peripapillary and central. The peripapillary atrophy is most frequently seen in high myopias which run through families. The central type is referred to as central areolar atrophy and may possibly develop without adequate explanation but is more often seen as the late stage of pseudotumor and angioid stripes. It follows occlusion of vessels in the nerve or retina after injections about the face, basal fractures, and without discovered etiology.

Hole in the macula

This is rarely seen except with choroidal atrophy and is at first limited to the tapetum with later serious effects upon vision. A rarer sequella of choroidal degeneration is pseudotumor of the macula caused by an accumulation of serum or blood beneath the pigment layer followed by characteristic changes.

Pseudotumors of the macula

These lesions, which require differentiation from tumor, are modest elevations of

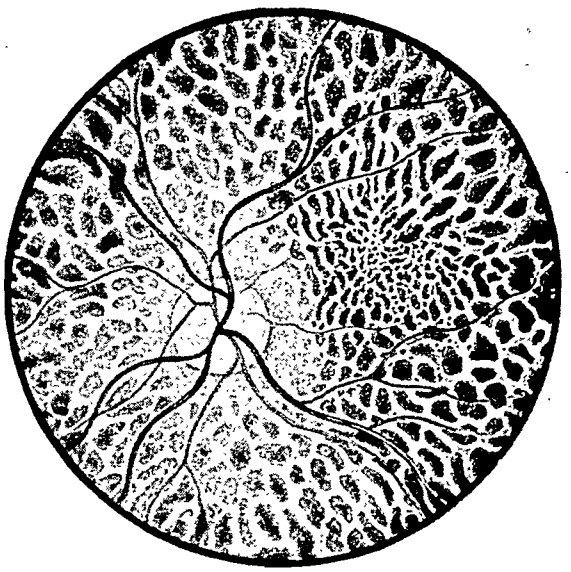


Fig. 3 (Lloyd). Late stage of progressive atrophy of the choroid. This man, aged 65 years, was blind but gave no history of difficulty in seeing at night.

3 to 6 diopters and of 6 to 8 disc diameters in width and height, somewhat lighter in color than the background and easily mistaken for a patch of choroiditis unless the

binocular scope is used. The first complaint, loss of vision, may precede objective evidence by a few weeks. The first visible change may be small hemorrhages, followed soon by the rounded mass in the macula (fig. 4). Two patients have recovered from this stage but neither had normal vision and one had a relapse within a year. The lesion may remain in the original state for some time but most of them undergo further changes within a few months. Cyst formation (fig. 5) is the most common type of lesion and is probably due to the clear exudate breaking through the pigment layer of the retina leaving no other covering than the retina. Less common is the organization of the exudate to form the woolly masses of Coats's disease (figs. 6 and 7). Better known is the sheet of organized tissue beneath the retina, the disciform degeneration of the macula (Kuhnt-Junius). Cysts are unstable and do not usually remain for any length of time (fig. 8). The clear exudate within may disappear along with the tapetum, leaving a bare spot in the macular area with sclerosed vessels and atrophic choroidal tissue as the background. Occasionally the sclera may be exposed. The fluid may spread laterally and raise the retina in folds, producing a flat detachment (fig. 9) of limited proportions. After a time, the involved tapetum atrophies and an extensive area of thinned pigmented tapetum remains. Occasionally there are streaks of "retinitis striata" beneath the retinal vessels (choroiditis proliferans, Fuchs).

The hand scope does not give satisfactory details of the cyst because the retinal image is never sharp but obscures the view of the deeper parts. The binocular scope shows the diaphanous retina in advance of the pigmented and hemorrhagic tapetum beneath. None of these spreading defects have been seen to pass over into a typical retinal detachment of average extent or elevation but I believe it does occur in elderly persons.

Judging from the appearance of the macular region after reattachment of the retina and the microscopic changes in the pigment layer in the late stages of pseudotumors, one should not expect too much improvement of vision because of damage to the pigment epithelium and the choriocapillaris.

Choroidal hemorrhages and the masses of "rice grains" (fig. 9a) about the macula usually referred to as retinitis circinata are common to every stage of these lesions. To the hand scope, the "star figure" of hypertensive disease, wreaths of retinitis circinata, and many hemorrhages seem to be in the retina but are actually in the tapetum.

A fulminating type of pseudotumor is due to the choroidal hemorrhage breaking through the lamina of Bruch, then through the pigment layer of the retina so it is seen with nothing but the retina over it. These lesions smother the light of the ophthalmoscope and look like the dark masses seen after cataract extraction which are recorded as subchoroidal hemorrhage or detachment of the choroid. The appearance of these is so alarming that the eye is usually enucleated at once.

One such case, reported by Dr. Verhoeff and Dr. Grossman, flattened down after six months; the macular region lost color; and microscopic examination showed the organized subretinal tissue characteristic of disciform degeneration. A case of the kind came to my care and, although the diagnosis was in doubt, because retroillumination at operation showed complete opacity of the area involved, the eye was removed about one week after total loss of central vision, known to have been 20/20 before the attack (fig. 10).

In none of the slides examined from cases of this type or illustrated in the literature, was the choroid stripped from the deeper tissues nor was blood found beneath the choriocapillaris. Excepting the stripping of the choroid by rupture of long ciliary vessels during operation for cataract or glaucoma, the term subchoroidal hemorrhage or detachment of the choroid is a misnomer.

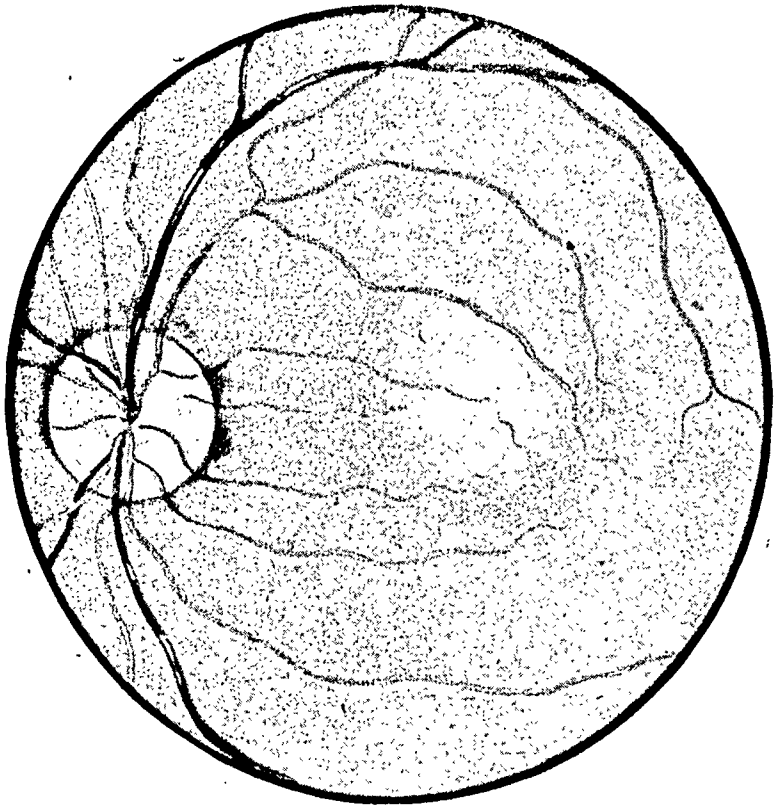


Fig. 4 (Lloyd). This illustrates the first stage in the development of pseudotumors of the macula. The patient, a man, aged 41 years, had recently been treated for syphilis. Small hemorrhages, followed soon by the rounded mass in the macula, were the first visible changes.

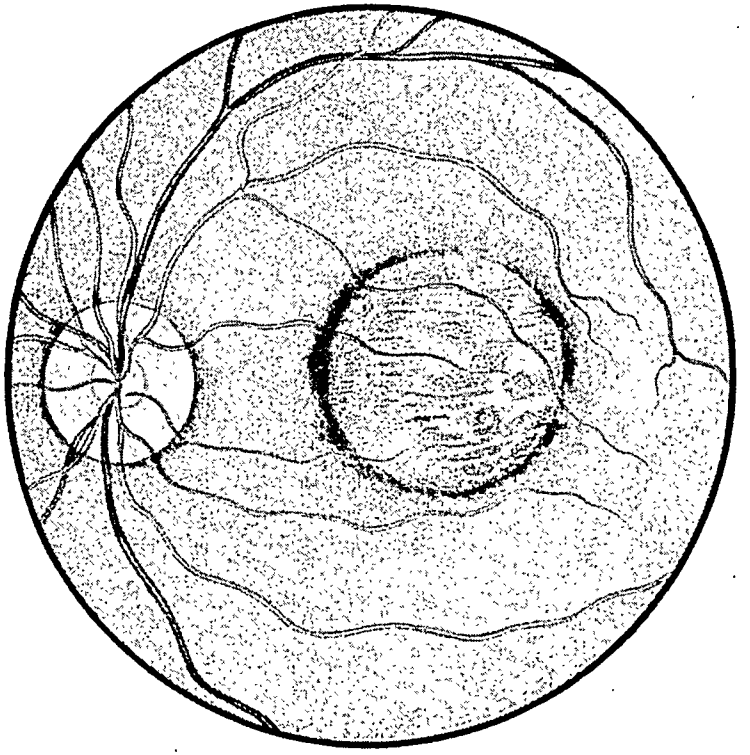


Fig. 5 (Lloyd). The same eye as shown in Figure 4. This drawing, made six months later than Figure 4, illustrates the change from a typical lesion to the cystic stage.

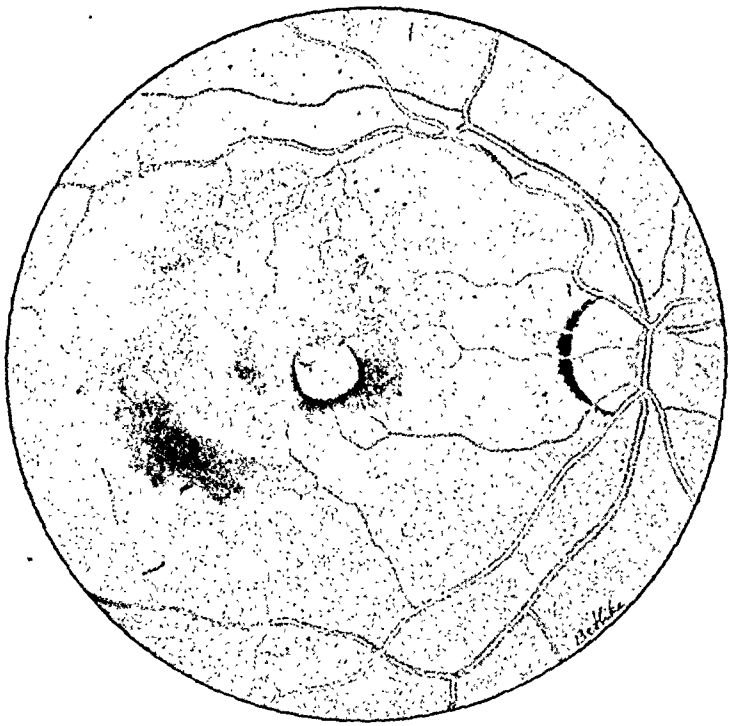


Fig. 6 (Lloyd). The patient, aged 54 years, showed as the first lesion, a hole in the macula, followed by hemorrhage and pseudotumor one year later.

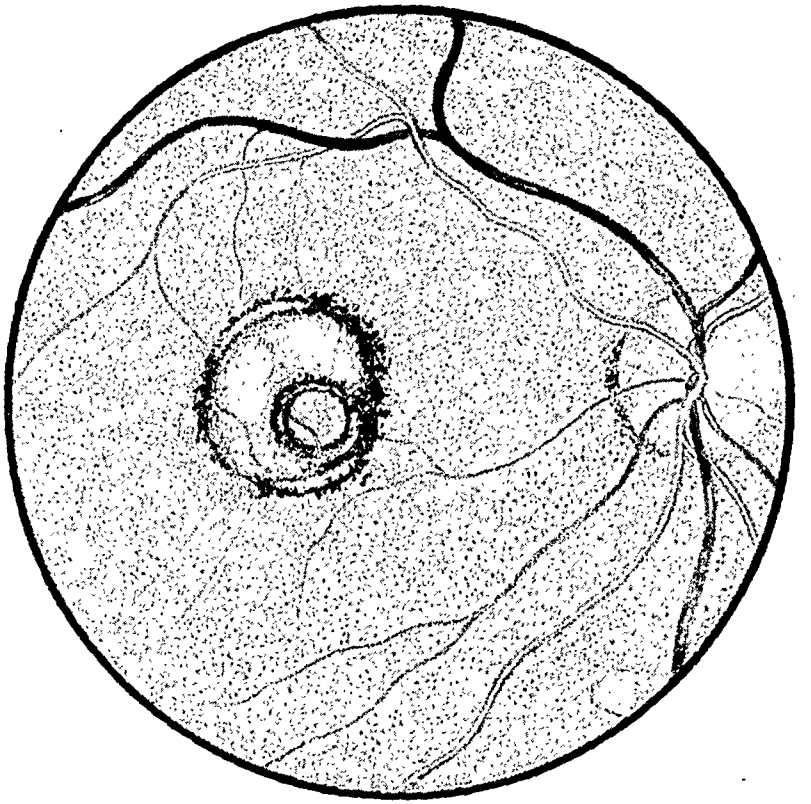


Fig. 7 (Lloyd). This drawing of the same eye as is shown in Figure 6 was made two years later. It illustrates the change into Coats's disease.

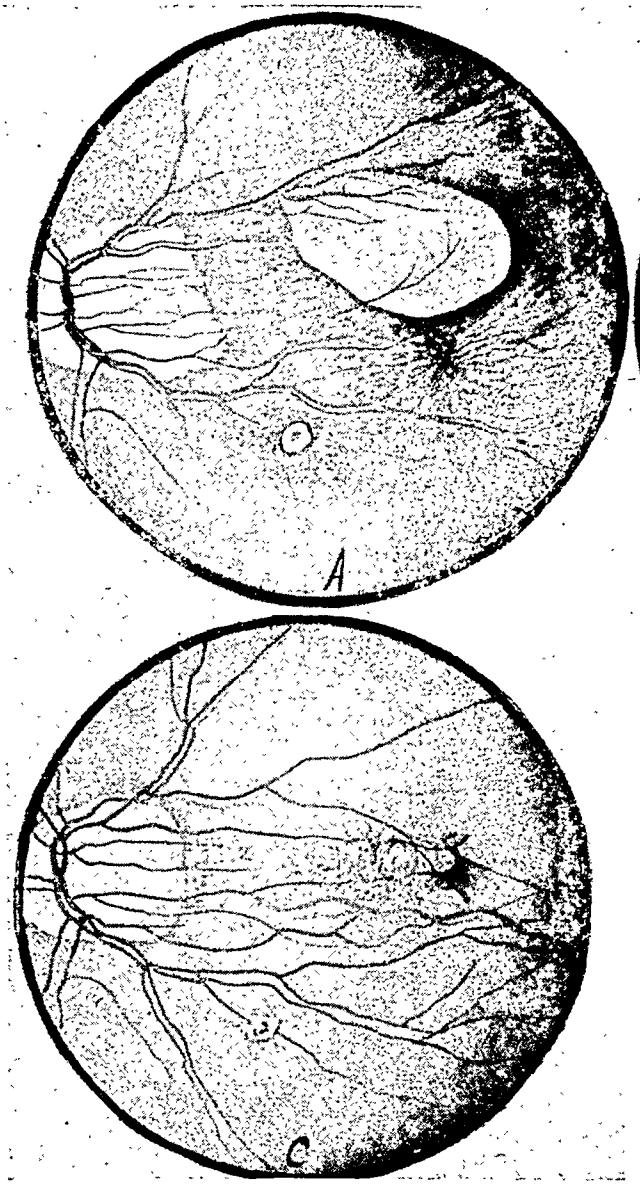


Fig. 8 (Lloyd). This illustrates the change from a cystic lesion (A) to a very small atrophic area in seven months. The patient, past fifty years of age, was highly myopic when the lesion appeared. (B) The lesion (—16D. sph. ⊂ —1.50D. cyl. ax. 165° = 20/50, 2 letters). Vision dropped to 1/200 three months later. (C) Five months later. Vision is 20/100. (Dr. Paul Chandler.)

The difference between the hemorrhagic type of pseudotumor, the usual pseudotumor, and the cyst which often follows is the presence of blood beneath the retina in the first instance; clear fluid beneath the pigment layer in the second; and clear fluid beneath the retina in the third. Judging from the appearance of the spreading lesion after cyst formation, it is fair to say that the difference in appearance between a cyst and a retinal detachment is due to the character of the retina at the macula and elsewhere.

The pseudotumor occurs most often in

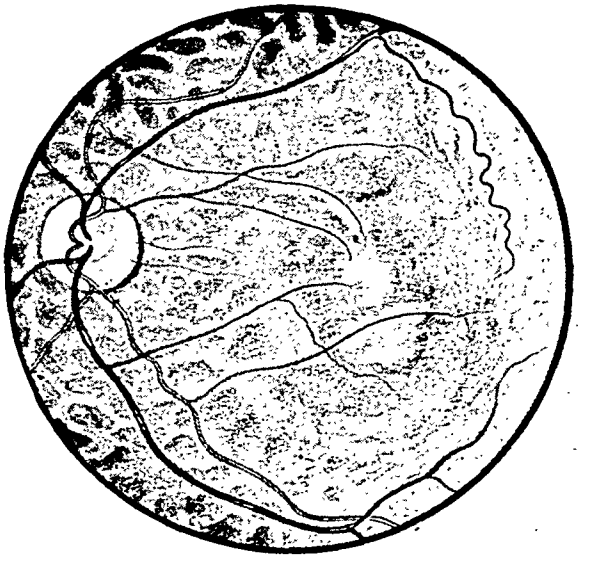


Fig. 9 (Lloyd). Illustrating the change from a cystic lesion to retinal detachment of limited area in six months.

older patients of the "healthy" arteriosclerotic type quite independent of the retinal lesions of the cardio-vascular-renal syndrome, although the two may go together. The lesions are often bilateral, with an interval of time elapsing between the attacks. The patient with pseudotumor may live for years after losing central vision, in contrast to those affected with high blood pressure. Quite young patients have been reported as having this condition, but the youngest in this group was aged 34 years. Most cases are found in the 50- to 60-years age group.

There is no explanation for the vulnerability of the macula that the location and frequency of the lesion implies. Atrophy of the peripheral tapetum with sclerosis of the choroidal vessels is a common antecedent and in three cases there were also holes in the macula. One patient had a definite history of syphilis.

Behr asserts that the lamina of Bruch controls the passage of nourishment and the return of waste products from the choriocapillaris to the external retinal layers. A highly albuminous fluid accumulates beneath the pigment layer, stripping it from the lamina. The pigment cells react to the exudate much as lens stroma reacts when exposed to aqueous. The epithelial layer proliferates and degenerates, making a sort of capsule beneath the retina with especially thick margins which throw back the light from the scope to form the image perceived by the examiner as retinitis circinata (Seefelder).

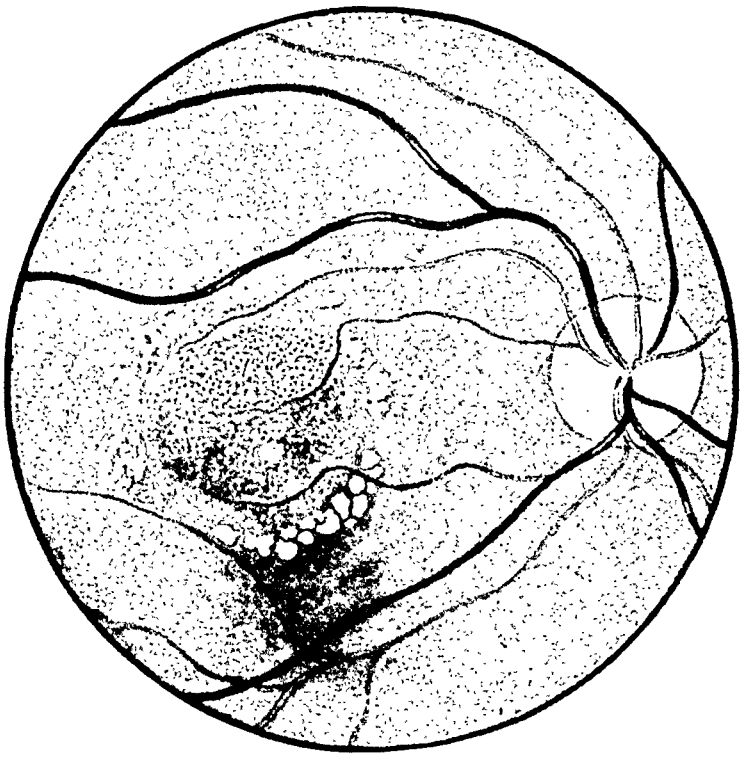


Fig. 9a (Lloyd). Bilateral lesions (see also Figure 9b) in a man, aged 65 years. "Retinitis circinata," here illustrated, is often seen in these cases.

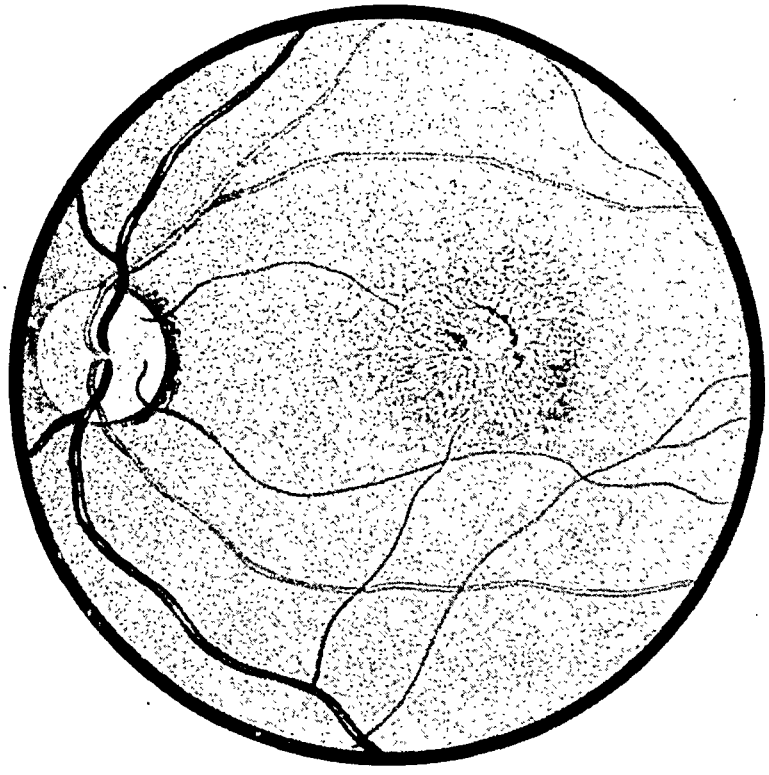


Fig. 9b (Lloyd). The soft spots in this eye are colloid masses in the lamina of Bruch.

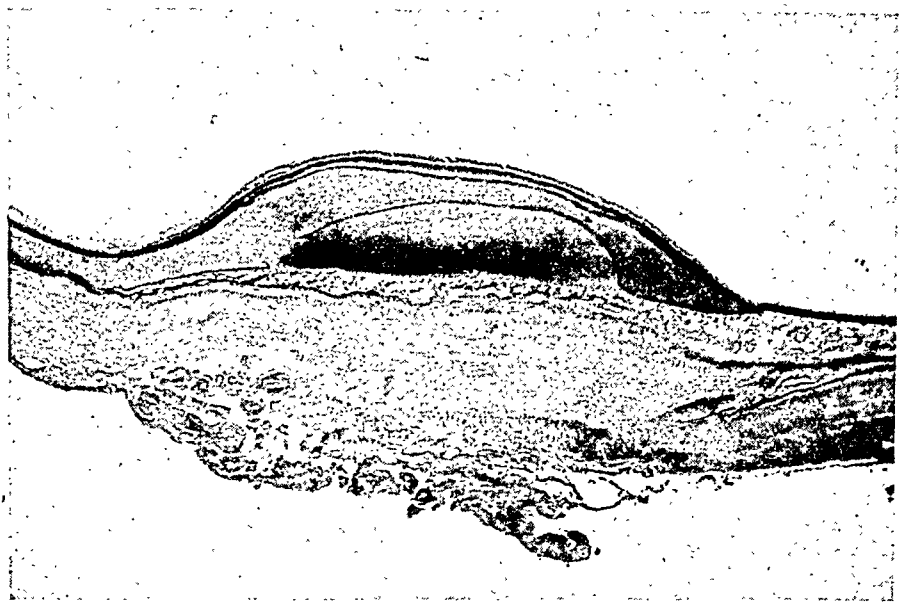


Fig. 10 (Lloyd). Sudden loss of vision with a dark mass in the macular area looking like "detachment of the choroid" after cataract extraction. The eye was removed one week after onset. The hemorrhage came from the choriocapillaris, lifted and broke the pigmentary layer. The break through the pigment layer is at the left.

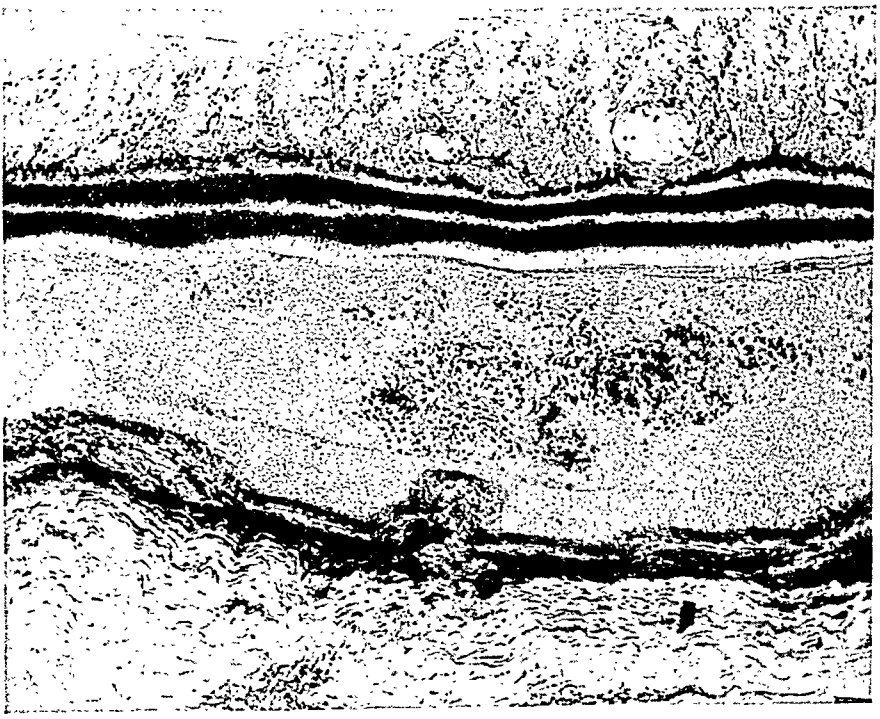


Fig. 11 (Lloyd). "Bud" from choriocapillaris passing through the lamina into the subretinal collection of blood in an acute case. From the same eye as shown in Figures 6 and 7.

Behr explains the connective tissue, bone, and cartilage found in the exudate beneath the retina in Coats's disease and disciform degeneration of the macula (fig. 11) as a metaplasia; but Axenfeld, Verhoeff, Vogt, Sandoz, and E. V. L. Brown* have demonstrated breaks in the lamina of Bruch (fig. 12) through which vessels passed into the organized subretinal tissue. This vascular intrusion also explains the recurring choroidal hemorrhages so often seen in these cases. Once vessels have entered the subretinal space, any form of connective tissue may develop. The diagnosis is confused by metastatic tumors of the choroid which look just like innocent lesions. This is probably due to the fact that the tumor mass in the choroid is small and concealed by an accumulation of subretinal fluid.

Every case should be examined carefully for sources of metastasis (fig. 13), the most frequent being the female breast and the prostate gland. Metastatic tumors at the macula are very rare and, in these older individuals, there is time enough to study the case until the diagnosis is certain. In younger patients, the ophthalmoscopic picture may be so strange and suggestive of tumor that we must fall back upon the well-established rule that an eye without possibility of useful vision should be sacrificed if there is serious doubt of the nature of the lesion.

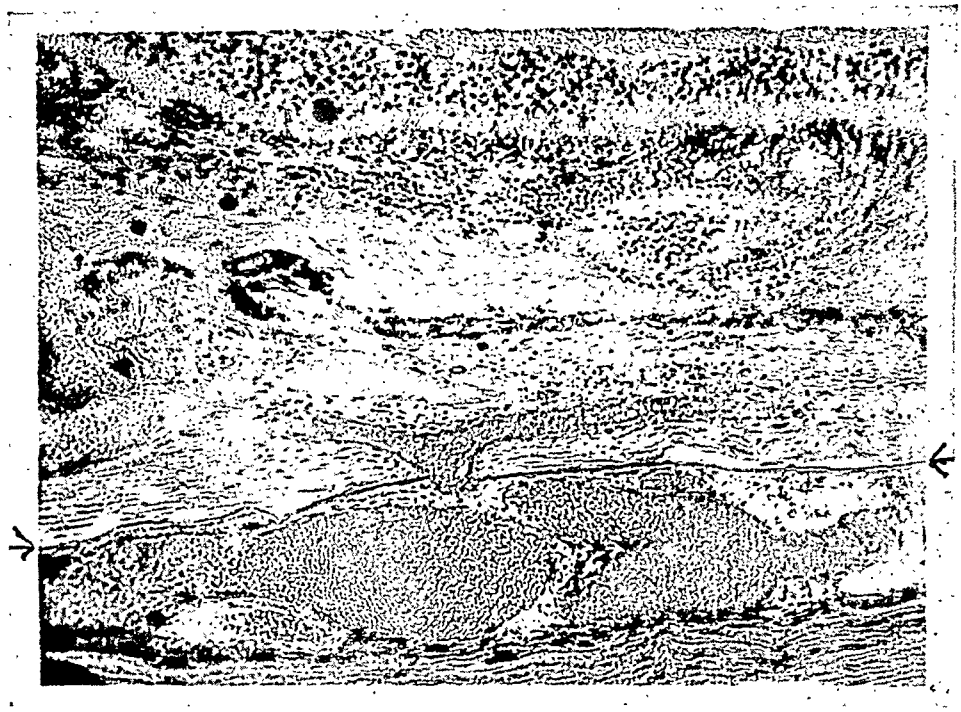


Fig. 12 (Lloyd). The black lines indicate the lamina of Bruch through which an arteriole is passing to the organized subretinal tissue. (From, Verhoeff and Grossman: Pathogenesis of disciform degeneration of the macula. Tr. Am. Ophth. Soc., 1937, p. 262.)

Chorioretinal tuberculosis presents a very similar picture but the vitreous is involved early and the course of the disease is more rapid. Scars of previous attacks and involvement of retinal vessels may assist in establishing the diagnosis. Positive reaction to tuberculin tests is also of diagnostic value.

*I am indebted for the privilege of examining slides from the three cases reported by Drs. Verhoeff and Grossman and also one from the case reported by Axenfeld in 1915. Drs. E. V. L. Brown, Beulah Cushman and Arnold Knapp have kindly given me slides from cases of this type reported by them.

Syphilis has rarely entered the picture because the fundus lesions it produces are results of vessel degeneration rather than gumma.

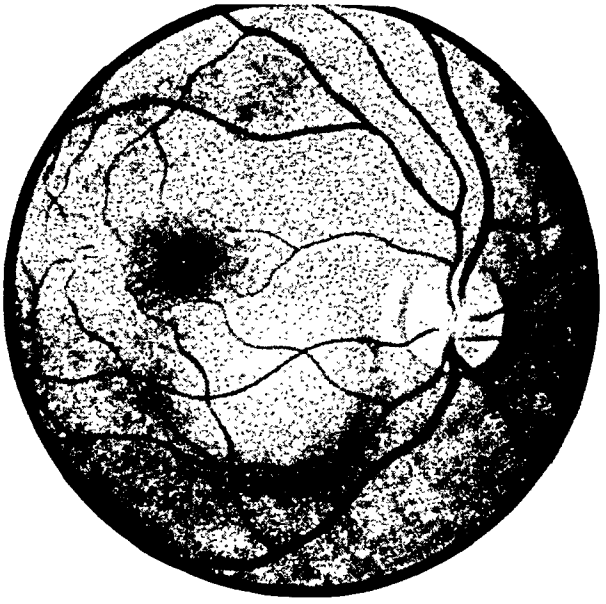


Fig. 13 (Lloyd). Metastasis from carcinoma of the breast in a patient about fifty years of age. The lesion was improved by X-ray therapy, but the other eye was involved in two years. (Dr. Walter Hipp.)

When these symptoms appear in children (fig. 14), the question of birth injury will arise. Lesions resulting from injury at birth are stationary, with threads of new tissue extending into the vitreous from the organized mass following hemorrhage. Blunt trauma may produce most confusing pictures but the damage is so severe that the eye is rarely retained. If it is retained, however, examination of the fundus is usually precluded by damage to the cornea or organization of tissue in the vitreous.

Two cases of congenital retinal folds (falciform ablation) required some study, but this condition is always connected with the disc and, although the fundus shows marked deviation from the normal, the clear vitreous permits satisfactory fundus examination.

A somewhat similar lesion is the so-called preretinal edema. A patient with this type of macular lesion had lived for many years in Africa and complained of poor vision in one eye after returning to this country. He improved under treatment, but I did not have the opportunity to follow the case to conclusion. The binocular scope located the pigment dots and the bubbles in the edematous retina but an exudate beneath the pigment layer caused the elevation. With the hand scope, the lesion looked as if the collection of fluid was preretinal, like the so-called preretinal hemorrhage, but both are really beneath the retina. Neither of these conditions has been examined under the microscope and, until this is done, there will be differences of opinion. I am sure

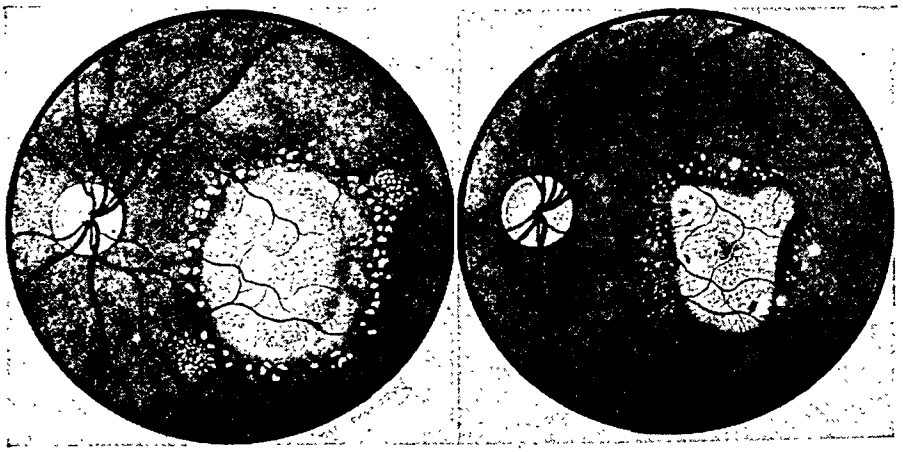


Fig. 14 (Lloyd). Lesion in a child aged 7½ years. The interval between the two drawings is two years. Tests were negative. The large spots about the lesion in the illustration at the left are crystals.

the so-called preretinal edema is not preretinal and would suggest use of the binocular scope in such cases to clear the doubt.

Angioid striping

This is a degenerative process occurring in eyes of older persons but with notable exceptions to age limits. The familial tendency is well known and, although this is considered an entity, the pathologic process is very similar to that of pseudotumors. It is not unusual to find typical cases in a family, as well as cases with similar fundus details excepting the stripes. The breaks in the lamina of Bruch are numerous but, because of brittleness, many are made when the section is cut.

The literature contains many case reports, but very few pathologic examinations have been made because only eyes removed after death have come to the laboratory. Hagedoorn, Böck, and Bertha Klien have each presented completed reports of cases studied with the ophthalmoscope and serially sectioned in the laboratory. Accumulation of fluid beneath the pigment layer, with organized subretinal tissue like that found in disciform degeneration, has been found but no mention is made of vascular intrusions.

An illustration (fig. 15) is presented showing angioid stripes in one eye while the other has a large atrophic area in the macular region with exposed sclerosed vessels of the deep choroid.

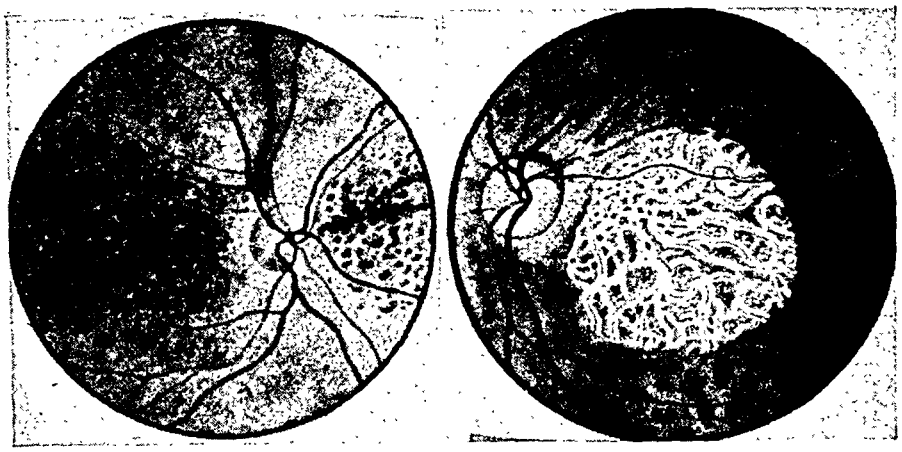


Fig. 15 (Lloyd). Angioid stripes in the right eye and central areolar choroidal atrophy in the left.

Summary

From this review it seems that a number of characteristic fundus lesions, considered to be entities, are really stages of a degenerative process affecting mainly the lamina of Bruch, the vessels of the choriocapillaris, and the pigment layer. This is to be expected, since Time takes its toll first of the elastic tissues, and its effects upon the vessel walls, skin, the sphincters and the detrusors are well known. The lamina is an elastic tissue and the choroidal vessels in the macular area seem especially vulnerable.

Although no detachment of the area or size seen in typical cases has occurred under observation, the similarity to flat detachments seen in young persons with myopia of moderate degree suggests the importance of routine serial sectioning of all posterior fundus lesions, with a systematic search for breaks in the lamina of Bruch and vascular intrusions.

Because of the reaction of the pigment layer to accumulations of fluid beneath it, one suspects that diathermy is effective because it inhibits the secretion and not because it closes a tear. Also, involvement of the macula in a detachment would seem to occlude much hope of good vision after reattachment.

These opinions should not lead one to think that I am opposed to operation for detachment. An ophthalmologist who has practiced when detachments were treated by prolonged rest in bed, subconjunctival salt injections, compress bandages, and tapping of the subretinal space—with a recovery rate of zero—can appreciate the benefits of the modern operation. The binocular microscope is essential to a satisfactory study of cases of this type and anyone who has used it can readily appreciate the advantages of observation with two eyes.

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BARRIERS AND AIDS TO FUSION*

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In attempting to discuss fusion, one is led from the study of the simple reflex to the elaboration of final percepts and concepts—from physiology to the realm of metaphysics. As objective investigators, we may not like the subjective aspects of psychology, but we should at least remember that the study of science must be synthetic as well as analytic. Thomas Young, the physicist and ophthalmologist, himself taught and followed that truism. Hence we shall not avoid mentioning such metaphysical concepts as consciousness, attention, and association, even though we translate them to forms of cerebral functioning.

SOME CONCEPTS OF FUSION ATTAINMENT

In considering the various theories of fusion in the visual cortex, the most easily understood are those which propound certain anatomic fusion centers, or a physiologic centering of fibers from corresponding retinal areas.

Unlike his well-known theory of conditioned reflexes, Pavlov's proposed thesis of cortical excitation and irradiation has not proved acceptable.

The replacement theory is summarized by stating that the cortical center selects parts from maximum capacity uniocular images, so that the final image is a mosaic derived from replacement rather than addition.

Chavasse suggests two possible theories. The first stipulates that fusion occurs by selection from two uniocular cerebral patterns, and the second that it occurs by reciprocal cerebral inhibition so that only one pair of corresponding areas can function at the same time. His refusal to consider the sensory aspects of fusion, however, and his insistence on regarding it simply as a motor reaction brought about by reflex activity leaves his reflexes like an army without a commander with no explanation of integration or synthesis.

The conclusions of Sherrington have led to the most complete concept of fusion. He proved that each uniocular image is developed and elaborated independently and that the union of the two images is the product of synthesis derived from interpretation with other already elaborated sensations.

We know that fusion is of late phylogenetic development and, as such, is easily liable to modification or perversion. For its natural and normal functioning it is necessary to have an overlap of the visual fields of the two eyes, a highly organized central nervous system, corresponding retinocerebral elements, and a correctly functioning extraocular muscle system so that the visual axes are correctly oriented.

The neural image arising in the retina is transmitted through nerve impulses to the lower visual reflex centers and the appropriate motor reaction for fusion is initiated by the higher visual reflex centers. We may note here the general acceptance of the conclusion that the semidecussation of the fibers at the chiasma has a motor significance rather than a sensory significance, since it provides a common efferent path. Thus there is no necessity for a common representation in the cortical field (Sherrington, Duke-Elder, and others).

BARRIERS TO FUSION

Barriers to fusion may be divided into two classes—those which prevent the development of fusion and those which cause its breakdown. Specifically they may be listed as follows:

* Presented at the sixth annual meeting of the American Association of Orthoptic Technicians, Chicago, October 12, 1947.

1. Dioptric. (a) Due to unequal uniocular images—for example, anisometropia over 4D, high astigmatism, aniseikonia. (b) Refractive—for example, hypermetropia or myopia may predispose to convergent or divergent strabismus respectively, the cause being a too tightly conditioned accommodation-convergence reflex. The uncorrected hypermetrope overaccommodates to see clearly and consequently overconverges. The resulting diplopia causes him to converge more to separate the images. Conversely the myope has no need to accommodate and, therefore, underconverges producing divergent strabismus. The initial treatment lies in correction with glasses, followed by an orthoptic loosening of the too tightly associated accommodation-convergence link.

2. Anomalous retinal correspondence. Although this is certainly a barrier to fusion, it should be considered as a biologic adaptation rather than a cause per se of the nondevelopment of fusion. The theory that anomalous retinal correspondence is a conditioned reflex—as Chavasse presumes—would be a most satisfactory explanation, if one is prepared to accept the principle of sensory conditioning. However, in spite of alleged synesthesia, no sensory conditioning has yet been demonstrated. The classical conditioned reflex refers to a motor or secretory response.

Duke-Elder regards anomalous retinal correspondence as secondary acquired correspondence which is a functional attribute. As an orthoptist, I can testify that it can be cured in 4 to 24 treatments in over 50 percent of cases (under 12 years of age) preoperatively. Another 15 to 25 percent will obtain true retinal correspondence in the first weeks after operation, provided preoperative, bimacular stimulation has been given. The cure may involve the extinction of a conditioned reflex, the reinforcement of an inhibited neural pathway, or the grounding of new neural connections.

If the anomalous retinal correspondence is not corrected before operation, any of the following situations may ensue:

a. The patient may develop a new anomalous correspondence adapted to the new position of the eyes.

b. He may turn the eye in again to the original angle in order to restore the old anomalous correspondence.

c. He may have persistent diplopia of the paradoxical or false type, or of the true type.

d. The possibility of obtaining fusion without training is remote and might occur only if there was a history of previous fusion, and if the eyes were straight after operation. Even then suppression would probably prevent the development of fusion.

3. Amblyopia. In this condition we need only consider amblyopia ex anopsia, which may be either the cause or the result of strabismus. When the child is conscious of diplopia, he turns one eye in further to separate the images and then suppresses the vision in that eye so that it becomes amblyopic from disuse. This is an active inhibition which is cerebral in character. Treatment consists in appropriate stimulation of the amblyopic eye and is usually successful. Unless fusion is stimulated and attained before operation while the amblyopia is in the process of being cured, there will be no binocular hold after the operation and the diplopia-strabismus-suppression cycle will be repeated. It is conceivable that when the vision of an amblyopic eye has been improved by occlusion, without fusion training being given simultaneously, diplopia will become troublesome, and the child will consequently either develop anomalous retinal correspondence or increase the angle of squint.

4. Suppression. When total or partial dominance is given to the image of one eye, and there is a loss of physiologic retinal rivalry, the usual cause is either incompatibility of the uniocular images or heterophoria.

In the latter, a small central suppression may prevent symptoms at first, but when compensation or adjustment can no longer be maintained, the effort becomes conscious and symptoms appear. The cure in this case consists of antisuppression treatment and the development of increased fusional range to overcome the heterophoria.

In the case of an alternating strabismus, suppression is both intensive and extensive, and requires treatments to obtain simultaneous cortical response to each uniocular impression. Sherrington proved the existence of the neural states of excitation and inhibition, which are believed to be due to electrical changes in the cortex. Inhibition may be of the intrinsic or adaptative type, as opposed to the extrinsic or antagonistic type, and in cases of amblyopia and suppression is probably of both types.

5. *Neurogenic anomalies* such as nystagmus, spasm, and so forth.

6. *Hyperphoria and hypertropia.* A vertical deviation of over five diopters is usually beyond the range of fusion, and can thus be considered a barrier to fusion.

7. *Loss of central fixation and false fixation.* These are further perversions of the amblyopic group.

8. *Deviation of the visual axes.* Strabismus, whether it is convergent or divergent, is a barrier to fusion since a correctly functioning extraocular musculature is a primary requisite. Whatever the etiology of the strabismus, the visual axes must be restored to approximate parallelism by operation. Nevertheless, it should be emphasized that the previous anomalies, such as amblyopia, suppression, anomalous retinal correspondence, and so forth, must be corrected and a fusion ability initiated before operative procedure, or the patient will be presented with straight eyes and a true or paradoxical diplopia, or a suppression which will cause him to squint again. The end organs should be capable of receiving the images, and then the two uniocular images must be compatible and capable of independent elaboration in the visual cortex. The facilitation of appropriate pathways and the integration of higher centers will then effect a correct motor response when the external musculature is finally adjusted.

A squint is a conditioned reflex and for its extinction requires not only the correction of muscular changes by operation, but also reconditioning by training.

Before final discharge, the patient should have good fusion range, and be able to converge correctly.

To reiterate, we have given the various theories and a definition of fusion, discussed the barriers to fusion, and the possibility of their removal by refractive correction, orthoptic treatment, and operation. To illustrate the importance of orthoptic training as being of therapeutic value in addition to its diagnostic uses, it will now be necessary to investigate the visual anlage of the individual, and the learning process.

Neuro-anatomy of vision

In the young child we have a condition of flux and an histologically proved anatomic network indicating a richly branching and interlacing central nervous system—fertile ground for the future formation of new associations and habits or reflexes.

Unlearned automatic reflexes are innately present, and they may be either physical reflexes which are not registered in consciousness—for example, the pupillary light reflex—or they may be psycho-reflex in nature and are registered in consciousness—for example, convergence. There are also learned or conditioned reflexes, of which an example is the accommodation-convergence linkage.

The inherited cellular adaptation may be modified by experience, and indeed neural tissue possesses the property of modification if only in a small degree. Of primary importance, however, is the possibility of the facilitation of present pathways and the

grounding or establishment of new connections between neurons—between receptors and effectors.

A response may be evoked or reinforced by changes and modification at the synapses, thus achieving a decrease in the threshold. Since the nerve impulse along a fiber is believed to be "all or none," the changes in the threshold must occur at the synapse; that is, at the point of excitation, by bioelectric potential and resulting ionization, or by certain physiochemical changes in the nerve cell.

It is conceived by recent experimentation that the mechanism of the transmission of nerve impulses across the synapse does not differ qualitatively from that of their conduction along the fibers themselves. It is only quantitatively greater at the synapse since the neuronal surface itself is greater here, and the chemical and metabolic changes associated with electric changes, which occur at the neuronal surface, show a greater manifestation here during nerve activity. Other neural theories which seek to explain conditioning are briefly that learned action occurs in closed neural chains, as opposed to direct neural chains, or that it depends on bioelectric fields for organization.

The quality of summation needs to be mentioned here, since it reflects on orthoptic training, which seeks to evoke responses by stimuli and association. Temporal summation occurs when two successive stimuli to the same nerve evoke a response even if the stimuli are too weak or the threshold too high for them to act individually. Spatial summation occurs when two stimuli are applied to two different afferent nerves which play upon the same reflex center. Summation is greater when they are applied simultaneously, and at least two simultaneous impulses are necessary to excite a neuron.

The learning process

We accept the conditioned reflex of Pavlov, as a true basis for the learning process, but since it has been proved that a conditioned response may be effected even when the cortex is destroyed, and considering that a simple chaining of conditioned reflexes will not adequately account for the patterning and integration of habits in their complex presentation, we may understand the neurologists' refusal to accept conditioning as a total explanation of neural behavior.

For a more complete understanding of the problem we must consider the functioning of the higher centers through the factors of interest and attention, and their superimposition upon the reflex foundation by means of association paths. Sherrington has shown the primary importance of the higher centers as modifiers and controllers of the reflexes.

Skilled reactions are controlled reactions, and any training is, therefore, a modification of the activity of the higher reflex centers through conscious control. The association systems which are concerned with the complex sensorimotor integration of adaptative behavior are capable of modification by training. The process of encephalization—or the dominance of the cortex which occurs in phylogenetic development—is indicative of learning possibilities, even ontogenetically.

Role of orthoptics in fusion

The role of orthoptics in the development of fusion is thus accomplished by the following physiologic and neurologic considerations:

1. The elicitation of response by the facilitation of neural pathways through the use of correct stimuli; the facilitation signifying a nonlearned increase in the strength of the response.

2. The elicitation of response by means of conditioned reflexes. New reflexes or responses may be conditioned by means of the fixation reflex (surely a primary reflex par excellence) and by kinesthetic re-

flexes. The direct and simultaneous stimulation of the two maculas, and hand and eye coördination are fundamental aids.

3. The consummation of the reflex arc is in itself a direct intrinsic stimulation to further response, especially if it is in the nature of a biologically superior response.

4. The elaboration of two uniocular images in the cortex and the arousing of the factors of attention and interest so that, with increased permeability of the association pathways, fusion is elaborated in a final synthesis.

SUMMARY

We have considered the theories of fusion and the necessary neural and physiologic factors. Reference has been made to the barriers to fusion and their removal by refractive, orthoptic, and operative means. The validity of orthoptic training on the basis of our present knowledge of the learning process is demonstrated and the attainment of fusion considered in the light of cortical neurophysiology.

402 Cobb Building (1).

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DISCUSSION OF MISS EYLES' PAPER

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The neuron component of the ocular-muscular apparatus has been somewhat neglected in our work because it is so poorly understood even by those best qualified to explain it to us. I think Miss Eyles has done an excellent piece of work in bringing together the many intangibles that form the basis of our present knowledge of how fusion is attained, and it is only by a sound knowledge of the physiology of vision and the associated neuron-anatomy that we can understand how fusion is made possible or impossible.

We must try to assign the most exact etiologic factor possible to each case of squint for if we are able, by a good history and a thorough examination, to find the etiology, we are well on the way to a complete physiologic cure.

True, some etiologic factors cannot be found and others cannot be removed and remain as permanent barriers. Still other barriers may be removed only after diligence and perseverance in the best of teaching techniques.

How diligent can you get? Certainly training should go on until all removable barriers are removed and the teaching phase given an intensive trial. For orthoptics becomes a teaching process only when there are two good eyes that are reasonably matched one to the other and an I.Q. high enough to learn new skills or relearn neglected skills.

As Miss Eyles has mentioned, if we assume there is a fusion center at some cortical or subcortical level we make everything very simple. Then, in the absence of a recognizable physical defect or recognizable functional defect, we can place failures into a comfortable fusion-defect group, dismiss them and work on the easy ones.

In the early days of orthoptics this group was a very large one, but it is dwindling in the face of better teachers and better techniques. I do not think the group will entirely disappear, but it will no longer be the wastebasket to catch all the failures from either side of the machine.

Most of the fusion-difficulty cases in those acceptable for training seem to occur in that group of alternators who had an early onset of squint—that is some time before the age of two—and who have been neglected. Many have had absolutely no fusion experience and have to be taught everything artificially. Their barriers to fusion are a fixed angle of squint, anomalous correspondence, deep alternating suppression, and complete comfort in their monocular world. The deviation should be corrected surgically in this group as early as possible, even before the child is capable of performing some of the tests you would like to do. Nothing is gained by waiting until he is capable of being tested for the deviation will have to be corrected in any case. The child is incapable of straightening his eyes—a mechanical barrier—even though he learns skills all the way up the binocular ladder.

If such an alternator is first seen at the age of 6 or 7 years, then preoperative training may be given to good effect if the angle is not so large as to make training all but impossible. In this latter case the last barrier to be removed will be the mechanical one of heterotropia and, needless to say, training should follow surgery as soon as possible and be as intensive as necessary to obtain binocular vision with fusion for casual seeing and reading.

Miss Eyles has pointed out that one small patient may harbor a whole nest of barriers to fusion, and it is fortunate that sometimes we can remove two barriers at once. Anti-suppression exercises are the same, basically at least, as antianomalous exercises and what a surprise occasionally is met when the surgical correction of a heterotropia also abolishes the anomalous correspondence.

Were I to be given a single choice of the many aids to fusion I would choose a good technician.

490 Post Street (2).

OPTIC ATROPHY IN DIABETES MELLITUS*

A REPORT OF THREE CASES IN ONE FAMILY

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One of the rarer ocular complications of diabetes mellitus is atrophy of the optic nerve. In a review of the literature, the precise pathogenesis of this phenomenon is infrequently discussed, the assumption being that the atrophy occurs following a retrobulbar neuritis and is, therefore, postinflammatory.

Duke-Elder states[1] that retrobulbar neuritis is a rare complication in diabetes, but by no means unknown. It attacks people at all ages, and the great majority of the victims are males. There is characteristically a sudden onset, with development of a central scotoma, which may clear or may persist indefinitely, resulting in some degree of permanent atrophy. As to the mode of origin of the optic neuritis, several theories are advanced. These include the existence of diabetic toxins; the rendering of the patient more prone to exogenous poisons, such as alcohol and tobacco; the possible etiologic factor of diabetes-induced arteriosclerosis; and, finally, some connection with diabetic acidosis, raising a theoretical parallelism between alcohol and acetone.

Actually, the type of optic atrophy occurring in diabetes mellitus is generally accepted as being secondary to an optic retrobulbar neuritis, the exact cause of which is poorly understood, but which is usually rather sudden and dramatic in onset, and which leaves the patient with more or less residual optic atrophy and loss of vision (usually central).

Rea[2] tabulates the ocular complications in 4,001 eyes of diabetics. Of this group, 27, or 0.65 percent, had an optic atrophy. In 914 eyes of nondiabetics, he found 4 cases, or 0.4 percent, of optic atrophy. These figures would bear out Duke-Elder's assertion that the condition of retrobulbar neuritis is a rare one in diabetes mellitus.

This paper is a report on three members of a family of nine siblings. These three each had severe, long-standing, and poorly controlled diabetes mellitus, and each had a slowly progressive primary optic atrophy. The other six children in the family, as well as the parents and grandparents, did not have diabetes and demonstrated no evidence of an ophthalmic disorder of any sort. In the histories of the three children afflicted jointly with diabetes and atrophy of the optic nerve, there is no hint of a clear-cut episode of optic neuritis, retrobulbar or otherwise, and the visual loss has been insidious and gradual in each instance.

It will be suggested that perhaps the relationship of diabetes to the optic atrophy in these cases is not necessarily contingent upon an actual "neuritis," (that is, an acute inflammatory reaction in the axones of the ganglion cells of the retina) with associated clinical symptoms and signs, but may instead be analogous to the degenerative process which occurs in tabes and taboparesis.

Although it is true that the pathologic process in neurosyphilis involving the optic nerve was once held to be a primary degeneration of the ganglion cells with consecutive atrophy of the nerve fibers, the consensus of opinion now favors a primary peripheral and interstitial neuritis (a "cirrhosis" involving the supportive tissue of the nerve), followed by an axone degeneration. In the strictest sense, therefore, the atrophy that occurs with tabes is secondary to a neuritis, retrobulbar in location. Clinically, however, this type of atrophy is readily

* From the Department of Ophthalmology, Southwestern Medical Foundation.

distinguished from the less insidious types, and the ophthalmoscopic picture is given the term of "primary optic atrophy" because there is no residual evidence of inflammation. If a retrobulbar neuritis, of whatever cause, occurs in the trunk of the nerve, there will be no ophthalmoscopic findings and the end result will also be "primary" atrophy. When the lesion is near the nervehead, the edema of the disc is marked and leaves behind, in the ensuing atrophy, those residual ophthalmoscopic traces of hemorrhage, exudate, vascular abnormality, and blurring of the disc margins that give the picture the name of "secondary" or "consecutive" optic atrophy.

Review of literature

The literature is not replete with discussion and opinion regarding the optic atrophy which occurs in diabetes. In three pages devoted to a discussion of the association of diabetic neuropathy and retinopathy, Rundles[3] discusses the retinal findings in his series of 125 cases, but does not mention optic atrophy. Burch[4] states that of 292 diabetics, one had optic atrophy, but does not elaborate.

O'Brien and Allen[5] studied the fundi of 555 patients under 31 years of age with diabetes mellitus. They summarized the retinal findings and found that four percent of their series showed retinopathy, but did not mention optic atrophy. McKee,[6] in 1941, analyzed 2,360 cases of diabetes mellitus from the ophthalmic point of view. Of this group, 476 persons had pathologic conditions of the retina which he felt to be more or less definitely related to diabetes, but there was only one case of atrophy of the optic nerve listed, and he apparently did not definitely ascribe this to diabetes.

As a matter or fact, Folk and Soskin,[7] in a discussion of diabetic ophthalmoscopic findings and of the differentiation between the findings in diabetic, arteriosclerotic, and albuminuric retinitis, stated that one of the criteria for diabetic retinitis is a "normal or nearly normal disc." While this actually had reference to the fact that, in the other two conditions, waxiness or edema of the disc serves to distinguish them, it does point up the fact that optic atrophy is a rare occurrence, and one not commonly associated with diabetes.

A specific reference to retrobulbar neuritis is to be found in a discussion by Frances and Koenig,[8] written in 1926. They stated that "Retrobulbar neuritis arising in the course of diabetes, the evident result of an endogenous toxin or toxins liberated during the disease, which exercises a selective action on the papillo-macular bundle of the optic nerve, is undoubtedly a clinical entity."

These authors felt that the precise toxins which attack the papillomacular bundle were not known, but that the ketone bodies (beta-oxybutyric acid, aceto-acetic acid, and especially acetone, along with some unidentified organic acids) might be the cause, and that the resultant amblyopia usually disappeared in from 3 to 8 months, the amelioration of the symptoms showing a definite relation to the disappearance of the ketone bodies from the urine.

Rönne is said to have described the pathologic process in the papillomacular bundle at necropsy of two patients, whom he had also studied clinically, as being a degenerative one, rather than a neuritis, and similar to that found in alcohol and tobacco amblyopia except for the presence, in diabetes, of "Kornchen cells," which are not found in the others.

Frances and Koenig concluded, after a case report, that glycosuric amblyopia, involving the central visual fields, the result of an endogenous toxin which is probably acetone, is a clinical entity.

Case reports

This recognized disease complex does not apply, however, to the three patients to be discussed herein, since the onset in their

cases was insidious rather than sudden, the absolute scotoma is peripheral rather than central, and the condition has not improved with better control of the diabetes, but rather has steadily grown worse (in one patient over an 11-year period).

CASE 1

History. I. J. T., a young woman, aged 21 years, was admitted to Parkland Hospital on January 26, 1947. This patient had been a known diabetic since the age of four years, but the onset of her visual difficulties occurred at the age of 12 years, when she found that she could not read fine print. By the time she was 17 years of age, she was unable to read school books; however, she was graduated from high school. At present she is a domestic. She states that she has little difficulty in performing housework but that she does not read any but the largest print and frequently stumbles and runs into objects.

Her past medical history, except for the severe diabetes mellitus, which has never been well regulated with insulin and diet, and the progressive visual difficulties, is essentially negative.

The family history is entirely devoid (with the exception of the two younger siblings) of diabetes or of significant visual disturbance. The grandparents were not examined, but there is no history suggestive of a hereditary type of optic atrophy. The parents do not have diabetes mellitus and the father, who is no known relation to the mother, is serologically negative with no history of treated lues. His visual apparatus, as well as his carbohydrate-metabolizing system, are normal. The mother was not able to report for examination, but she is not a diabetic and a recent communication states that an ophthalmic examination is essentially normal.

Eye examination. I. J. T. stated that her vision seemed to be appreciably worse after an attack of measles in 1941. The onset of visual disturbance was considerably before this, in 1936, at the age of 10 years. She stated her vision was better at night than during the day. Physical examination of this patient was essentially negative except for the eye findings. The pupils were round and regular (2.5 mm.) and reacted very sluggishly to light and accommodation, with no consensual reaction.

Vision was: R.E., 15/200, JO; L.E., 20/200, JO. Cycloplegic retinoscopy showed a refractive error of: R.E., −0.75D. sph. ⌒ +1.0D. cyl. ax. 180°; L.E., −1.0D. sph. ⌒ +1.0D. cyl. ax. 180°. The patient subjectively accepted: R.E., −1.0D. sph. ⌒ +1.0D. cyl. ax. 180°; L.E., −0.5D. sph. ⌒ +0.5D. cyl. ax. 180°, which brought the vision only to: R.E., 20/200, JO; L.E., 20/200, JO; hardly an appreciable improvement.

Funduscopic examination revealed the media to be clear. The peripheral fundus was normal with no hemorrhages, exudates, or vascular abnormality. Both optic discs were grayish-white, centrally, fading to white peripherally. The right eye demonstrated more pronounced pallor than the left. Both discs showed definite loss of substance. The disc margins were clear-cut and sharply demarcated (fig. 1).

Visual-field studies with a 5-mm. white target at 330 mm. revealed bilateral, quite regular constriction of from 10 to 30 degrees, somewhat more pronounced in the right eye, especially temporally (fig. a). Attempts to obtain color fields were not satisfactory, and it was found that the patient was red-green color blind, and recognized a solid-blue object with difficulty.

The blindspots with a 5-mm. target at one meter were elongated in a vertical direction. There were no isolated scotomas, and it was felt that the visual fields were not pathognomonic of any particular disease entity. The responses with a target smaller than 5 mm. were not conclusive. The intraocular pressure was: R.E., 18 mm. Hg (Schiøtz);

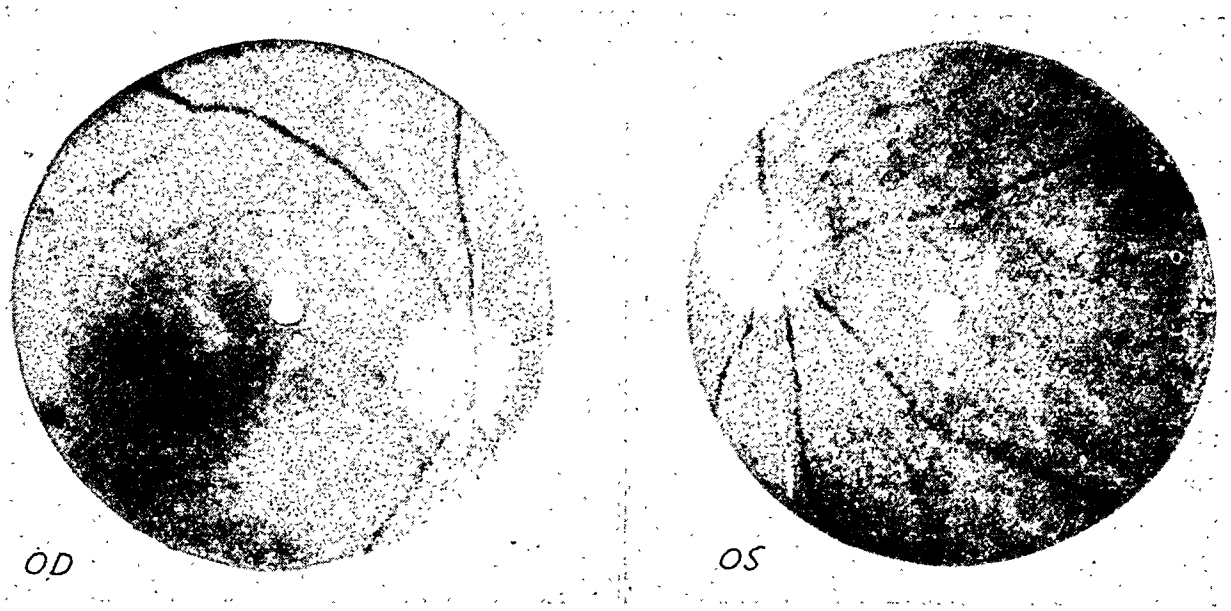


Fig. 1 (Stansbury). Fundi of *Case 1,* showing pallor as well as sharp outline of optic discs. Vision is: *20/200,* JO, O.U. The maculas normal.

L.E., 18 mm. General physical and neurologic physical examinations were entirely normal.

Laboratory reports. Blood studies revealed: Hb., 13.5 gm.; R.B.C., 4.21, W.B.C., 7,150, with normal differential. Urinalysis, sp. gr., 1.013; acid; sugar, 4 plus; negative acetone. The blood serology was negative; the fasting blood sugar, 277. Spinal fluid examination showed normal pressure, no cells. Wassermann and colloidal gold tests were negative. X-ray films of the optic foramina showed no constriction nor abnormality and the sella turcica was normal.

This patient was regulated on 40U protamine zinc insulin and 15U regular insulin before breakfast and 10U regular insulin before supper, and was discharged without

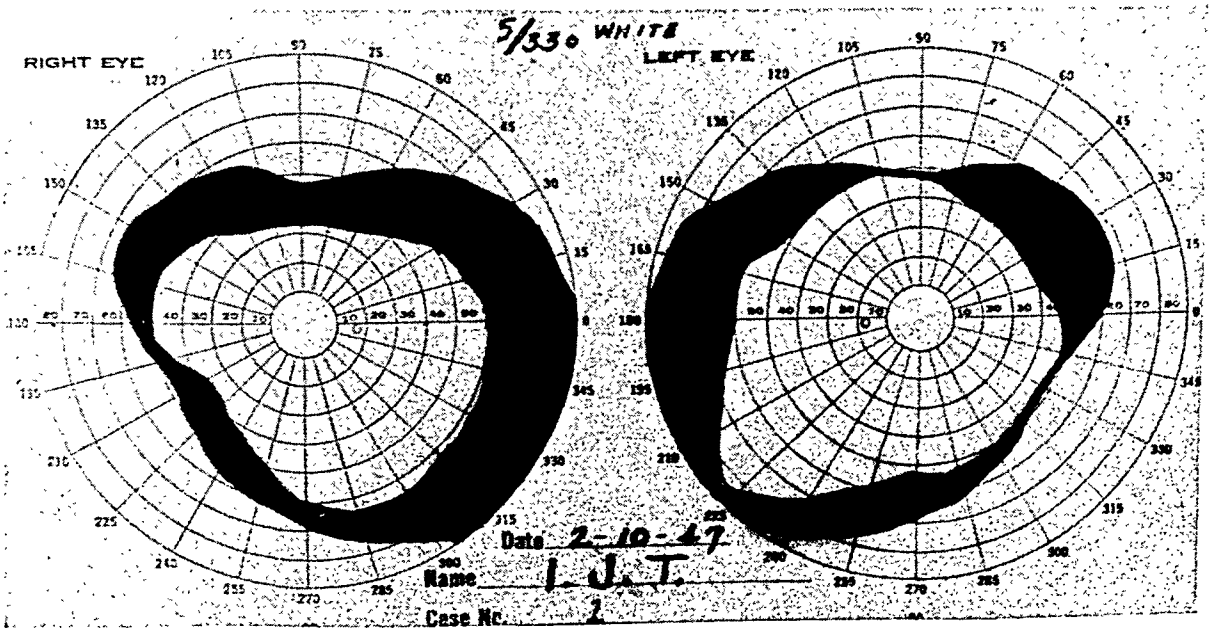


Fig. a (Stansbury). Peripheral fields of *Case 1,* 5/330 white.

other treatment. Intensive vitamin-B therapy had been employed since 1944, and it was advised that this be continued.

CASE 2

History. D. L. T., a girl, aged 14 years, was a sister of I. J. T. She had been a known diabetic since the age of seven years and was admitted to the hospital on February 4, 1947. This patient, a high-school sophomore, made excellent grades in her school work until one year ago, when she began to have trouble reading her lessons.

The patient's past medical history began with the sudden onset of loss of weight at the age of seven years, whereupon her parents diagnosed diabetes mellitus (having had previous experience with the first patient), and arbitrarily placed her on insulin and a diabetic diet. There was no history of diabetic coma, but there had been frequent episodes of mild insulin reaction. She had had diphtheria, measles, and mumps in childhood, and there was a history of recurrent furunculosis. Two years prior to admission, at the age of 12 years, she first noticed diminution of vision, particularly for near, with blurring of print and lacrimation. There was no complaint of difficulty with vision at night. Four weeks before her admission, she had been hospitalized elsewhere with left lobar pneumonia and left-sided pleurisy.

General physical examination revealed a well-nourished, prepuberty white girl, with no positive findings except for an auscultatory friction rub at the left 5th rib posteriorly. Neurologic examination was entirely normal.

Eye examination. Vision was reduced to: R.E., 20/200, J2; L.E., 20/200, J4. The pupils measured 4.5 mm., and were round and equal, with normal light and accommodative, as well as consensual, reactions. The media were clear, and the peripheral fundus, macula, and vascular tree were normal binocularly. The optic discs were flat and sharply demarcated, with a peripheral white ring fading to gray centrally, and had the typical appearance of a developing primary optic atrophy (fig. 2).

Retinoscopy with homatropine cycloplegia showed: R.E., −0.75D. sph., L.E., −0.50D. sph., but subjectively with: R.E., −0.75D. sph.; L.E., −0.25D. sph., vision remained only very slightly improved at: R.E., 20/200 J2; L.E., 20/200, J3.

The color vision was defective with the American Optical color charts, but the patient was able to distinguish and recognize red, green, and blue objects. The intraocular pressure was: R.E., 21 mm. Hg (Schiøtz); L.E., 25 mm. Visual fields (fig. b) showed moderate peripheral constriction, more marked temporally, for 5/300 white. Tangent-screen studies revealed only moderate enlargement of the blindspots, more marked on the right. The color-fields could not be examined satisfactorily due to the defective color-vision, but in general the form-fields with 5-mm. targets were larger for blue than for red and green, which was felt to corroborate the existence of neuroretinal rather than choroidal damage.

Laboratory studies showed the serology to be normal (Kline and Mazzini). C.B.C.: Hb., 10 gm., R.B.C., 3.8; W.B.C., 9,100; normal differential. Urine: sugar, 3 plus; 1.025, sp. gr.; acid reaction; negative acetone. Fasting blood-sugar, 190. The spinal fluid examination on February 5, 1947, revealed a normal pressure, but 3 segmented cells and 128 lymphocytes; on February 7th, two days later, the spinal fluid showed no segmented cells and 4 lymphocytes. The spinal fluid Wassermann and colloidal gold tests were negative. X-ray studies of the optic foramina and sella turcica were normal.

During her hospital stay, the patient developed an acute pleuritis and some parenchymal pulmonary consolidation which was thought to be an exacerbation of the previous episode and unrelated to her diabetes. She was felt to be adequately controlled at

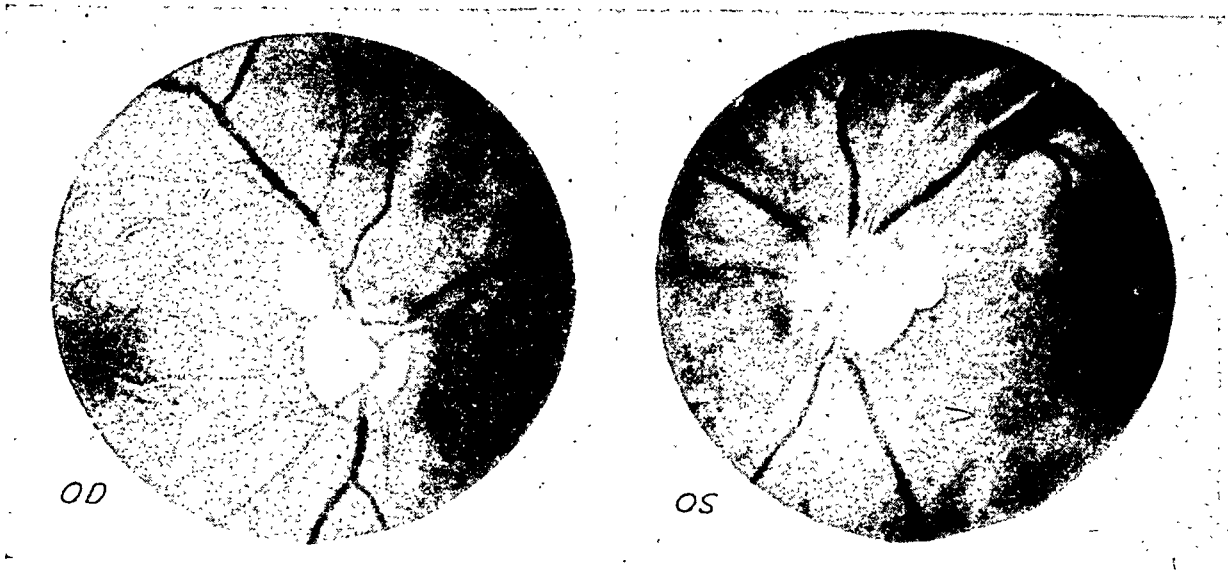


Fig. 2 (Stansbury). Fundi of *Case 2.* Vision is: R.E., 20/200, J2; L.E., 20/200, J3.

the time of her discharge on protamine-zinc insulin (40U) and regular insulin (15U) before breakfast, and regular insulin (10U) before the evening meal, in addition to a 1,390 calorie diet. On this regimen, the urine-sugar varied from 3 plus to a trace, with no acetone, and it was not felt possible to obtain better control. (Note: Information has been received that this patient has developed tuberculosis of the spine since this hospitalization.)

CASE 3

History. R. T., a boy, aged 13 years, was admitted to the hospital on February 4, 1947. He was a brother of patients reported in Case 1 and Case 2. The boy had been known to have diabetes since he was seven years of age when the mother tested his urine, found sugar, and arbitrarily placed him on insulin. He had never been taken to a physician for regulation and stated that he frequently experienced mild insulin reactions which were

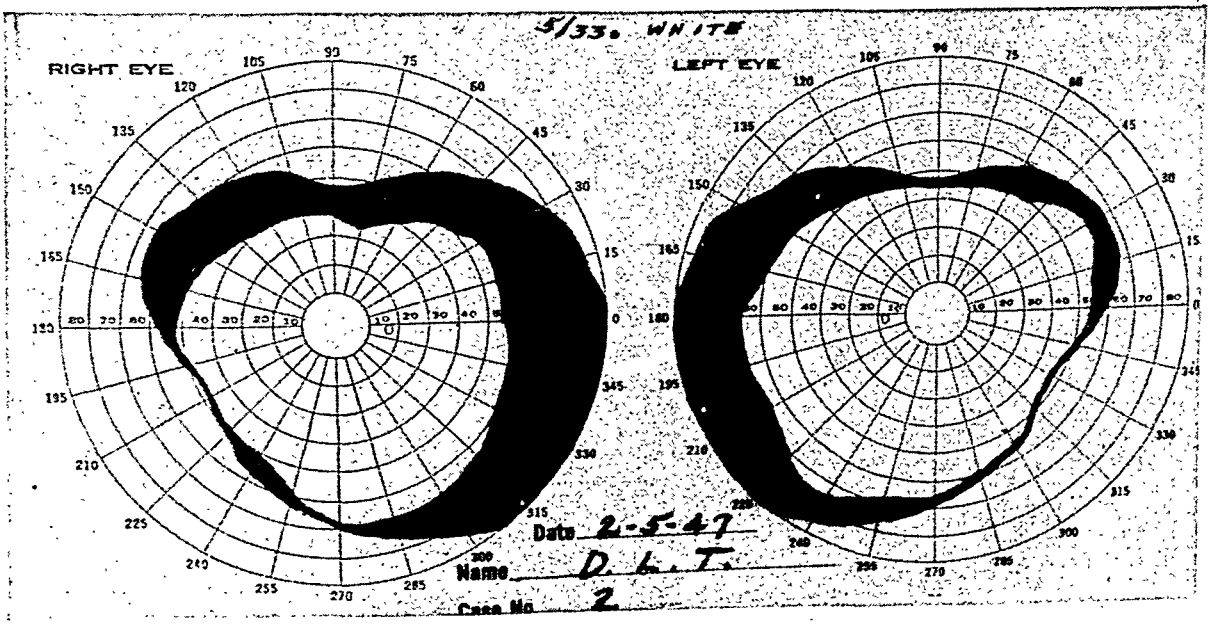


Fig. b (Stansbury). Peripheral fields of *Case 2.*

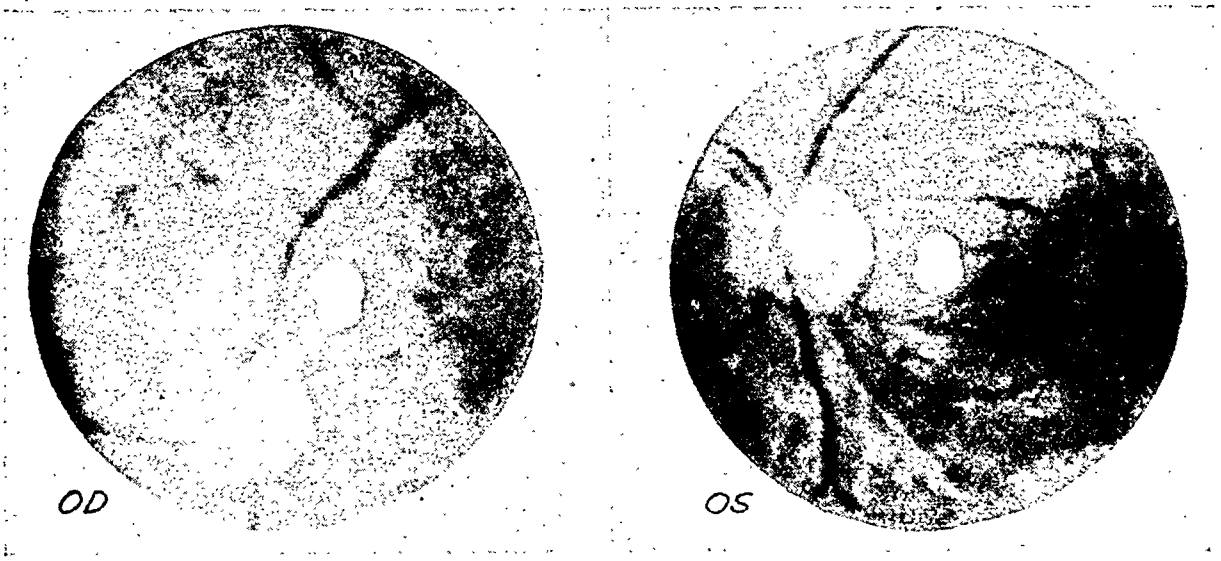


Fig. 3 (Stansbury). Fundi of *Case 3.* Vision is: R.E., 20/200, J6; L.E., 20/100, J6. The haziness of the disc margin on the right is an artifact.

relieved by drinking fruit juice or eating a piece of candy. Two years before admission, at the age of 11 years, he noticed the inability to read for prolonged periods without blurring of the print, and although in the seventh grade and not failing in his studies, he was conscious of slowly diminishing visual acuity. There was no difficulty with vision at night.

Eye examination. The past medical history was noncontributory, and general physical examination, with emphasis on the neurologic aspect, was entirely negative except for the ocular findings. The boy had not reached puberty. Vision was: R.E., 20/200, J6; L.E., 20/200, J6. Homatropine retinoscopy showed: R.E., +0.50D. cyl. ax. 90°; L.E., +0.25D. cyl. ax. 100°; but subjectively he accepted: R.E., plano; L.E., +0.25D. cyl. ax. 90° to make his best corrected vision: R.E., 20/200, J6; L.E., 20/100, J6. The pupils were round and equal (4 mm.), reacted to light and accom-

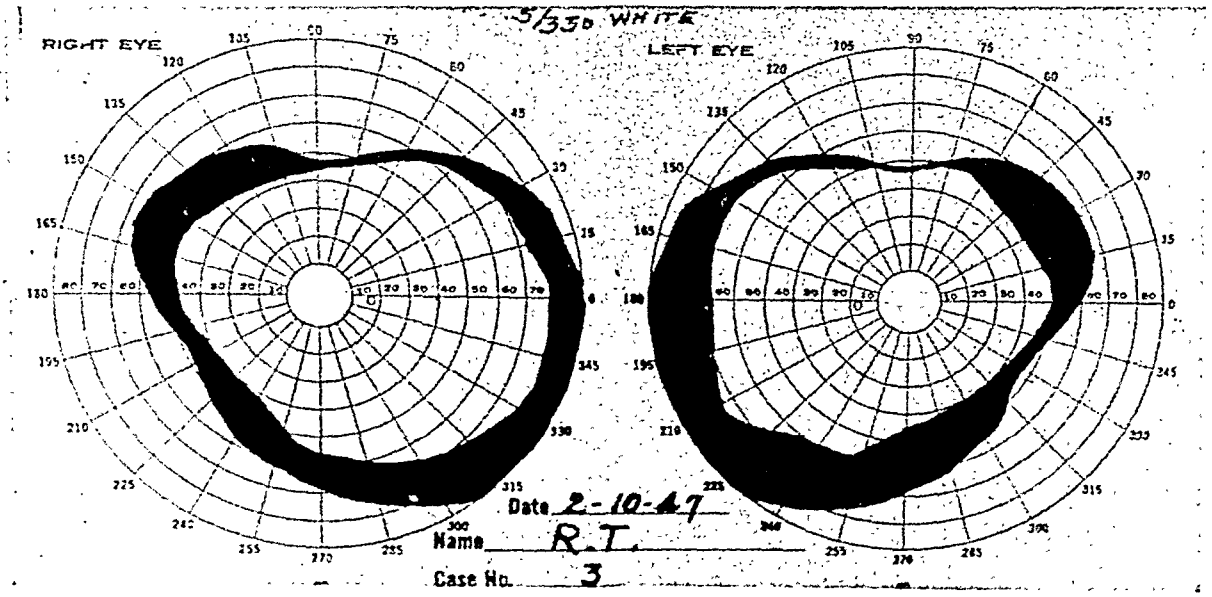


Fig. c (Stansbury). Peripheral fields of *Case 3.*

modation, and the consensual reaction seemed sluggish. The extraocular movements were normal, and the media clear. The peripheral fundi showed no evidence of hemorrhage, exudate, or vascular abnormality, but the appearance of the optic discs was quite similar to that of the other two patients. The margins were sharply demarcated, the physiologic cups wide, the periphery pale white (especially temporally) fading to gray centrally (fig. 3). One observer described debatable degenerative changes in the macular regions of this patient. The intraocular pressure was: R.E., 25 mm. Hg (Schiøtz); L.E., 27 mm. Visual fields in this case, too, showed nothing pathognomonic, but rather a concentric peripheral constriction, more marked temporally (fig. c). The color vision was defective, and attempts to outline the color fields were not successful. The blindspots of Mariotte were elongated vertically, more so on the right, but there were no central scotomas.

Laboratory studies revealed a negative serology. C.B.C.: Hb., 14; W.B.C., 6,700; normal differential. Urine: sugar, 2 plus; sp. gr., 1.025; acid; acetone negative. Fasting blood-sugar, 305. Spinal fluid on February 5, 1947, was clear; the pressure was normal, but there were 3 segmented cells and 120 lymphocytes; on February 15, 1947, a repeat examination revealed 3 segmented cells and no lymphocytes; spinal fluid Wassermann and colloidal gold tests were negative.* X-ray studies of the optic foramina and sella turcica were normal.

This patient's diabetes was regulated with 20U protamine-zinc insulin and 15U regular insulin before breakfast. His hospital course was uneventful, and he was discharged on a high-protein, high-vitamin diet.

* The spinal fluid findings in Case 2 and Case 3 were felt to represent a possible error in that both specimens with a high cell-count were collected by the same student on the same day, and in a later specimen, each patient showed a nearly negative cell-count. It must be admitted that the significance of the spinal fluid findings is not clear.

Comment

Of the remaining six children in this family whose ages were 23, 20, 17, 15, 11, and 9 years, respectively, the three oldest were available for examination. Vision in each of these siblings was: 20/20 J1, O.U., color vision was normal, and the optic nerves were normal to examination. In fact, there was no evidence of an ophthalmic pathologic condition or diabetes.

The father, aged 46 years, was examined and was found to be normal except for early presbyopia; the mother of these children (aged 40 years) and the three younger children were not available for examination, but there were no visual complaints, and all had been tested for diabetes and found to be free of signs or symptoms.

As has been stated, there was no known hereditary visual affection and no history of diabetes in the grandparents or the more remote ancestors. Generally speaking, this large family, with the exception of these three diabetic children, seems to be normal physically, and of sturdy stock. The father's occupation was that of a farmer.

Discussion

In considering the possibility that a causative factor other than diabetes might be responsible for the optic atrophy in these children, and in the absence of any indication that syphilis had played a part, the disease pattern of hereditary optic atrophy or "Leber's Syndrome" was given serious consideration.

This relatively rare condition, of unknown etiology but with a definite "hereditary tendency, affecting particularly males about the 20th year of life, . . . showing in its early stages fleeting evidence of optic neuritis, followed by a secondary atrophy which involves a serious impairment of central vision with retention of the peripheral fields"[9] . . . has several characteristic features. These are listed by Raaf and Bair[10] as: (1) A predilection for males; (2) average age of on-

set 23 years for males and 25 years for females (among Europeans); (3) rapid impairment of vision, with maximum disability within two months from the onset, and rarely with advancement of symptoms after six months; (4) patients are usually in good health, no other disease being characteristically associated with hereditary optic atrophy; (5) the sole complaint is usually diminution of vision, with the most common defect being a central scotoma, although peripheral defects are frequently seen; (6) color blindness is usually the only other symptom; (7) in early stages, the fundus may be normal or may show typical optic neuritis, optic atrophy supervenes, and the disc never regains its normal appearance; (8) from 10 to 29 percent of all patients show some subsequent improvement and, if the age of onset is early, the prognosis is better; furthermore, there is an inherited tendency to improvement; (9) in 93.6 percent of cases (European series) the disease was transmitted by the mother.

It will readily be seen that the majority of these criteria are not met by the three subjects of this paper.

Fisher,[11] in 1916, advanced the idea that Leber's optic atrophy is the result of hereditary changes in the pituitary gland, probably temporary in character, but clinical and X-ray studies have failed to bear this out, and the theory which blames irregularities in the growth of the sphenoid bone has not received much support. In the patients under discussion, there was no evidence of a primary pituitary disturbance, and the films of the skull did not reveal prominent clinoid processes or deep sella turcicas.

Pathologically, there is said to be[12] atrophy of the ganglion cells and nerve-fiber layer of the retina in Leber's disease, with the atrophy of the nerve limited to the papillomacular bundle and other parts of the nerve normal. There is destruction of the medullary sheaths but no inflammatory signs (this report records the autopsy findings in but one case), which leads its author to conclude that the underlying pathologic process is a primary neuronic (inherited) degeneration localized in the optic nerve, rather than a toxic retrobulbar neuritis secondary to neighboring sepsis and infected tissue which bears an inherent vulnerability.

Bhaduri[13] suggests that the condition may be embryologic, with a common germ-plasm defect in the anlage of the retina and the inner ear. In substance, however, it would seem that, by virtue of their failing to meet practically all of the criteria for hereditary optic atrophy, this syndrome can be excluded as a possible diagnosis in the patients herein reported.

In a further consideration of the differential diagnosis of these cases, any of the more remote causes for primary atrophy of the optic nerve must be considered. As has been stated, primary optic atrophy occurs subsequent to retrobulbar neuritis, when the inflammation confines itself to the trunk of the nerve and does not approach the nerve-head.

Duke-Elder[14] considers among the causes for retrobulbar neuritis followed by optic atrophy, the group of so-called "neurotrophic virus infections." These include disseminated (multiple) sclerosis, acute disseminated encephalomyelitis, neuromyelitis optica (of Devic), diffuse periaxial encephalitis (of Schilder), and herpes zoster. All of these are characterized by an extensive demyelinization of the optic-nerve fibers where these fibers are myelinated (hence retrobulbar), followed by degeneration of the axis cylinders, and finally a proliferative gliosis. In the subjects under discussion, the absence of positive neurologic signs, except ophthalmologically, along with the absence of clinical history and peripheral nerve damage, would appear to exclude this group of diseases.

In an exhaustive study concerning the relationship between Recklinghausen's disease (or multiple neurofibromatosis) and

gliomatous tumors of the optic nerve, Davis[15] makes the statement that many cases of unexplained atrophy of the optic nerve may be due to early tumors of the nerve, some of which may have been incorrectly diagnosed as retrobulbar neuritis.

Exophthalmos need not be present, but the diagnostic leads that are of value in establishing the presence of atypical neoplasms of the nerve are said to be subcutaneous nodules which are manifestations of the general condition, café au lait pigment patches on the skin, and certain typical changes, visible by X ray, involving the sella turcica and the optic foramina.

None of the three patients herein studied showed evidence of subcutaneous tumors, café au lait spots, skull changes visible to X ray, exophthalmos, or evidence of increased intracranial pressure, so that the possibility of tumor of the optic nerve being responsible for their optic atrophy seems remote.

These children were all three well nourished. The two younger siblings might be said to be somewhat retarded as regards pubertal changes. None of them showed evidence of an avitaminosis which might have produced an optic neuritis of the axial type. Since the onset of the visual disturbance, although occurring at about the same age in each patient, did not occur in the same calendar year, or coincident with an epidemic such as typhoid, influenza, and so forth, the possibility of an optic neuritis from endogenous toxins (other than diabetic) seems remote. External toxins, such as tobacco, alcohol, lead, arsenic and so on, were considered and then rejected as highly improbable due to the complete lack of contact. There was no evidence of adjacent infection, periorbital, intracranial, or in the paranasal sinuses, to produce optic neuritis and subsequent atrophy. As a matter of fact, two of the cardinal signs of optic neuritis were absent; namely, sudden onset and central scotomas. On the contrary, the progress had been very insidious and, although central vision was defective, the absolute scotoma was peripheral in each case.

It was suggested that, since each of these children had had frequent episodes of insulin shock, this alone might in some manner produce atrophy of the optic nerve. However, it was felt that, if this relationship existed, such a syndrome would be recognized and established.

Summary

To summarize, then, three children of a farming family of nine siblings have been shown to have had rather severe diabetes mellitus from early childhood and, in addition, each of these children has a pathologic condition of the eyes manifested by an absolute peripheral scotoma, a relative central scotoma, defective color vision, and a well-advanced primary optic atrophy (binocular), but no evidence of diabetic retinopathy.

The other six children in the family, as well as the parents and grandparents, are free of diabetes, and none shows evidence of optic atrophy or other ocular disease. The evidence may be circumstantial on these grounds, but from the standpoint of the selectivity of the optic atrophy, it would seem that, in these patients, there is a direct relationship between their diabetes and their visual symptoms.

A consideration of the possible etiology of the atrophy of the nerve, other than following a retrobulbar neuritis secondary to endogenous diabetic toxins, gives no clues, and an attempt has been made to rule out the common causes for retrobulbar neuritis and optic atrophy, including lues, exogenous toxins, the virus neuropathies, endocrine dysfunction, cranial malformation, tumor of the optic nerve, and particularly Leber's syndrome of hereditary optic atrophy. The weight of evidence in these patients seems to point to diabetes as the factor responsible for their eye-findings, but the pertinent history, as well as the clinical findings,

differs rather markedly from the usual case of this type in that there is no clear-cut episode of retrobulbar neuritis and the loss of central vision has been relative and gradual, the papillomacular bundle being only incidentally involved.

It is suggested that perhaps the underlying pathologic process in this group of patients is indeed a degenerative process—rather than an actual inflammatory "neuritis"—of the type that is said to occur in alcohol or tobacco amblyopia, but differing rather markedly in that the process here does not show a predilection for the papillomacular bundle, but rather involves the entire bundle of nerve fibers somewhere behind the globe and anterior to the external geniculate bodies. Furthermore, the process appears to be a particularly insidious one. Alternately, this might represent a "tabes-like" type of quiet neuritis and axone-degeneration.

In either case, the causative agent is not known, but it can be speculated that some type of endogenous poison, whether ketone-bodies or something else, occurring in the presence of active diabetes mellitus, is responsible for the condition. That there may be another, as yet unknown and undetermined, factor in this syndrome of optic atrophy and diabetes is a possibility. It seems reasonable to suppose that a joint defect in the germ plasm—some type of aberration common to the anlage of the pancreas and the visual organ—may be basically responsible for the presence of the two conditions of diabetes and optic atrophy in these patients, and this relationship could conceivably apply wherever these diseases coexist.

Conclusion

Optic atrophy can occur as a complication of diabetes mellitus. It is probably preceded by some type of retrobulbar neuritis, but it is suggested that in certain instances, the process may be primarily a degenerative one.

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NOTES, CASES, INSTRUMENTS

AN OPERATION FOR SHORTENING A RECTUS MUSCLE

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Marquette, Michigan

Operations for increasing the action of an eye muscle by advancement or resection are attended by the possibility of the sutures giving way and decreasing the amount of correction. This is especially true when the muscle is attenuated or stripped of its fascial covering.

In the Reese resection the pull of the sutures is in the direction of the muscle fibers making it easy for the sutures to slip toward the cut end. This is most likely to occur when tension is placed on the suture to draw the muscle into place against the stump before tying. It can still occur after the ends are in position and the sutures tied but is less apt to at this time, as some of the pull is now in a horizontal direction across the muscle fibers.

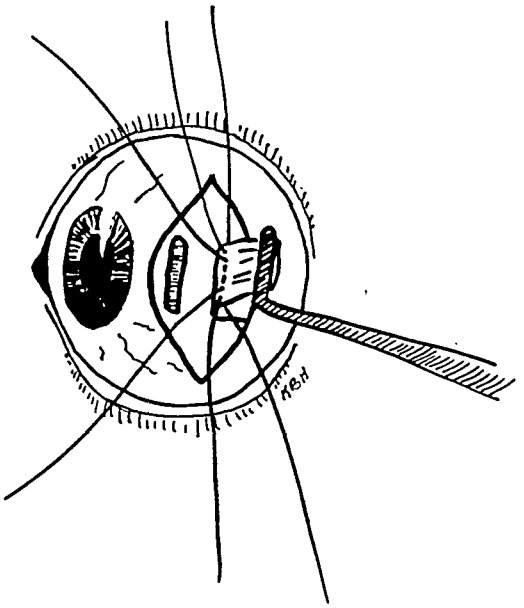


Fig. 1 (Hornbogen). The central mattress suture has the loop on the outside instead of the under surface of the muscle, and the conjunctiva is not included.

The modification here presented is one in which the pull of the suture is always across the muscle fibers and not with them. The muscle is exposed in the usual manner but not stripped of its fascial covering. A muscle forceps is applied near the insertion and the tendon severed leaving a stump of about 1.5 mm.

A central mattress and two wing sutures are placed in the muscle at the desired distance, as in a Reese operation, except that the central mattress suture has the loop on the outside instead of the under surface of the muscle, and the conjuntiva is not included (fig. 1). They are next passed through the stump. At no time during this stage should any pull by the sutures be exerted against the fibers. As tension is placed on the central suture to draw the muscle and the stump together, the assistant, holding the forcep attached to the end of the muscle, draws it toward the canthus making a V with the sutures at the apex (fig. 2). This puts all of the suture pressure across the fibers. The suture has such a firm hold on the muscle that it is not neces-

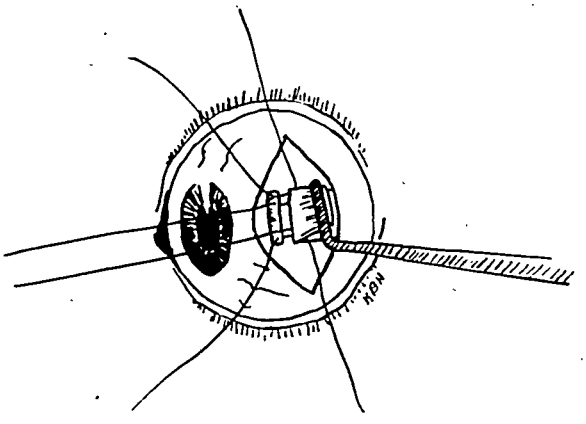


Fig. 2 (Hornbogen). As tension is placed on the central suture, it is drawn toward the canthus, making a V with the sutures at the apex.

sary to rotate the globe to bring the stump to the muscle.

The amount of force applied need be governed only by the breaking strength of the suture or by the amount necessary to tear through the bite of stump and episclera. The flap is held in this position until the sutures are tied and cut.

The forceps are removed leaving a flap of tendon beyond the sutured stump (fig. 3). This is now laid back, flat, along the muscle as far as it will reach and sutured to it at each edge. If the amount of shortening is large and the excess tendon is unduly long, a portion may be excised before it is sutured in position (fig. 4). The conjunctiva is closed separately. If one does not wish to bury the knot of the mattress suture, it can be carried through the limbal flap of conjunctiva and tied outside.

The suture material used can be that preferred by the individual operator. I have been using 4-0, 10-day, chromic gut for the mattress suture and 4-0 plain gut for the remainder.

This method is applicable to either the internal or external rectus. The thickening produced by the double layer of muscle is minimal and of no consequence and is not comparable to that produced by a tucking or a cinch operation. With this technique it is possible to mobilize the eyes earlier in the postoperative period.

401 Savings Bank Building.

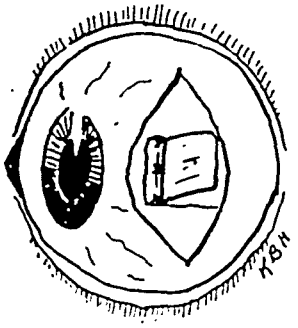


Fig. 3 (Hornbogen). The forceps are removed leaving a flap of tendon beyond the sutured stump.

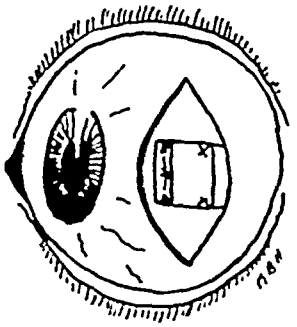


Fig. 4 (Hornbogen). If the amount of shortening is large and the excess tendon is unduly long, a portion may be excised before it is sutured in position.

BIPRONGED FORCEPS

AN INSTRUMENT FOR PLASTIC SURGERY

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Birmingham, Alabama

In performing plastic procedures of the eyelids, it is frequently necessary for an assistant to apply forceps to areas immediately contiguous to that held by the surgeon. This is in order to prevent distortion in

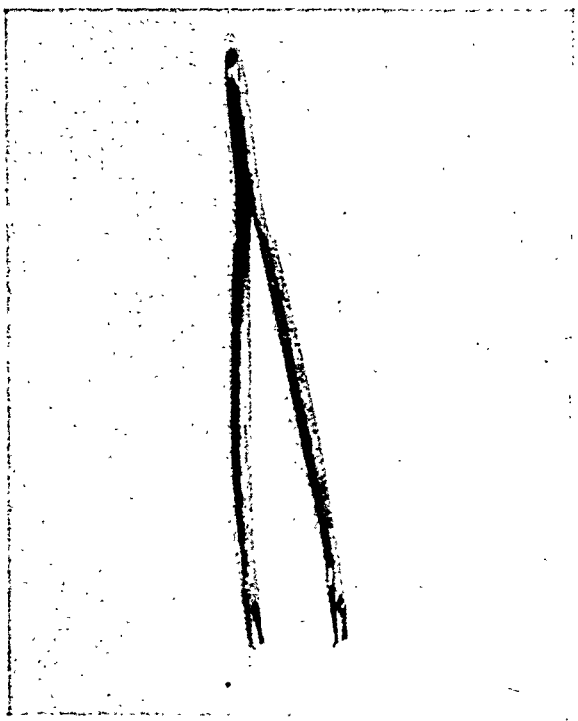


Fig. 1 (Callahan). Bipronged forceps for use in plastic eyelid surgery.

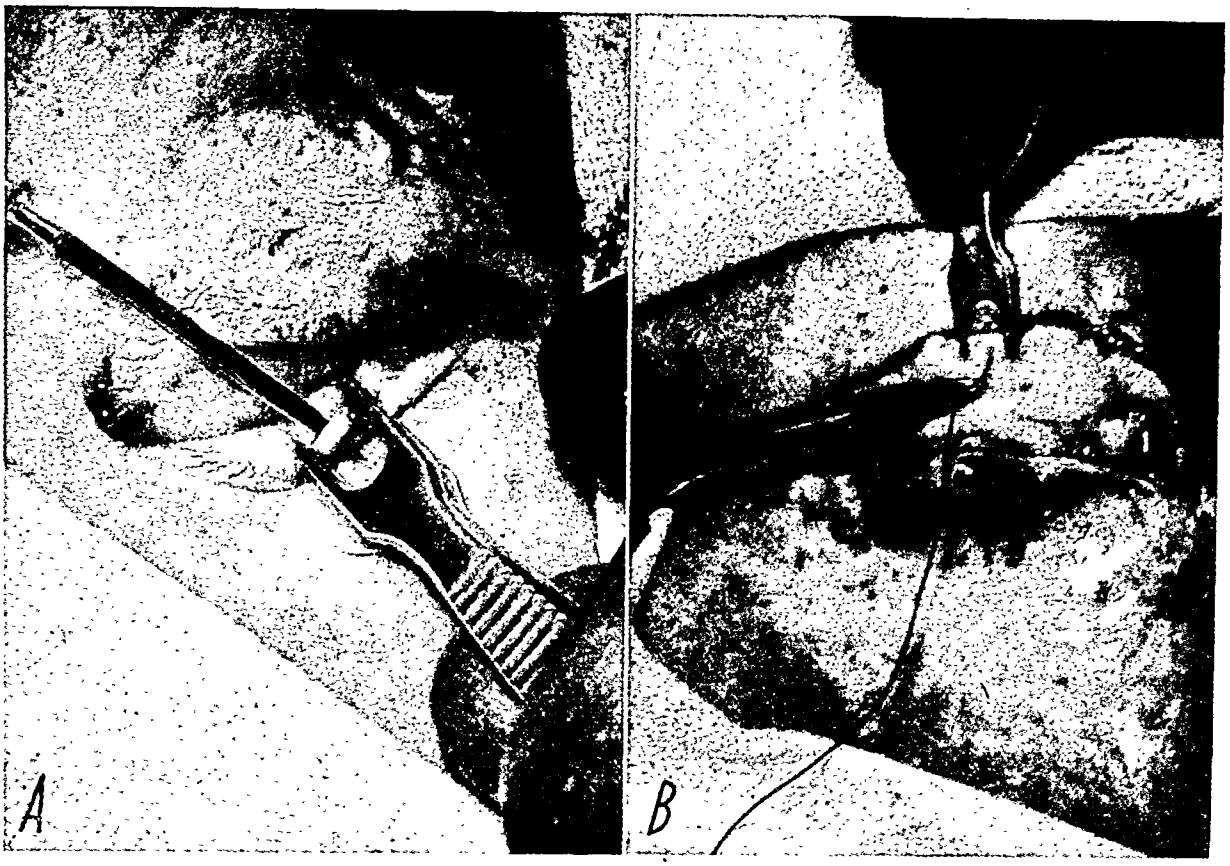


Fig. 2 (Callahan). (A) The bipronged forceps are holding the margin of the lower lid firmly, as a Graefe knife denudes a small rectangular area of transitional epithelium. (B) A free-skin graft is placed in position for the correction of ectropion. The bipronged forceps are holding the graft so that the first suture may be placed without difficulty.

making incisions and in placing sutures. The need for a bipronged forceps which would hold tissue firmly, without crushing, and would allow working space between the prongs, became apparent. This would allow smoother handling of tissue and free the assistant for cutting sutures, sponging of blood, and so forth.

An instrument was designed with prongs 8 mm. long, and the interspace 5 mm., fitted on the end of a handle similar to that of a Lester forceps (fig. 1). Each of the prongs on one side carries a small sharp tooth, which meshes between two teeth on the opposite prong. Denuding small rectangular areas for lid adhesions (fig. 2A) and placing sutures through a free skin graft (fig. 2B) are two of many technical procedures facilitated by its use.

Medical College of Alabama (5).

FLEXIBLE CABLE SLIT CONTROL FOR BIOMICROSCOPE

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Steubenville, Ohio

It has long been felt that control of the width of the slitlamp beam should be so facilitated mechanically that the biomicroscopist could alter the beam with utmost ease while examining pathologic details.

Of extant models of biomicroscopes, the Haag-Streit (Goldman),* and the Zeiss (Comberg)† are examples of geared control of the slit width. The simplified Universal model biomicroscope‡ lends itself to

* Goldmann biomicroscope (Haag-Streit, Berne, Switzerland).

† Comberg biomicroscope (Carl Zeiss, Jena, Germany).

‡ Universal biomicroscope (Bausch & Lomb Optical Co., Rochester, N.Y.).

incorporation of a flexible cable and knurled knob which will permit accurate, speedy slit-width readjustment without the fumbling in the dark which heretofore has inhibited alteration of the beam.

It is well known that the best results in visualizing the manifold optical changes of the ocular media are obtained with a combination of changing microscope focus, beam width, oscillatory field (Koeppe),[§] and panoramic sweeping of the beam across the field while employing the various modes of illumination. This type of optical scrutinization or "visual palpation" leads to definitive interpretation of the various refractive, reflective, and dispersive changes which characterize pathologic alteration of the ocular structures or media.

Direct focal illumination produces the finest optical delineation but unless the observer employs[‖] reciprocally the wide and narrow beam for observation and localization, he loses the full potentiality of biomicroscopy. The study of shadow formations ("optic reduplications"), vacuoles and bullae, deposits, and so forth, is enhanced by smooth control. Differentiation of extrasectional as well as sectional features in localization is helped by being able to widen and narrow the beam facilely. If students of the technique would learn at the outset to examine the eye with the various methods of illumination and with rapid beam-width control, considerable improvement in biomicroscopic technique would ensue.

Study of zonal discontinuity in the lens is benefited with ready control of the beam flux. After a survey of the lens with a wide beam, the transition to optic section for localization of details is smoother and more rapid in contradistinction to the present method of reaching to the slit housing for the slit-control screw and then twisting it to obtain the requisite narrowing. It is small wonder that the busy practitioner, unconcerned with the minutiae of biomicroscopy, may allow the slit to rust into fixation at one wide width. To help him as well as beginning students, I offer this suggestion for modification of a domestic biomicroscope.

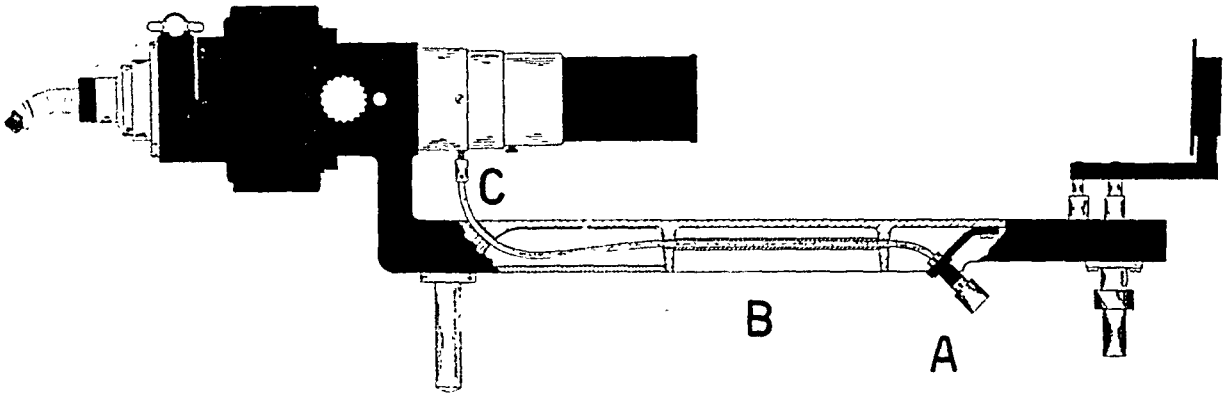


Fig. 1 (Stein). Cross-sectional view of apparatus.

The knurled knob is placed (fig. 1-A) at the distal extremity of the illuminating arm in proximal juxtaposition to the Arruga screw at such an angle as to be readily available to the controlling fingers of either the right or left hand. By means of a flexible cable affixed within the matrix of the illuminating arm (fig. 1-B), rotation of the knurled knob results in corresponding rotation of the inverted slit-control screw to which the cable is fastened (fig. 1-C), leading to alteration of the width of the corneal parallelepiped, lens prism, and optic section.

[§] Koeppe: Cited by Berliner, pp. 69 and 108.

[‖] Berliner, M. L.: Biomicroscopy of the Eye, 1943, v. 1, p. 79.



Fig. 2 (Stein). Universal model (Bausch & Lomb) biomicroscope with slit-control cable attached.

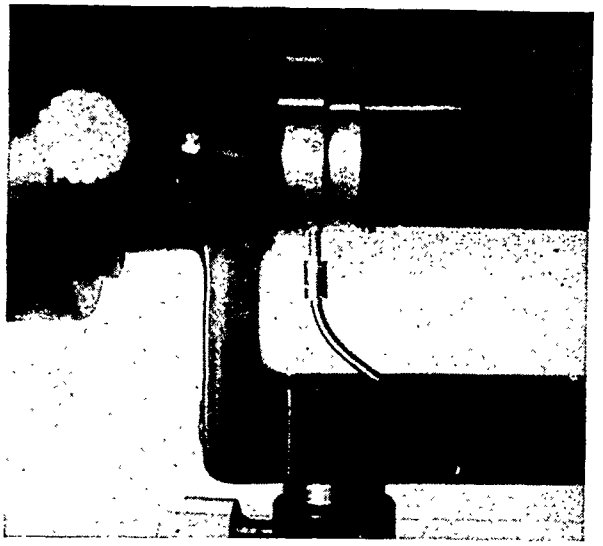


Fig. 3 (Stein). Close-up view of attachment of flexible cable to inverted slit screw.

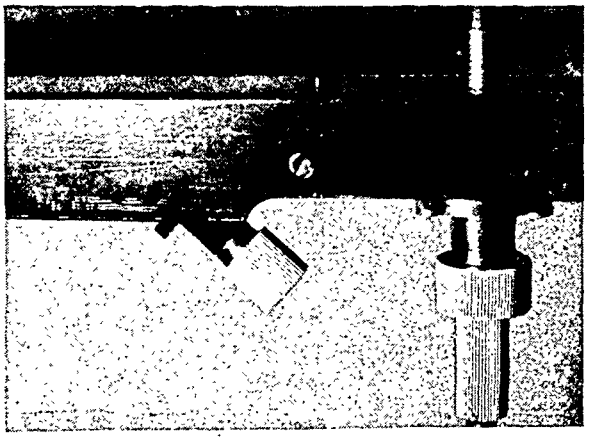


Fig. 4 (Stein). Close-up view of distal control knob placed behind Arruga screw.

The photographs (figs. 2, 3 and 4) depict the appearance of the illuminating arm of the Universal (Bausch & Lomb) biomicroscope, modified according to the suggestion of the writer.

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TOTAL DISAPPEARANCE OF THE IRIS DUE TO ESSENTIAL ATROPHY*

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Chengtu, Szechwan, China

Apparently all cases of essential atrophy of the iris reported in the literature showed only holes or partial defect. A total disappearance of the iris, as far as we know, has not been reported before. We were fortunate enough to observe such a case recently.

Sun Chuan-Min, a man, aged 31 years, apparently had normal eyes when he was young, since neither his parents nor his friends ever made any remarks about them. His vision in both eyes was always good. Four years ago he suffered from a severe eye inflammation, which was probably trachoma. Since then his vision has been poor. Even three years ago he could read with the left eye alone.

On examination, both eyes were found to have trachoma, with scars in the conjunctiva of the upper tarsus and a thin total pannus. The right eye showed a normal anterior chamber, iris, and fundus. The left eye had a white macula on the temporal side of the cornea and had no iris at all. The depth of the anterior chamber could not be estimated. On the nasal side, the ciliary process could be seen projecting against the equator of the lens. On the temporal side, the corneal macula obstructed the view of the deeper structures. However, the golden glistening equator of the lens could be seen with focal illumination. The fundus was normal. The papilla was pink, the central vessels appeared normal, and there was no evidence of glaucoma. Vision was: R.E., 2/60; L.E., 1/60. The slitlamp examination was somewhat hindered on the temporal side by the corneal opacity and revealed a total absence of the left iris.

* From the Department of Ophthalmology of the West China Union University.

The visibility of the entire equator of the lens made the absence of the iris especially conspicuous.

We have to consider three possibilities for this absence: (1) Congenital aniridia. (2) Traumatic expulsion or extraction of the iris. (3) Essential atrophy.

As the patient's parents never mentioned anything about any anomaly of the left eye and as congenital aniridia would have been very conspicuous even in the darkly pigmented Chinese eye, since such an eye would have certainly shown a red pupillary reflex in the dark, it would seem that congenital aniridia was not present. That the patient had had good vision and could read with the left eye even as recently as three years ago further strengthens this contention. The second possibility, that of injury, is excluded by the negative history and by the clinical examination which did not reveal any sign of violence or scar.

Without doubt we have here a special case of essential atrophia iridis in which the disappearance of the iris tissue progressed so rapidly and so extensively that the last iridic fibers became invisible.

Essential atrophy of the iris is, as a rule, monocular as is exemplified in our case where the change was confined only to the left eye.

The tension of the right eye was 7 mm. Hg (Schiøtz) and that of the left eye, 16 mm. Hg. That the latter figure was much higher than the former again emphasizes the correctness of our supposition. The low tension in both eyes was probably due to the increased permeability of the cornea due to the pannus. Anyhow, the tension in the left eye was more than double that in the right.

If we take into account the probable permeable condition of the corneas, we may say that there was a definite relative glaucoma in the left eye. We know that in the later stages of essential atrophy the tension goes up. As a rule, it is at that time that a large part of the iris tissue is already resorbed. No doubt we have here in our case the cardinal sign necessary for the diagnosis of essential atrophy of the iris.

Concerning the cause of this increase in tension, there is much difference in opinion. We do not believe that the diminished surface of the iris due to the defects causes the resorption of the aqueous. We feel that the increase of tension may be due in early cases to the remnants of the fine fibers of the iris which are seen in some cases as white felt in the neighborhood of the holes of the iris or on the surface of the lens. These fibers may obliterate the gaps of the pectinate ligament and hinder the filtration in a way similar to that found in cases of glaucoma following degeneration of the zonular lamellae. Histologic examinations of cases with advanced glaucoma showed that the root of the iris was drawn to the pectinate ligament.[1]

Fine and Barkan's case[2] exhibited the most advanced degree of atrophy involving both eyes in a 9-year-old boy. The strands left formed a V-shaped figure in the right eye and an irregular X-shaped figure in the left eye. Duke-Elder[3] has summarized all the literature on this subject quite thoroughly. Rones reported a case where the iris showed an ectropion of the pigment epithelium; such an ectropion was apparently not present in our case.

E.E.N.T. Unit of the West China Union University Hospital.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

COLORADO OPHTHALMOLOGICAL SOCIETY

December 20, 1947

DR. MAURICE MARCOVE, *presiding*

FAMILIAL NODULAR DYSTROPHY

DR. WILLIAM M. BANE presented three cases of corneal dystrophy showing the deposits typical of Groenow's familial dystrophy including striations, small and large, round and oval deposits, ring-shaped opacities, and larger, white fluffy deposits. These cases were in the same family—the mother, Mrs. N., aged 39 years; a daughter, Betty, aged 14 years; and a son, John, aged 10 years. The youngest boy, aged 9 years, had normal vision and the corneas showed no signs of the disease. The mother stated that her mother and maternal grandmother, both deceased, had eyesight not improved much by glasses, and that she has two sisters living who have an eye condition similar to hers. Two brothers have no eye trouble. She and her family came from Iran. It seems safe to presume that the sisters and the mother and grandmother also had this same type of corneal dystrophy.

Mrs. N. states that, when examined 11 years ago in England, a diagnosis of punctate keratitis and vitreous opacities was made. The true condition was apparently not recognized. Betty and John had poor vision but never wore glasses and were never previously examined. Although examination with the corneal microscope revealed in each case a picture typical of the disease as described by previous observers, each of these three cases also showed a different picture. There were more striations in the 10-year-old child, the development of more nodules in the 14-year-old child, and more of the fluffy white deposits in the mother. It was also noted that, in the mother, there was more involvement of the deeper layers of the cornea than in the children. William Zentmayer in his article for the Jackson Birthday Volume, said that the disease was apparently limited to adults; whereas, Duke-Elder states that the earliest known cases begin about 10 years of age, although in one child aged five years, some early signs had been noted. The 10-year-old boy in this family had so much involvement of each cornea that it seems fair to believe that his eyes became involved when he was 8 or 9 years of age, or even younger.

Discussion. Dr. Harry W. Shankel quoted Berliner as saying that cases of corneal dystrophy are seen as early as five years. The cases herein presented are especially interesting in that they are seen in the typical stages of the various decades of life; in the youngest child, there are spots in radiating lines; in the older girl, these spots have coalesced somewhat; and in the mother they are seen in large groups of nodules. Dr. Marcove said that this is purely a degenerative disease and not at all infectious. It differs somewhat from Groenow's original report which was of an epithelial dystrophy.

CHORIORETINITIS DUE TO TOXOPLASMOSIS

DR. JAMES STRONG presented a white woman, aged 31 years, who had first been seen four months before complaining of blurring of right vision. She had had a similar attack four years before lasting five months and again three years before lasting three weeks. Examination revealed vision to be 20/25, O.U. The left eye seemed to be quite normal throughout. The right eye showed numerous keratic precipitates on the cornea, and the aqueous was quite full of cells. The iris, pupil and lens were normal.

The vitreous was hazy. An active area of chorioretinitis about 1 by 2.5 disc diameters in size was seen about 2 disc diameters above and temporal to the macula. Disc and vessels were normal.

The patient was started on atropine drops and penicillin by mouth, but the described signs became worse. Penicillin, 300,000u. in wax, was begun daily with no benefit. She was then hospitalized and given typhoid therapy alternating with calcium gluconate intravenously. She improved remarkably for a while and then became much worse again. She was given a course of gold sodium thiosulphate and improved considerably. In the meantime, a cataracta complicata had begun to develop. Vision was 20/200. One month ago she received a whole blood irradiation after which the lens cleared entirely, and the aqueous beam became almost imperceptible. X-ray films of the chest and an exhaustive physical examination were normal. A laboratory test for toxoplasmosis will be done soon.

Discussion: Dr. Ralph Danielson asked about the possibility of brucellosis and added that toxoplasmosis is a probability but not likely since it is seen mainly in children and only healed lesions are seen in adults. Dr. Walter Ohmart said that the negative X-ray films and Mantoux test did not finally rule out tuberculosis which this could well be. Dr. W. H. Crisp said that the probability of tuberculosis is so likely that, as a therapeutic measure, the patient should be at absolute bed rest for many weeks. Capt. A. Schultz suggested a therapeutic test of streptomycin, 1 gm. daily by injection or by iontophoresis, as it is given at Fitzsimons General Hospital with very good results. Dr. John C. Long stated that he was quite opposed to the use of gold empirically and quoted Hill of Richmond who reported the loss of both corneas after its use. Dr. Leonard Swigert repeated that the case seemed typically tuberculous and suggested a series of old tuberculin along with small doses of X ray with which he had had very good results in two cases of Eales's disease.

Dr. Strong (closing) agreed that all signs pointed toward tuberculosis but said that the internist on the case had insisted that infection could not possibly be present with all the performed tests being negative. Brucellosis tests had been negative. X-ray films of skull had shown reduction in brain convolutions which pointed toward toxoplasmosis. (Two weeks later, Dr. Strong received the report that this patient was strongly positive for toxoplasmosis.)

Bitemporal hemianopsia

Dr. James Strong presented a 23-year-old white woman who complained of headaches, blurring of vision, and eyestrain of six months' duration. In addition, she had had increased thirst for the past month. Examination revealed 20/20 vision, O.U., easily correctible to 20/15. Funduscopy was entirely normal except for blurring of disc margins in right eye. Visual-field studies revealed slight enlargement of each blindspot with moderate bitemporal hemianopsia. X-ray films of the skull were negative. Repeat of fields one month later showed that the hemianopsia had disappeared entirely. Impression: Optic neuritis.

Discussion. Dr. Marcove suggested that in optic neuritis of sufficient extent to blur disc margins, it would be most unusual to have 20/15 vision; therefore, the diagnosis is most unlikely and there must be some type of intrancranial pathologic condition. Dr. Long added that there should be a sedimentation rate and a spinal puncture to rule out an infection such as arachnoiditis.

Congenital glaucoma

Dr. Walter Ferer presented a 12-year-old Spanish boy who was admitted to Colorado General Hospital complaining of poor vision in the right eye during most of his life. The condition had been diagnosed as having hardening of the eyes but had received very little treatment. Examination

revealed vision to be: R.E., 20/400, incorrectible; L.E., 20/30, correctible to 20/20. Tension was 38 mm. Hg (Schiøtz) in the right eye and 34 mm. in the left. The corneas were large and prominent and measured 13 mm. The cornea of the left eye was clear, while that of the right was cloudy with many tears in Descemet's membrane. The irides were somewhat atrophic and the pupils were oval and reacted to light and accommodation. Anterior chambers and lenses were normal. The left disc was normal, while the right disc was deeply cupped and atrophic. Gonioscopy showed the right chamber angle to be entirely obliterated in all its circumference, while the left was obliterated only in patches. In the hospital, the tension of the left eye was easily controlled with pilocarpine and that of the right was not controlled at all with either pilocarpine or D.F.P.

Discussion. Dr. Marcove said that this case was presented for two reasons: (1) To seek surgical opinion as to type of operation to perform since something beyond medical treatment should be given, this would be a choice between goniotomy, trephination, and cyclodialysis; (2) to describe the drug D.F.P.

This drug was first discovered in a wargas plant where it was noted that those exposed to it became miotic and remained so for at least 10 days. At the University of Pennsylvania, it was found that the chemical was di-isopropyl fluorophosphate. It will soon be available commercially and is believed to be a tremendous advance in the medical treatment of glaucoma—especially secondary glaucoma. It was used at first in 0.1-percent solution but this seemed to produce too much spasm and 0.05-percent solution appeared to be much more practical. The drug stimulates the parasympathetics and its action is more prolonged than that of other miotics; however, it takes 2 to 3 days to commence its action after eserine or pilocarpine has been used. It is used in peanut oil and is unstable in water or mineral oil.

Dr. Danielson said that he had had a case almost identical with this one which was first seen when the patient was five months of age on which he had done a bilateral iridencleisis with very satisfactory results after three years. Dr. Tom Van Bergen said that at the University of California Clinics, the operation of choice in these cases is cyclodialysis.

Complication to streptomycin

Capt. A. Schultz (by invitation) said that since October, 1945, streptomycin therapy has been used at Fitzsimons General Hospital on slightly more than 500 patients with tuberculosis. In this group only one case with a visual-field defect was noted as a complication. This is a presentation of the case.

Mrs. M. L., a 31-year-old white woman, with pulmonary tuberculosis came to the Eye Clinic at Fitzsimons General Hospital, on October 20, 1947, complaining of sudden loss of vision in upper visual field of the right eye two days previously.

Her past history revealed that in July, 1946, a diagnosis of pulmonary tuberculosis was made. Her sputum was positive. The X-ray examination showed minimal infiltration of the right lower lobe. Cavitation was not found. She was treated with phrenic crush and pneumoperitoneum. The latter treatment consisted of the injection of about 800 cc. of air into the peritoneal cavity, five days before the onset of her visual symptoms. On August 28, 1947, parenteral streptomycin was begun, using 2 gm. daily in four divided doses. On October 18, 1947, 52 days after streptomycin had been started, the patient had sudden visual complaint, preceded by severe occipital headache. Streptomycin was discontinued on October 20, 1947.

Eye examination. On the first examination on October 20, 1947, visual acuity in the right eye was 20/30, correctible to 20/20; in the left eye, 20/20. The pupils were equal and regular, reacted well to light and accommodation. There was no diplopia. Slitlamp

examination was negative. Ophthalmoscopic examination of the right eye revealed the media to be clear, disc normal, retinal arteries generally attenuated, superior vessels slightly, inferior vessels moderately. The macula was normal, as was the periphery. The patient could not see the ophthalmoscopic beam in the inferior retina. The left eye was normal throughout. There was no caliber irregularity of arteries.

Visual field. Right eye, absolute altitudinal defect for 3/300 white and 3/1000 white up to a bright light through midline, sparing macula. There was a relative area in entire lower half of field for 3/330 and 3/1,000 white.

Color sense. She could recognize 10/1,000 blue within 10 degrees of macula inferiorly in the right eye, but no red or green. The left eye was normal.

Therapy. Immediate therapy consisted of 50 mgm. sodium nitrite, I.V., (Nitroscleran) and 50 mgm. q3h, I.M., for 24 hours. Hourly massage of the eye was ordered. The following day it was felt more energetic therapy was indicated since the vascular spasm and field defect persisted. The ciliary ganglion was anesthetized with 2 cc. of 2-percent novocaine injected retrobulbarly. A paracentesis of the anterior chamber was performed. An injection of 100 mgm. sodium nitrite, I.V., was made concurrently. Dicumarol was started, keeping the prothrombin time at 40 to 50 percent of normal; 660 mgm. rutin were given daily. The latter two drugs were given on the premise that a thrombus might be present at the bifurcation of the central retinal artery.

Course. Under this regimen, the field defect improved and recognition of colors returned. On October 23, 1947, three days after onset, ophthalmoscopic examination of the right eye disclosed about one diopter of papilledema with enlargement of the blindspot. Visual acuity remained at 20/30 in the right eye, correctible to 20/20 until November 7, 1947, 19 days later, when visual acuity in the right eye was found to be 20/100, uncorrectible. No new ophthalmoscopic findings were present. Previous therapy was continued. Four ampules of amyl nitrite were inhaled, improving vision to 20/70 in the right eye. This was repeated on alternate days and in two weeks visual acuity in the right eye was 20/30 uncorrected. The final examination on December 2, 1947, showed visual acuity of the right eye to be 20/30, correctible to 20/25; left eye, 20/20.

Ophthalmoscopic examination of right eye showed the media to be clear; disc was of normal size, shape, and color except for a slight temporal pallor; the previous elevation had disappeared. The arteries of superior retina were nearly normal in caliber, A-V ratio was 2:3. The inferior retinal arteries showed generalized attenuation but were not as constricted as at the time of first examination. A-V ratio, 1:3. Macula and peripheral fundus normal. Left eye entirely normal.

Visual field. Visual-field studies showed the right eye to have a normal peripheral field for 3/330 white. Central field (3/1,000 white) showed normal physiologic scotoma, but a 2 by 5 mm. vertical relative scotoma was present just nasal to the fixation point. This was a remnant of the previous superior scotoma. Color fields for 10/1,000 red, green, and blue, were almost normal.

The patient has had no recurrence to date. Drug therapy was discontinued on November 20, 1947. No more streptomycin has been given. Pulmonary tuberculosis improved under the relative short course of streptomycin therapy.

Discussion. Dr. Long said that intravenous ether has been used in arterial emboli in legs and it might have been useful here. Dr. Marcove said that he felt that the ganglion cells of retina die after 3 to 4 hours. It was unusual that in this case amyl nitrite benefited after 17 days.

Morris Kaplan,
Secretary.

SOCIEDAD OFTALMOLOGICA DE MADRID

June 26, 1947

Entropion of the lower lid

Dr. Marin Amat presented his operative procedure, consisting of: (1) An incision parallel to the ciliary border and some 5 mm. from it, including the skin and the orbicularis muscle; (2) resection of the muscle fibers if they protrude in the wound; and (3) placement of the suture points (which is the fundamental part in the procedure) so that the needle point penetrates successively the lower (cutaneous) lip of the wound, deep enough to include the thickness of the broad ligament, and the upper (cutaneous) lip of the same wound. In addition some auxiliary steps are taken when necessary.

This method, in addition to its simplicity and rapidity of execution, has the great advantage in that the sutures can be removed a day or two after the operation, giving a perfect functional and cosmetic cure.

Discussion. Dr. Mario Esteban said that in order to have an operation for entropion give desirable results it is always necessary to look for a base to give firm support to the sutures, a matter which is as easy in the upper lid as it is difficult in the lower lid. In the lower lid where the tarsus is narrow and flexible we can only find tarsal support if we make the incision and the line of suture very near to the free border. Sometimes the best way to achieve this is simply to make a deep lineal cauterization parallel to the ciliary border.

The usual operations with or without excision of a cuneiform strip or an elliptical piece, and with sutures placed beneath in superficial planes, are of uncertain results in the lower lid. Sometimes the skin will slip upwards and nothing will have been accomplished. Other times there will be a shortening and descent of the lid, but no eversion of its border and the eyelashes.

I believe that the procedure described by Dr. Marin Amat obviates the first of these inconveniences. As for the second, one must be careful to give the suture threads an adequate direction so that when tying, the palpebral border will be drawn forward and not downward.

Dr. Marin Amat concluded by thanking Dr. Esteban for his discussion. He added that this procedure, which he had used many times, does not give safe results and that the cure is obtained much later after elimination of the scab and cicatrization by second intention. The effect of the suture is so great that one must estimate it carefully so as not to produce an ectropion.

Pseudoneoplasms of the orbit

Dr. Diaz Gomes and Dr. Marin Amat discussed two cases of this condition, one of a chronic inflammatory type and the other of a hydatid cyst.

The first case is that of a 48-year-old woman who showed an enormous exophthalmos (10 mm.) of the right eye which was not reducible, did not pulsate, and had developed slowly. All biologic tests (Wassermann, the reactions of Weinberg and of Cassoni) were negative, as well as X-ray studies. A very extensive Krönlein operation showed an extensive flat neoplasm in the orbit, situated between the bony and muscular pyramid. It completely covered the latter on the outside, above and within.

The cure was rapid with proper position of the globe in the orbit, return of vision, and disappearance of the intense papillitis that had existed. There only remained a slight immobility of the globe and ptosis of the upper lid. Histopathologic analysis showed that it was a case of chronic inflammatory nature of the acinous glandular ty[illegible] (lacrimal gland) with infiltration of lymphocytes, plasma cells, and histoid elements.

The second case was that of a boy, aged 16 years, who had an exophthalmos (6 mm.) of the left eye for several months, irreducible and without pulsation, with almost complete loss of sight and a very intense papillitis. It was thought this might

be an intraorbital neoplasm, perhaps of the optic nerve, in view of the age of the patient and the early loss of vision.

In order to expose the neoplasm freely, a transfrontal surgical procedure was undertaken, which confirmed the presence, at the vertex of the orbit above and within the optic foramen, of a hydatid cyst the size of a chestnut. This was perfectly and fully removed. The postoperative course was satisfactory. The patient left the hospital without exophthalmos, without diplopia, with normal ocular motility, with a vision of 6/6, and with complete disappearance of the papillitis. There was a perfect anatomic and functional cure.

The extensive surgical procedures permitted to remove completely the neoplasms, in the first despite its extension and in the second despite its depth, are factors which are essential in operations of the orbit. Dr. Diaz Gomez made a few additional observations. In the first place it is very useful in order to diagnose the exact localization of the tumor and therefore to determine the best way to approach it, to get exact visualization of all the structures by means of injecting in the orbit some opaque medium of contrast to the X rays, a medium which would be harmless to the eye and the other intraorbital structures. He added, "I have read somewhere about this procedure, but do not remember where nor the details and I will be grateful to any of you gentlemen who can enlighten me on this."

The second point is that the transfrontal route could even be improved, in the sense of avoiding loss of the superior orbital border with disagreeable cosmetic consequences, as well as the difficulties which the resection places on the muscles which are inserted there. I believe this could be avoided by omitting to resect a strip of the orbital border, and, if this is not possible, it might be possible to insert a strip of bone afterwards to replace the lost bone, similar to the other procedures we do in cranioplasty.

Discussion. Dr. Bartolozzi congratulated Dr. Marin Amat and Dr. Diaz Gomez for their very interesting paper. The orbit is a closed box and to diagnose what takes place there is one of the most difficult things in ophthalmology. For this reason many times the only solution is to open up the box in the manner which Dr. Diaz Gomez has done with such brilliant results. It is evident that it is difficult to diagnose correctly many cases of exophthalmos especially when one lacks sufficient experience.

I recall a case of exophthalmos seen with Professor Carreras and diagnosed by him as having a chronic inflammatory origin. In this case, there was no antecedent factor except an old trauma to the frontal region. Could this be one of those rare cases where the process was due to a late hemorrhage caused by changes due to a very old trauma? At times, several years may elapse between the trauma and the hemorrhage. Only a surgical intervention could have cleared this up.

With reference to the suggestion of Dr. Diaz Gomez on the possibility of obtaining radiographs of the orbits with their contents visualized by means of a contrast medium, this work has already been realized. Finally, I agree with Dr. Diaz Gomez on the desirability of trying a plastic reconstruction of the roof of the orbit in cases where it is necessary to remove it in the course of the operation, since this would improve the appearance of this region and the function of the musculature.

Dr. Marin Amat thanked Dr. Bartolozzi for his discussion and added that the Krönlein operation which Dr. Diaz Gomez performed on the first patient is not the limited, circumscribed operation which we oculists do, but it is a much more extensive operation, with removal of the entire external wall of the orbit and, in addition, a large part of the roof of the orbit down to the sphenoidal fissure, so that the full contents of the orbit can be explored and the extensive tumor can be removed. In his second case, the transfrontal approach, he mobilized a

very extensive piece of bone periosteum and muscle, leaving it to adhere by its lower-external portion. Resection of the whole roof of the orbit leading to the exposure of the frontal lobe of the cerebrum and all orbital contents affords a large field of observation by means of which it is not only possible to remove the hydatid cyst from the apex of the orbit but also to perform total extirpation in cases where it invades the cranial cavity.

Facial paralysis with hysterical manifestations

Dr. Bartolozzi presented a clinical case characterized by the association of facial paralysis with typical hysterical manifestations. It is a case of a young woman, aged 18 years, who suddenly showed the following symptoms: deviation of the mouth towards the right side, impossibility of closing the left eye, pain in the left half of the head, and marked loss of vision of the left eye. The first examination showed a left, total facial paralysis, anesthesia of the regions supplied by the ophthalmic and superior maxillary branches of the trigeminus, limitation of movement of the left eye (downward, downward and inward, and downward and outward), marked loss of vision of this eye (fingers at half a meter) and slight loss in the right eye (7/10). The visual fields were restricted in both eyes, more marked in the left. The fundus was completely normal. Other tests, ocular and general, were negative. Not being able to ascribe such a complex picture to some definite process, it was suspected that the case presented a superposition of an hysterical process upon an organic picture. When the test was properly made, a typical "fatigue" field was obtained. Concurrently there was a rapid improvement in visual acuity.

Discussion. Dr. Marin Amat congratulated Dr. Bartolozzi and confirmed the extreme symptoms outlined, mentioning the frequency with which hysterical manifestations are superposed on organic diseases. This frequency is even more manifest in diseases of the nervous system, necessitating a careful discrimination between the functional or hysterical symptoms and those due to an organic or anatomic lesion.

When the second pair of cranial nerves (optic nerves) are affected at the same time with another pair of cranial nerves, as in the case of Dr. Bartolozzi, the functional examination will remove all doubts and will disclose the hysterical manifestations superposed on an organic lesion. In cases where vision is retained, the problem is simple, assuming that the hysteria shows the triad described by Charcot—a spreading of the personality, reduced field of consciousness, and a reduced field of vision.

One should emphasize that the constriction of the field of vision is one of the most constant phenomena of ocular hysterical manifestations. The constriction is concentric and regular and has certain characteristics which help to reveal it. These are: an inversion of the red with reference to white; the displacement curves of Foerster, and the fatigue curves of Wilbrand, or the fatigue spirals of Von Reuss, the outlines and isopters of which constitute true spirals like those which Dr. Bartolozzi has shown in his patient. In addition, the concentric reduction of the visual field shows a constant variability not only from day to day but from one moment to another. These are typical changes in the visual fields of hysterical and neurasthenic patients.

On the other hand when there is loss of visual acuity (amaurosis) the diagnosis is also not difficult (pupillary reflexes and fundus being normal). However, there are exceptional cases where there could coexist an amaurosis due to an organic lesion in the cortical centers of sight (as uremia or lead poisoning, principally) when it becomes necessary to resort to the other symptoms of these affections in order to complete the diagnosis.

Joseph I. Pascal,
Translator.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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THE REBATE CASES

By this time everyone knows that 3,221 ophthalmologists in the United States have been charged in the antitrust suits brought by the government against the Bausch and Lomb Optical Company and four subsidiaries and the American Optical Company with violating the Sherman antitrust law by accepting rebates. That the number is so large should occasion little surprise, for it has long been known that the practice of accepting rebates by ophthalmologists is extensive, hoary with age, and has almost become a tradition or at least an accepted custom.

This custom arose in the very early days of American medicine when almost every physician and surgeon accepted rebates from drug stores, undertakers, and orthopedic supply firms, as well as from opticians. Fee splitting between physicians and surgeons was common and widespread. Specious arguments in favor of such practices have been advanced from time to time among the doctors themselves. That they were uncomfortable about it, to say the least, is shown

by the fact that their patients knew little or nothing about what went on behind the scenes.

Physicians of every specialty, furthermore, took hypocritical pleasure in condemning openly and officially in their societies and special organizations these usages as unethical. As has been said before, it was like Congress and the people during Prohibition days, voting dry but drinking wet. We look back on those evil days of national hypocrisy with no pleasure to our conscience.

Fee splitting still goes on, but certainly in a very subdued and gradually disintegrating form. The optical rebate practice is the last to remain of these unethical ways of getting something for nothing by exploitation of the patient. Thanks to government action it, too, appears to be on the way out. Unfortunately, the great science of ophthalmology and all ophthalmologists in this country are smeared and stained with muck in the process. The price will be worth it if the cancer is excised.

Among the 3,221 ophthalmologists named in the suit are members of all the ophthalmological organizations of this country, including the American Board of Ophthalmology. These are our friends and respected colleagues. Many of them are our leaders whose contributions to our science are noteworthy and significant, whose service to their patients is of the highest quality, and whose personal conduct is above reproach. We know that they and the rest of us deep in our hearts have hated the rebate practice that has so many roots in our professional lives and that has become so firmly established through effective outside pressure and reluctant inner complacence.

A widespread custom, handed down from generation to generation of ophthalmologists, endorsed and engaged in by so many of our past leaders and present prominent figures, overwhelmingly seductive to our young men just getting started in practice and eagerly fostered by optical firms, cannot be expected to be easily changed, especially by courageous, individual voluntary action.

It is significant, therefore, that 92 members of the Chicago Ophthalmological Society named in the antitrust suit have accepted a consent decree recently entered in the Federal District Court at Chicago. Under the terms of the decree, the ophthalmologists, while not admitting receipt of rebates from the optical companies on the sale of spectacles to their patients, consent to be enjoined against accepting such rebates and to remove themselves from any further proceedings in the antitrust suit against the optical companies.

The stipulation stated that the physicians are in agreement in condemning rebates by optical companies, that they affirm that they are not accepting such rebates, and pledge themselves not to accept any rebates or credits from dispensers. The order that was issued also provides that other doctors named in the suit may voluntarily become parties to the consent decree by signing the stipulation.

The action taken by the members of the Chicago Ophthalmological Society is a welcome and wholesome sign of moral progress. It means that they will no longer be glorified optometrists, but true doctors of medicine. It means that they will practice ophthalmology unfettered by commercial chains. It means considerable financial loss to their pockets, but it means increasing confidence, love, and respect from their patients, and quiet nights of respect for themselves.

Derrick Vail

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjuctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Spring, K. H., and Stiles, W. S. **Apparent shape and size of the pupil viewed obliquely.** Brit. J. Ophth. 32:347-354, June, 1948.

After photographing pupils at varying angles the authors found considerable individual variation in the apparent position of the pupil at oblique angles of view. For all pupil sizes the relative apparent vertical diameters at different angles are the same. At a given angle the ratio of horizontal to vertical diameters may be taken as a linear function of the apparent pupillary diameter for normal view.

Orwyn H. Ellis.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Braley, A. S. **Experimental studies in inclusion blennorrhea. Isolation of a virus.** Tr. Am. Ophth. Soc. 45:432-461, 1947.

It is assumed that a new unknown virus was isolated, which however may represent a variant of the virus of inclusion blennorrhea. Because of the manner in which the inclusion blennorrhea was handled in passing through the mouse brain it is quite possible that a mutation of the virus may have occurred, which transformed an atypical virus into a typical one. This virus could then give rise to a follicular conjunctivitis in baboons in which there might be an immunity to further innoculation with the inclusion blennorrhea from a patient. If we consider a virus to be a mutation from bacteria by loss of their ability to synthesize artificial media then it would appear probable that a mutation of an atypical virus could be brought about.

It is concluded that the virus of inclusion conjunctivitis as it occurs in the human was not grown, but a variant which was a true virus was produced from the atypical virus of inclusion blennorrhea.

David O. Harrington.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Estable, J. J. **The ocular effect of several irritant drugs applied directly to the conjunctiva.** Am. J. Ophth. 31:837-844, July, 1948. (2 figures, 14 references.)

Palm, Eric. **On the passage of ethyl alcohol from the blood into the aqueous**

humour. Acta ophth. 25:139-164, 1947.

The purpose of this work was to investigate how a lipoid-soluble substance would pass into the eye. Ethyl alcohol was chosen as the typical substance. It was injected into animals, the changes in the alcohol concentration in the blood and the aqueous humour were measured at intervals and the two curves thus obtained were measured. Alcohol passes through the membrane that separates the blood from the aqueous at so high a rate that diffusion in the anterior chamber cannot be regarded as taking place immediately and consequently the rate of penetration cannot be determined precisely. The penetration rate is estimated to be approximately one-third to one-half of the rate at which heavy water enters the eye. Alcohol enters the eye more rapidly than any other substance than water; for example at five to eight times the rate of urea. The comparison was suggested that the membrane that separates the blood from the eye functions, as far as permeability is concerned, as a porous lipoid membrane. The high rate of penetration of alcohol as compared with that of previously investigated lipoid-insoluble substances shows that the conditions that prevail in the eye are similar in this respect to those in the central nervous system and differ fundamentally from those found in the other tissues of the body.

F. H. Haessler.

Pirie, A., Schmidt, G., and Waters, J. W. **Ox vitreous humour. 1. The residual protein.** Brit. J. Ophth. 32:321-339, June, 1948.

The authors review the scanty literature on vitreous residual protein, and present their methods of procedure. Partition chromatographs of hydrolysates of commercial gelatin, cornea gelatin, vitreous humour residual protein and a mixture of glycine, proline and hydroxyproline showed striking similarities in the pattern exhibited by the first three. It was evident that all three contained roughly comparable amounts of proline, hydroxyproline, glycine, glutamic and aspartic acids, and alanine. This evidence was sufficient to suggest that the vitreous humour protein might be a member of the collagen gelatin group. X-ray photographs of vitreous humour residues, both in the unstretched and the stretched state were taken. The general agreement of the spacings of the X-ray reflections with those of oriented collagen fibers provides additional support for the view that the protein of the vitreous humour belongs to the collagen class. For further identification the action of collagenase which digests only collagen and reticulin of proteins was studied. A preparation of the enzyme readily dissolved the isolated residual protein of the vitreous humour. This again suggested that the protein was of the collagen class. The structure of the vitreous humour, which may perhaps be considered as a network of submicroscopic fibers, has a firmer, more stable arrangement than a colloidal gel.

When comparing the swelling curve of ox cornea collagen with the vitreous as a whole, acidity or alkalinity was found to have the exactly opposite effect. The effect of salts on the volume of washed vitreous humour residues was studied. The salts were found to depress shrinkage, and in general the valency effect of the anion was more clearly apparent. Ox vitreous humour has been shown to have a great deal more hexosamine than the humours of other animals. This indicates that the hyaluronic acid content of ox vitreous humour is greater and this probably explains its greater rigidity.

Vitreous cannot be considered as uniform, but must be made up of at least two structures, the collagen-like network and the hyaluronic acid and protein jelly. Liquefaction of the humour follows enzymic hydrolysis of the network, and therefore one may say that this network is essential for maintenance of a normal

vitreous humour. The relationship of the network to the jelly is of prime importance. Orwyn H. Ellis.

Spring, K. H., and Stiles, W. S. **Variation of pupil size with change in the angle at which the light stimulus strikes the retina.** Brit. J. Ophth. 32:344, June, 1948.

No abnormally high pupillomotor effect resulted from rays that entered near the edge of the dilated pupil, and hence were incident on the retina at an angle with the normal. Thus, for practical purposes the part of the pupil through which light enters the eye is not a factor in determining size of the pupil. Orwyn H. Ellis.

4
PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Freusberg, O. **Muscular spasm of accommodation or transitory lenticular myopia in a swampfever-like toxemia.** Klin. Monatsbl. f. Augenh. 112:304-308, 1947.

The clinical syndrome of high fever, nausea, marked albuminuria and transitory myopia was observed among German troops stationed in the swamps of northern Finland. The author denies the possibility that this myopia could be due to a central or peripheral toxic stimulation of the accommodative mechanism, because the myopia does not disappear under the influence of a mydriatic and because of the lack of a simultaneous miosis. He regards the myopia as a lenticular one due to changes in the refractive index in the lens, similar to the transitory myopia in diabetes and in sulfonamide poisoning. (References.) Max Hirschfelder.

Harms, H. **The distribution of the light sense in the retina.** Klin. Monatsbl. f. Augenh. 112:353-357, 1947.

The light sensitivity of various meridians of the retina during light and dark adaptation was investigated by the author. In light adapted persons the fovea is found to have the highest sensitivity, whereas the peripheral parts show ten to fifteen times lesser sensitivity. The greatest decrease takes place within a radius of 20 degrees from the center of the retina. The fovea centralis of dark adapted persons shows less light sensitivity than its immediately adjoining region, usually 5 to 15 degrees from the point of fixation. The relative increase of light sensitivity in dark-adapted persons is more marked within this intermediate zone than it is in more peripheral parts. Individual differences in the various persons tested were noted during the experiments. (References.) Max Hirschfelder.

Jaeger, A. **A new instrument for checking the visual acuity in reduced illumination.** Klin. Montsbl. f. Augenh. 112:346-353, 1947.

A "nightvision selector (Nachtsehwähler)" is described which has the advantage of greater flexibility during the examination of acuity in low grade illumination. The instrument permits a change in the intensity of the illumination as well as a change in the size of the test letters. The article describes the use of a luminous foil for gauging the intensity of illumination, the arrangement of the illuminating lamps, and the test charts used. It also contains the arrangement which provides for constant light adaptation which precedes the test for vision in reduced illumination. In practice the test is taken by several persons at once, who sit 5 m. from the test object and are exposed to illuminated test signs of 0.005 lux and 0.0005 lux intensity for 10 seconds after various time intervals. After 15-minute dark adaptation and with 0.0005 intensity 61 percent saw about 0.09, 30 percent 0.06 and 8 percent less than 0.05. (References.) Max Hirschfelder.

Katz, J. **A new method for exact determination of visual acuity.** Klin. Monatsbl. f. Augenh. 112:341-346, 1947.

A method for exact determination of visual acuity by means of rotable Landolt rings is described. The method excludes the influence of guessing by making mathematical allowance for results which are subject to guess. Twelve observations of each of two to four Landolt rings of various sizes are the basis of the method. The article contains the mathematical calculations which make the method an exact one. Max Hirschfelder.

Kessler, J. **Instrument for the measurement of depth perception.** Klin. Monatsbl. f. Augenh. 112:339-341, 1947.

Two discs of glass, one of which is transparent, the other translucent, are arranged so that the distance between them can be varied. The transparent glass bears points arranged to make a letter or number, the other has an irregular arrangement of dots. A source of light is placed behind them. The measure of depth perception is the smallest angle of separation under which the patient can recognize the figures on the anterior disc.

Max Hirschfelder.

Swan, K. C. **Some aspects of studying binocular vision.** Am. J. Ophth. 31:845-852, July, 1948. (3 figures, 5 references.)

v. Tschermak-Seysenegg, A. **Is Fraunhofer correct?** Klin. Monatsbl. f. Augenh. 112:358-360, 1947.

The arrangement of slit and prism for the dispersion of light into spectral colors puts red to the left, blue to the right side. The letters A to H signifying the Fraunhofer lines are arranged in the same manner. England and America follow the opposite orientation and arrange the spectroscope so that blue is on the left, red on the right. According to the author, this is done to have the lower wave length on the left, the higher one on the right and, in this way, have an increasing mathematical series instead of a decreasing one. The author proposes a compromise which would retain the original arrangement by Fraunhofer which is still in use in continental Europe, but which would introduce the usage of the Hertz oscillation numbers which are low for red and high for blue.

Max Hirschfelder.

5

DIAGNOSIS AND THERAPY

Heinz, K. **The totally reflecting prism as an adjuvant in ophthalmoscopy.** Proc. Ophth. Soc. Vienna p. 90, Dec. 11, 1944.

By the use of a rectangular prism with reflecting hypotenuse surface it is possible to examine even the most distant periphery of the fundus of the human eye. Neither the patient nor the examining physician have to change their mutual positions during the examination. It is sufficient to turn the prism in different angles in order to visualize the distant sections of the periphery of the fundus. The instrument is of value in localizing retinal holes. F. Nelson.

Kirby, D. B. **Instruments for cataract surgery.** Tr. Am. Ophth. Soc. 45:423-432, 1947.

Detailed specifications for a complete set of matched instruments for cataract surgery is presented. All the instruments have balanced cylindrical handles so that each instrument has the same feel, grip, length, weight, size and balance. The article is photographically illustrated.

David O. Harrington.

Koch, F. L. P. **Pupillometry: a comment.** Tr. Am. Ophth. Soc. 45:415-422, 1947.

The various techniques of pupillometry and pupilography are reviewed in considerable detail. The characteristic components of the normal light reflex are listed and the application of pupillometry to diagnosis is discussed.

David O. Harrington.

Moehle, Walter. **Corneal scissors.** Am. J. Ophth. 31:864-865, July, 1948. (1 figure.)

Sloan, L. L. **A note on plastic test objects for perimetry.** Am. J. Ophth. 31:861-862, July, 1948. (1 table.)

6
OCULAR MOTILITY

Coachman, E. H. **A common extraocular muscle imbalance.** Eye, Ear, Nose and Throat Monthly. 27:175-179, April, 1948.

The author emphasizes the necessity for prolonged occlusion to detect the total muscle imbalance because momentary screening will not bring out latent phorias. In the vertical phorias, especially, this is essential for complete correction and relief of symptoms.

Orwyn H. Ellis.

Critchley, C. F., and Cameron, A. J. **Exophthalmic ophthalmoplegia treated with prostigmin.** Lancet 1:751, May 15, 1948.

A 33-year-old woman with exophthalmic ophthalmoplegia was treated with daily injections of 0.125 g. of prostigmin for two months. The exophthalmos and ophthalmoplegia improved and the dose of prostigmin was reduced. In two weeks one eye became more protuberant, 0.125 g. was again given, and the proptosis subsided. After about seven months the prostigmin was withheld. A month later the proptosis appeared to have decreased a little more and the function of the eye was otherwise within normal limits. (References.) Bennett W. Muir.

Jackson, F. E. **Problems in research in orthoptics.** Am. J. Ophth. 31:805-810, July, 1948. (2 figures, 1 table.)

Jaensch, P. A. **Ocular muscle implants.** Klin. Montsbl. f. Augenh. 112:309-312, 1947.

This article is a supplement to a previously (vol. 111) published paper on the same subject. The results of the Hummelsheim operation in 12 cases of congenital or acquired paralysis of the lateral and medial rectus are described. The author recommends the procedure for all cases of paralysis of the lateral muscle. The usefulness in cases of paralysis of the medial muscle needs further investigation. In cases of postoperative divergent squint, however, a muscle implant from the upper and lower rectus muscle supports and supplements the advancement of the internal rectus. (References.)

Max Hirschfelder.

Scobee, R. G. **Anatomic factors in the etiology of heterotropia.** Am. J. Ophth. 31:781-795, July, 1948. (11 figures, 6 references.)

Schulte, D. **Bilateral isolated paresis of the superior rectus, a rare disturbance of the eye muscles.** Klin. Monatsbl. f. Augenh. 112:299-304, 1947.

The author observed a bilateral isolated paresis of the superior rectus muscle. Upward rotation and torsion were disturbed in the position of abduction of the individual muscle. The resulting double images are like those due to bilateral overaction of the inferior oblique muscle. The cause of the paresis was probably vascular damage in both lateral nuclei of the oculomotor nerve. The most sensible treatment of the condition is bilateral tenotomy of the inferior oblique rather than a bilateral recession of the inferior rectus muscle. Max Hirschfelder.

Venco, Luigi. **On the factors which regulate the taking of corneal transplants.** *Ann. di ottal. e clin. ocul. 72:749-766*, Dec., 1946; 73:28-52, Jan., 1947.

Venco reviews the pertinent literature and discusses at length the various factors which may possibly bear on the taking of corneal transplants. He holds that success in keratoplasty is due above all to the great vitality and resistance of corneal

tissue, to its relatively low rate of metabolism, to its marked regenerative capacity, and to the fact that the transplant is in immediate contact with its sources of nutrition.

There is evidence that the cornea has greater resistance than any other tissue known to biologists and that, because of its low rate of metabolism, it can survive for some time even after refrigeration and when deprived of its external sources of nourishment. Likewise the grafted tissue is well tolerated because the corneal proteins (presumably because of a deficiency of closed-chain amino acids in their chemical composition) have little or no antigenic property.

The orientation or "polarity" of the transplant may be entirely disregarded. Corresponding layers in host and transplant must be apposed as accurately as possible, but the graft may be placed without regard to its original meridians in the donor's eye. The presence of normal tissue in some part of the surrounding cornea of the recipient's eye is essential if the graft is to remain transparent. Whether the donor and recipient are related by blood or whether they belong to the same blood group is immaterial. Since in general the factors that might prevent a successful transplant diminish with age, the older the donor the greater the chances of success.

Harry K. Messenger.

7

CONJUNCTIVA, CORNEA, SCLERA

Brausewetter, G. **A case of band-shaped corneal opacity successfully treated with hydrochloric acid.** Proc. Ophth. Soc. Vienna p. 44, March 29, 1943.

A posttraumatic band-shaped extensive corneal opacity in a patient's eye was treated twice with 2-percent hydrochloric acid solution after removal of the epithelium. The vision improved from counting of fingers at 25 cm. to 6/36.

F. Nelson.

Bruens, E. **Treatment of gonorrheal ophthalmia with chemotherapeutic and antibiotic remedies.** Klin. Montsbl. f. Augenh. 112:327-332, 1947.

The sulfonamide therapy of the past eight years is reviewed. It is pointed out that the successful treatment of ophthalmia neonatorum by the exclusive use of sulfonamides during the earlier years has become less and less successful lately, because the gonococci became sulfa-resistant or because only sulfa-resistant strains survived the influx of the new drug. There are indications that the treatment with penicillin will suffer a similar experience. The author recommends quarter-hourly irrigation of the conjunctival sac with normal saline solution in addition to the half-hourly instillation of 20 percent Cibazol or Globucid (sulfathiazole compounds) solution or repeated instillation of penicillin solution. For severe cases he suggests general sulfa treatment and intramuscular milk injections, again in addition to the regular quarter-hourly irrigation of the conjunctival sac. (References.) Max Hirschfelder.

Giacomelli, Piero. **The rosaceal keratidites.** Arch. di ottal. 51:106-135, July-Aug.-Sept., 1947.

The author describes two cases of keratitis rosacea, briefly summarizes the clinical picture, and reviews the principal hypotheses advanced to explain this obscure problem. The disease is an expression of a decreased respiratory activity in the tissue which is brought on by an increase in venous pressure and by deficiency of lactoflavin. This is probably due to a disfuction of the suprarenal cortex which controls both these factors.

Francis P. Guida.

Hatschek, G. **Contribution to the treatment of diseases of the anterior segment.** Klin. Monatsbl. f. Augenh. 112:318-327, 1947.

The therapeutic measures for various

forms of conjunctivitis, blepharitis, corneal ulcers and herpes corneae are discussed. The lack of certain drugs in postwar Europe has been taken into account. The measures which are recommended follow in general those used in the United States. The use of silver nitrate for conjunctivitis is strongly stressed. Subconjunctival injection of the patient's blood (3 to 5 cc.), puncture of the anterior chamber and parenteral injection of the hormone of the adrenal glands has been of value in the treatment of cases of deep keratitis which resisted ordinary measures. The importance of improving the general health of the patient by adequate general measures is stressed. (References.) Max Hirschfelder.

Lepri, Giuseppi. **Epithelial sclerocorneal cysts of congenital origin associated with congenital malformation of the fundus.** Arch. di ottal. 51:53-80, April-May-June, 1947.

Lepri reviews the literature and then describes the general characteristics and accepted pathogeneses of non-traumatic sclerocorneal cysts. He describes one case of congenital cyst which showed an associated prepapillary cyst in the left eye and a very small cyst on the nerve margin of the right eye. Francis P. Guida.

Lindner, K. **Excision of corneal scars.** Proc. Ophth. Soc. Vienna, p. 72, May 22, 1944.

A woman, 40 years of age, had frequent severe eye inflammations during childhood resulting in dense central keloid scars in each cornea. Vision was reduced to counting of fingers at 25 cm. After superficial trephining with a 3-mm. trephine the keloids, together with an opaque layer of corneal tissue, were "pealed off." In the right eye a vision of 6/36 was obtained with contact lens. F. Nelson.

Lindner, K. **The treatment of a case of argyrosis of the conjunctiva.** Proc. Ophth. Soc. Vienna p. 69, April 17, 1944.

Following the procedure of Weymann (J.A.M.A. 1367, 1929) Lindner treated an opera singer who had developed a disfigured argyrosis of the conjunctiva with subconjunctival injections of a mixture of 12-percent sodium thiosulfate and 2-percent potassium ferric cyanide. It is necessary to use platinum-iridium needles for these injections. Four treatments were necessary and the patient was fully satisfied with the cosmetic result.

F. Nelson.

Lippi, E. V. **White rings of Coats.** Arch. di ottal. 51:97-105, July-Aug.-Sept., 1947.

The author describes one case and then presents his theory of the pathogenesis of the lesion. He believes that there is an alteration of the perforating nerves of the cornea and of the openings in Bowman's membrane which leads to a degenerative process of the surrounding tissue. This theory of pathogenesis does not preclude a neurovascular etiology. To a primary alteration of this nature a toxic action or a trophic disturbance may be added.

Francis P. Guida.

Michtner, H. **Uncommon lead impregnation of the cornea.** Proc. Ophth. Soc. Vienna p. 87, Dec. 11, 1944.

An 18-year-old woman who had been in an explosion of lead nitroresorcinate suffered burns of the upper extremities and the thorax as well as foreign body lesions in both eyes. The bulbar conjunctiva and the lower temporal quadrant of the cornea of the right eye had numerous small grayish-white opacities in the epithelial layer. Vision was 6/6. The left eye also had numerous opacities in the exposed section of the conjunctiva. The cornea was dotted with numerous dust-like grayish-white incrustations which were confluent in places and also involved the parenchyma. The structure of the iris was blurred and somewhat hyperemic. The incrustations probably were lead oxide. Microanalysis of particles of the corneal

opacities by a spectrographic method failed to show lead. The author tried to dissolve the opacities which, in later stages, probably consist of lead carbonate, by application of ammonium tartrate.

F. Nelson.

Pendexter, S. E., Jr. **B. pyocyaneus corneal ulcer treated with penicillin.** Am. J. Ophth. 31:862-863, July, 1948.

Rössler, F. **Psoriasis of the conjunctiva.** Proc. Ophth. Soc. Vienna p. 42, Feb. 22, 1943.

A woman, 29 years of age, had generalized psoriasis on the face, forehead and upper and lower lids as well as on the trunk and limbs. The efflorescences of the lids continued into the conjunctiva where the lesion was variable and changed within a few days. The differentiation from seborrhoeic eczema is often difficult.

F. Nelson.

Rössler, F. **Clearing of a band-shaped corneal opacity.** Proc. Ophth. Soc. Vienna p. 42, February 22, 1943.

A 10-year-old child suffered from iridocyclitis for the last four years and developed a band-shaped corneal opacity. Rössler removed the epithelium of the cornea and treated the area with a two-percent hydrochloric acid solution. The corneal opacity cleared up immediately.

F. Nelson.

Sauer, H. **Treatment of herpetic corneal ulcers by cauterizing with zinc sulfate.** Proc. Ophth. Soc. Vienna p. 42, Feb. 22, 1943.

Since 1925 patients with herpetic eruptions of the cornea are treated with 20-percent zinc sulfate solution which is applied with an applicator after cocaine anesthesia. Immediately afterwards the eye is rinsed with physiologic saline solution and bandaged with collargol ointment. Usually an early lesion heals within three to five days after one cauterization, older and extensive lesions within 8 to 13 days. Only two recurrences were observed. Burning pains usually persist for several hours after the treatment. It is necessary to sterilize the zinc sulfate solution by boiling because molds grow readily in it.

F. Nelson.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Alagna, Gaspare. **More about the etiogenesis of recurrent uveitis with hypopyon.** Ann. di ottal. e clin. ocul. 73: 53-61, Jan., 1947.

A 52-year-old man had severe unilateral uveitis, in the course of which hypopyon occurred three times, and which was also accompanied by a typical dendritic keratitis. This and other cases which he has already reported support Alagna's thesis that the etiology of this very serious ocular syndrome is to be attributed to the virus of herpes simplex or at least to a herpetiform virus.

Harry K. Messenger.

Lindner, K. **Prevention of expulsive hemorrhage.** Proc. Ophth. Soc. Vienna, p. 62, Jan. 17, 1944.

In the right eye of a woman 52 years of age, iridencleisis was performed for chronic glaucoma. After the scleral incision the iris bulged forward immediately, and during incision of the iris liquified vitreous body began to pour out. The sclera was trephined at once in the temporal upper quadrant but little blood escaped. Ophthalmoscopy revealed a large choroidal protrusion in the lower nasal quadrant. Another trephining hole was put in that region after which quantities of blood escaped in intermittent pulsating spurts. After two weeks high choroidal detachment was still present but it disappeared completely within three months. Vision became 6/9 and tension remained below 30 mm. Hg.

F. Nelson.

Simonelli, Mario. **Uveo-meningeal syndrome following epidemic keratoconjunctivitis.** Giorn. ital. di oftal. 1:25-35, Jan.-Feb., 1948.

In a 32-year-old woman a uveo-meningeal syndrome appeared a few days after the onset of a typical epidemic keratoconjunctivitis. There was a neuritis as well as a perineuritis and in the absence of choroidal lesions the author attributes this to a direct transmission of the infection from the leptomeninges to the sheath of the optic nerve. All the lesions are believed to be the result of virus infection. The allergic mechanism is suggested as one method of extension.

Francis P. Guida.

9

GLAUCOMA AND OCULAR TENSION

Copps, L. A. **Cyclodialysis and iridectomy for glaucoma with cataract.** Wisconsin M. J. 47:469-471, May, 1948.

The author reviews the literature on the surgery of cataract occurring in eyes with glaucoma. His method of combined cyclodialysis through a scleral incision and iridectomy through a keratome incision at the limbus at the same operation has proved successful in five out of eight patients. These had advanced glaucoma. It seemed imperative to control the tension in one operation, a minimum of surgery was desirable, and in gonioscopic examination a large part of the chamber angle was found closed.

Orwyn H. Ellis.

Harshman, J. P. **Glaucoma associated with subluxation of the lens in several members of a family.** Am. J. Ophth. 31: 833-836, July, 1948. (1 figure.)

Jacobs, C. H. **Cataract extractions under intravenous pentothal sodium anesthesia.** Pennsylvania M. J. 51:861-865, May, 1948.

The author reviews the literature and presents a report on 77 cataract extractions done under intravenous sodium pentothal anesthesia. In the postoperative course 77 percent were satisfactory, and 10 percent had emesis.

Orwyn H. Ellis.

Sautter, H. **Subcapsular collection of fluid in a shrinking traumatic cataract.** Klin. Monatsbl. f. Augenh. 112:316-318, 1947.

Two cases of traumatic cataract after perforating injuries are reported. The cortex and nucleus underwent shrinkage, but this shrinkage was not everywhere followed by the lens capsule. The latter formed a small, optically transparent sac above the shrunken cataract. The author assumes that fluid has collected within this space, either by secretion or by invasion from the aqueous. (3 references.)

Max Hirschfelder.

Simonelli, Mario. **The effect of the administration of nicotinic acid and its amide on the manifestations of napthalene cataract.** Giorn. ital. di oftal. 1:47-52, Jan.-Feb., 1948.

Previous investigations of the author have demonstrated that nicotinic acid normally present in the lens is greatly reduced in the cataractous lens. In this paper he demonstrates conclusively that nicotinic acid or its amide, administered subcutaneously or subconjunctivally does not interfere in any way with the production of the naphthalene cataract in the rabbit, but rather tends to accelerate the rate of its appearance. This is possibly caused by the vasodilating action of the PP factor, which increases the amount of the toxin in the aqueous, and a greater stimulation of the auto-oxidative processes of the lens. Francis P. Guida.

10

CRYSTALLINE LENS

Gittler, R. **Cataracta pisciformis.** Proc. Ophth. Soc. Vienna, p. 93, Feb. 26, 1945

A rare type of bilateral cataract was seen in the eyes of a man, 45 years of age, whose father, paternal aunt, and one of his sisters likewise had cataract. The lens opacities were flat and just anterior to the adult nucleus. In addition, small, dense, ring-shaped opacities, some of them with clear centers, could be seen in front of the flat opaque layer. The zone of the senile nucleus was much closer to the lens capsule in the central than in the peripheral area. This cataract resembles that which Vogt described as pisciform and is a hereditary congenital cataract. F. Nelson.

11

RETINA AND VITREOUS

Agnello, F. **Toxic amblyopia in a subject with an idiosyncrasy to quinine.** Riv. di ottal. 2:155-163, March-April, 1947.

The author discusses a case of toxic amaurosis, due to idiosyncrasy, in a young man who had ingested two grams of quinine. The ophthalmoscopic picture was the classic one of quinine poisoning: optic atrophy, thinning of retinal vessels and marked constriction of visual fields. The pathogenesis of the blindness is similar to that due to male fern and a result of the direct action of the drug on the sensory elements of the retina. The ischemia is secondary.

Francis P. Guida.

Appleby, R., and Pischel, D. K. **Review of 100 cases of retinal detachment.** Am. J. Ophth. 31:796-804, July, 1948. (1 figure, 4 tables, 10 references.)

Harwood, D. H. **Solar eclipse and vision.** Ann. Western Med. and Surg. 2: 22-223, May, 1948.

The author reports a case of macular damage that followed looking at an eclipse without proper protection. A program for prevention, especially publicity in schools, is outlined.

Orwyn H. Ellis.

Lewis, P. M. **Diathermy treatment of angioma of the retina.** Am. J. Ophth. 31: 829-833, July, 1948. (2 figures, 10 references.)

Mallner, J. **Macular hemorrhage in spotted typhus fever.** Proc. Ophth. Soc. Vienna, p. 82, Oct. 23, 1944.

A man, 38 years of age, had spotted typhus fever with all the typical symptoms. When he awoke after 10 days of deep stupor the vision of the right eye was blurred. A small, oval, dark-red hemorrhage with the surface of a raspberry was found in the macula. Vision gradually improved during absorption of the hemorrhage to 6/18. Macular hemorrhages are extremely rare in spotted typhus fever. F. Nelson.

Tower, Paul. **Solar retinitis.** Ann. Western Med. and Surg. 2:217-221, May, 1948.

The author reviews the literature and reports nine cases of central retinitis due to exposure during an eclipse. A plea is voiced for prevention through education of teachers and parents.

Orwyn H. Ellis.

12

OPTIC NERVE AND CHIASM

Barazzoni, Antonio. **Observations on cases of optic atrophy from methyl alcohol poisoning.** Ann. di ottal. e clin. ocul. 73:8-27, Jan., 1947.

The present-day knowledge of methyl alcohol poisoning is summarized with especial reference to toxicology, symptomatology, ocular lesions, pathologic anatomy, pathogenesis, diagnosis, and therapy. Six cases are presented, in all of which the vision was reduced and the nerve heads showed atrophy of the simple type. Various modes of treatment were tried, but in no case was there other than temporary recovery of vision.

According to the most plausible hypothesis the toxic substances reach the op-

tic nerve by way of the central retinal vessels and are rapidly absorbed by the tissues, where they come in contact with the papillomacular bundle and cause irritation but no true inflammation. The retinal ganglion cells participate in this irritative state and in consequence undergo irreversible degenerative changes because of which all therapy is unsuccessful.

Harry K. Messenger.

Esente, Ivan. **Optic neuritis due to lactation.** Giorn ital. di oftal. 1:53-72, Jan.-Feb., 1948.

The author reviews reported cases of optic neuritis during lactation and emphasizes the differentiation between optic neuritis during lactation and optic neuritis due to lactation. In the first group the etiology does not differ from that of any other neuritis. The second group is more definitely that of a metabolic neuritis most likely due to a poor utilization or to a true deficiency of vitamin B. Cessation of nursing usually allows a reestablishment of the vitamin equilibrium in a short time. The author describes one case in which vitamin B therapy brought about some improvement in vision.

Francis P. Guida.

Klein, R., and O'Mallie, P. P. **Chiasma lesion due to fall in epileptic fit.** Brit. M. J., pp. 880-881, May 8, 1948.

A 32-year-old male epileptic fell and struck his right forehead during a seizure. Blindness and optic atrophy occurred in the right eye, and a temporal field defect in the left. No fracture was found. The vision of the right eye improved to 6/9 seven months later but this did not remain long and blindness ensued. The visual field and acuity improved to normal in the left eye. The lesion was thought to be vascular, in or near the anterior chiasmal angle. (References.)

Bennett W. Muir.

Pickard, Ransom. **The alteration in size of the normal optic disc cup.** Brit. J. Ophth. 32:355-361, June, 1948.

The author presents a large series of patients observed over a fifteen-year period. A steady and regular increase in the size of the normal cup of the optic disc was noted. The cups did not average over one-half of the size of the disc. When a cup occupies 70 percent of the disc area further tests should be made before considering it normal.

Orwyn H. Ellis.

Trávik, K. **Sudden blindness in a patient suffering from a cerebral tumor and cerebral syphilis.** Bratislavské Lekárske Listy 28:210-215, 1948.

Blindness developed in the course of a few weeks in a man, 45 years of age. The optic nerve was damaged by a tabetic process. A gummatous basal opticochiasmal arachnoiditis also existed. Glioma was diagnosed clinically, localized by arteriography and the diagnosis was confirmed at autopsy. F. H. Haessler.

13

NEURO-OPHTHALMOLOGY

Bender, M. B., and Brown, C. A. **The character of the nystagmus induced by amytal in chronic alcoholics.** Am. J. Ophth. 31:825-828, July, 1948.

Cholst, M. R. **Widening of the angioscotoma in the alarm reaction.** Am. J. Ophth. 31:821-825, July, 1948. (3 figures, 2 tables, 10 references.)

Cristini, Giuseppe. **Anomalous associated movements of lids and pupils from abnormal regeneration of oculomotor nerve fibers.** Riv. oto-neuro-oftal. 22:323-334, Sept.-Dec., 1947.

Three cases are reported showing some phenomena characterized by abnormal movements of lids and pupils due to anomalous regeneration of fibers of the third cranial nerve after trochlear paralysis. A boy of 15 years had paralysis of the

left third and fourth cranial nerves from a probable rupture of an aneurism of the circle of Willis. On looking downward or inward the left upper lid retracted upward; the left pupil at rest was larger than the right one, and it did not react in the usual tests, It became contracted on looking downward and inward. A woman, 40 years of age, after cranial trauma showed a limited movement of the right eye. At rest the left upper lid was higher than the right and on looking down it went still higher. The right pupil was dilated and rigid and the left did not react to light. A woman, 56 years of age, with persistent headaches from a probable aneurism of the circle of Willis had a right oculomotor paralysis. She exhibited the same type of upper lid and pupil anomalies as the other woman. The writer states that the sign of Fuchs is due either to an increased tonus of the lid elevator because of an anomalous regeneration of fibers to the elevator or due to transmission to this muscle of the impulses which normally go to the orbicularis. The pupillary associated movements are ascribed to an analogous regeneration of fibers. Similar phenomena are well known in neurology. They always suggest a trochlear lesion and may give a hint in the diagnosis of the site of the original lesion and the time when it occurred. (Bibliography.) Melchiore Lombardo.

Di Luca, Giuseppe. **A provoked retinal angiospasm.** Riv. oto-neuro-oftal. 22: 309-322, Sept.-Dec., 1947.

A woman, 50 years of age, with chronic simple glaucoma showed a rapid emptying of the retinal artery when her carotid sinus was compressed by a finger. The emptying took place from the center towards the periphery of the disc. As soon as the pressure was released the empty section of the artery refilled. During the compression the patient had difficult respiration, blurred vision, tremor and paresthesia of the limbs, and a threatened collapse. The writer concludes that the compression of the carotid provoked an angiospasm of the central retinal artery with angiospasm of the small cerebral arteries, cerebral ischemia and cardiac inhibition. The carotid sinus which regulates the general blood flow has no action on the arteries of the brains. A peripheral vasomotor neuro-vegetative center must exist common to ophthalmic territories. (Bibliography.)

Melchiore Lombardo.

Joy, H. H. **Agnostic alexia without agraphia following trauma.** Am. J. Ophth. 31:811-820, July, 1948. (3 figures, 35 references.)

Matteuci, P., and Kluzer, G. **The question of double cortical representation of the macula.** Riv. oto-neuro-oftal. 22: 253-262, July-Aug., 1947.

A man of 33 years had short attacks of headaches of sudden onset which then became continuous. At the same time ocular disturbances consisted of a marked defect of central vision in both eyes, a right lateral homonymous hemianopsia, with a bilateral central scotoma and marked papilledema in both eyes. A diagnosis of intracranial tumor was made and trephining of the occipital region at left showed the presence of a big meningioma occupying almost the entire left occipital lobe. It is noteworthy that a tumor localized in one occipital lobe could provoke not only the homonymous lateral hemianopsia but a bilateral central scotoma instead of a simple hemianopic scotoma. Clinical and experimental data do not give clear evidence of double cortical representation of the macula. Experimental researches do not show that macular crossed fibers exist. Individual variations in the localization and also a true unilateral cortical specialization of the central vision may exist. (Bibliography.)

Melchiore Lombardo.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
601 Union Trust Building, Cincinnati 2
News items should reach the editor by the 12th of the month

DEATHS

Dr. Frederick William Adams, Carmel, California, died April 23, 1948, aged 88 years.

Dr. Emil Amberg, Detroit, Michigan, died April 12, 1948, aged 79 years.

Dr. William Rudisel Fringer, Rockford, Illinois, died March 7, 1948, aged 84 years.

Dr. William Elliott Gamble, Santa Monica, California, died April 23, 1948, aged 88 years.

Dr. William Burton Newton, Alpena, Michigan, died April 19, 1948, aged 67 years.

Dr. H. Lee Simpson, Detroit, Michigan, died February 3, 1948, aged 69 years.

Dr. Hiram Jason Smith, Chicago, Illinois, died February 16, 1948, aged 65 years.

MISCELLANEOUS

ENDOW OPHTHALMIC FELLOWSHIP

Alumnæ of the Upsilon chapter of the Delta Gamma sorority of Stanford University have presented the university with an endowment of $41,000 for a fellowship in ophthalmology. The gift represents proceeds of the sale of the sorority house following dissolution of Stanford sororities in 1944. Presentation of the gift, which fits into a national Delta Gamma alumnæ project for the care and prevention of blindness, followed approval by the superior court of Santa Clara County of the dissolution of the Stanford Delta Gamma association as a corporation. Sorority gifts also included a contribution to the building fund of the Palo Alto Society for the Blind.

SOCIETIES

CINCINNATI OPHTHALMOLOGICAL CLUB PROGRAM 1948-1949

The Cincinnati Ophthalmological Club announces its program for the coming year. Beginning in October, the club will meet on the second Friday evening of each month. The program will include as guest speakers: Dr. Herman M. Burian, Boston; Dr. Peter C. Kronfeld, Chicago; Dr. Alston Callahan, Birmingham; Dr. Derrick Vail, Chicago; Dr. Harold F. Scheie, Philadelphia.

Newly elected officers of the club for the year 1948-49 are: presidium, Dr. Donald J. Lyle, Dr. Ira A. Abrahamson, and Dr. Karl W. Ascher; secretary and treasurer, Dr. Joseph D. Weintraub; historian, Dr. Karl L. Stoll; program committee, Dr. K. W. Ascher, Dr. George Heidelman, Dr. Albert L. Brown, and Dr. Francis X. Siegel; committee on clinical presentations, Dr. Ira A. Abrahamson, Dr. Richard A. Hoffman, Dr. Barnet R. Sakler, and Dr. Cyril E. Schrimpf; dinner committee, Dr. Donald J. Lyle, Dr. Horace W. Reid, Dr. Victor Ray, Dr. Charles A. Hofling, and Dr. Louis J. Hendricks.

PERSONALS

HEADS CLEVELAND CLINIC

Dr. Roscoe J. Kennedy has been appointed head of the department of ophthalmology at the Cleveland Clinic. After receiving his medical degree, in 1931, at the University of Iowa College of Medicine, Dr. Kennedy interned at Harper Hospital, Detroit, and served as resident at the Buffalo (New York) General Hospital and at Wills Hospital, Philadelphia.

Dr. Kennedy came to the Cleveland Clinic in 1937 to complete a fellowship course of study and was appointed to the professional staff in 1938. During World War II, he served for four years in the medical corps of the U. S. Navy in the Southwest Pacific, holding the rank of captain.

Dr. Kennedy was certified by the American Board of Ophthalmology in 1939, and has made various contributions to medical journals. He is secretary-treasurer of the Cleveland Ophthalmological Club and is also a member of the Cleveland Academy of Medicine, American Medical Association, and American Academy of Ophthalmology and Otolaryngology. He was born at New Hampton, Iowa, and attended Notre Dame University.

WINS LITERARY PRIZE

At the exhibit of the American Physicians Literary Guild at the A.M.A. convention in Chicago, Dr. Joseph I. Pascal, New York, received first prize for his essay, "On Lecturing and Teaching."

APPOINTED PROFESSOR AT JEFFERSON

Dr. Arno Emerson Town, clinical professor of ophthalmology, New York University College of Medicine, has been appointed professor of ophthalmology at Jefferson Medical College to succeed Dr. Charles E. G. Shannon, who has retired. Dr. Town was graduated from Jefferson in 1926. He also received a Master of Medical Science degree in ophthalmology from the University of Pennsylvania School of Medicine in 1931. During the last war he served as a commander in the United States Naval Reserve as ophthalmologist at the United States Naval Medical Center, Bethesda, Maryland, and aboard the hospital ship *U. S. S. Benevolence.*

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VOLUME 31 OCTOBER, 1948 NUMBER 10

THE PROVOCATIVE TESTS IN THE DIAGNOSIS OF THE GLAUCOMAS*

H. SAUL SUGAR, M.D.
Detroit, Michigan

The importance of establishing the diagnosis in the early glaucomas has led to a long list of so-called provocative tests for these conditions. These tests attempt to cause an abnormal elevation of intraocular pressure as evidence of a disturbance in the regulatory mechanism of this pressure. However, with the increasing realization that we are dealing with several glaucomas rather than with a single disease entity, and because the provocative tests are generally considered unreliable,[1] an evaluation of several of these tests was undertaken in normal and glaucomatous eyes.

The various tests were made on the same group of glaucomatous patients so as to compare not only the test results with normal eyes, but also to compare the results of the various tests in the same glaucomatous eyes. As a consequence of these studies a further provocative test combination is presented which has given greater elevations of intraocular pressure than previously used tests.

The tests to be considered are the so-called water test, the caffeine test, the pupillary dilatation or mydriatic test, the combined cold-pressor and jugular compression test (the lability test), and a combination of the latter with the water test. These tests will be considered in the above order and then compared. All tonometric readings were made with a new Schiøtz tonometer, certified at the Chicago testing station, and are in terms of millimeters of mercury.

THE WATER TEST

The drinking test or water test was introduced by Schmidt[2] in 1928 following the studies of Marx[3] on the changes in the blood produced by drinking a liter of water.

METHOD

As the test is generally done, the patient drinks a liter of water before breakfast. Tonometric measurements are made every 15 minutes. In glaucomatous patients the tension is said to increase from 6 to 15 mm. Hg (Schiøtz) in about half an hour. In my own studies each test was done at least two hours after breakfast. Each patient was asked to drink a liter of water within a period of five minutes. The readings were made at one-half hour and again at one hour following the water ingestion.

RESULTS

In 143 normal eyes of adults from 18 to 70 years of age, the average rise of intraocular pressure was 1.9 mm. Hg (ranging from −2 to +9 mm.) at one-half hour. At the one-hour reading the intraocular pressure decreased an average of 0.5 mm. (ranging from −2 to +13 mm.) from the half-hour reading.

In 17 eyes the one-hour reading was higher than the half-hour reading, while it decreased in the remaining 126. In the same group of 143 normal eyes, the tonometric tension rose from 23 to 27 mm. to 30 mm. in

* From the Wayne University College of Medicine and the Glaucoma Clinic, Receiving Hospital, Detroit. Under a grant from the W. K. Kellogg Foundation.

TABLE 1

RESULTS OF THE WATER TEST IN GLAUCOMATOUS EYES

(The figures in parentheses indicate the range of change)

Initial Tension (mm. Hg [Schiøtz])	Simple Glaucoma											
	Unoperated Eyes						*Operated Eyes*					
	Without Miotics			Following Pilocarpine			Without Miotics			Following Pilocarpine		
	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension
10–14	—	*mm.* —	*mm.* —	—	*mm.* —	*mm.* —	3	*mm.* +2.3 (+2 to +3)	*mm.* 0	—	*mm.* —	*mm.* —
15–24	9	+2.9 (−3 to +8)	−0.4 (−3 to +3)	15	+4.4 (+2 to +9)	−1.6 (−5 to +1)	5	+6.0 (+2 to +9)	−1.8 (−3 to +1)	4	+6.0 (+3 to +13)	+0.7 (0 to +3)
25–29	50	+5.9 (−2 to +20)	−2.1 (−11 to +4)	40	+4.6 (−2 to +11)	−2.1 (−5 to +1)				4	+5.2 (+2 to +8)	−3.0 (−8 to +2)
30–34	27	+5.4 (−5 to +18)	−1.1 (−15 to +7)	20	+5.3 (−1 to +12)	−0.9 (−12 to +6)				3	+6.3 (+4 to +9)	−4.3 (−6 to −2)
35–39	19	+8.7 (0 to +20)	−0.1 (−10 to +20)	7	+6.1 (0 to +12)	−3.0 (−7 to +5)						
40–44	7	+8.8 (0 to +23)	+0.3 (+8 to +12)	5	+6.6 (0 to +15)	+2.6 (−7 to +10)						

Initial Tension (mm. Hg [Schiøtz])	Unoperated Narrow-Angle Glaucoma						Posterior Lens Dislocation						Postcataract Glaucoma					
	Without Miotics			Following Pilocarpine			Without Miotics			Following Pilocarpine			Without Miotics			Following Pilocarpine		
	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension
10–14		*mm.*	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*
15–24	3	+4.6 (+2 to +9)	0 (−1 to +1)	3	+7.3 (+5 to +11)	+2.0 (−2 to +6)												
25–29	—	—	—	2	+1.5 (0 to +3)	−1.0 (−2 to 0)	1	+11	+2							1	+20	−4.0
30–34	2	+5.5 (+2 to +9)	+1.0 (0 to +2)	—	—	—	1	+16	−2	1	+8	+6						
35–39													1	+10	−6			
40–44													1	+10	−8			

6 eyes, to 31 mm. in 1, and to 32 mm. in 2.

In all instances where the tension in normal eyes rose to 30 mm. or above, both in this group and those normals to be discussed, the patients were asked to return for visual-field studies and a review of the tonometry and ophthalmoscopy. Two thirds of them were studied in this way and no evidence of glaucoma was found. Many of these and of those who did not return were in the age group between 18 and 35 years. Glaucoma simplex in such a proportion of unselected normals is not to be expected. The significance of these readings of 30 to 32 mm. will be considered in a later section of this paper.

The water tests on glaucomatous eyes were done both without miotics and following the use of pilocarpine in operated and unoperated eyes. The results are shown in Table 1.

Control study

A control study was made on the same general group of glaucomatous eyes. Sixty-one were unoperated eyes with simple glaucoma. They were divided into two groups, the first consisting of 56 eyes with an initial tension under 40 mm. Hg and 5 with 40 mm. or over.

Those with an initial tension under 40 mm. showed an average decrease of 0.7 mm. after one-half hour, and an additional average decrease of 0.4 mm. during the second half hour. The range of change was −7 to +5 mm. In the 5 eyes with an initial tension of 40 mm. or higher, there was an average increase of 1 mm. after one-half hour and an average of zero change during the second half hour. The range of change was −8 to +12 mm.

Fourteen operated eyes with simple glaucoma were observed as controls. There was no significant relation between the initial pressure and the change after one-half hour and after one hour. At the half-hour reading these eyes showed an average decrease of 0.7 mm. During the second half hour a further average decrease of 0.7 mm. occurred.

Controls on 4 quiescent narrow-angle-glaucoma eyes showed an average increase of 1.7 mm. at the half-hour reading, with no change during the second half hour.

In 3 eyes with glaucoma seondary to posterior lens dislocation, the control readings showed an average increase of 3 mm. at one-half hour (range −2 to +7 mm.), followed by an average decrease of 1.3 mm. during the second half hour (range −5 to +2 mm.).

Comments

In the normal series reported above, the provocative effect of the water test averaged only 1.9 mm. in the first half hour but individual instances showed up to 9 mm. of increase, which is higher than many of the provocative results in the glaucomatous eyes. Thus, it is impossible to draw a sharp line separating the normal from the glaucomatous in every instance. Arbitrarily, one might say that an increase in intraocular pressure of over 9 mm. at the half-hour reading may be considered a positive water test. A negative test would not indicate the absence of potential glaucoma in the broad definition of this term, nor does a positive test prove its presence with certainty.

The average one-hour readings of this test, when compared to the half-hour readings, show a general decrease of intraocular pressure. However, in 18 of the 112 (16 percent) unoperated eyes with simple glaucoma in which the test was performed without the previous use of miotics, and in 12 of the 87 (13 percent) following the use of pilocarpine, there was an increase in the intraocular pressure during the second half hour. This indicates the necessity of doing the one-hour reading, at least when the rise during the first half hour indicates a negative response.

A separation of the results of the water test in unoperated eyes of patients with simple glaucoma according to the initial tension readings indicates that the average ele-

vation of intraocular pressure following the ingestion of a liter of water depends to some extent on the level of the initial pressure. With increasing levels of initial tension, there is proportionately a greater increase in the pressure increment as is shown in Figure 1. The same is true when the tests are done in the same group of eyes following

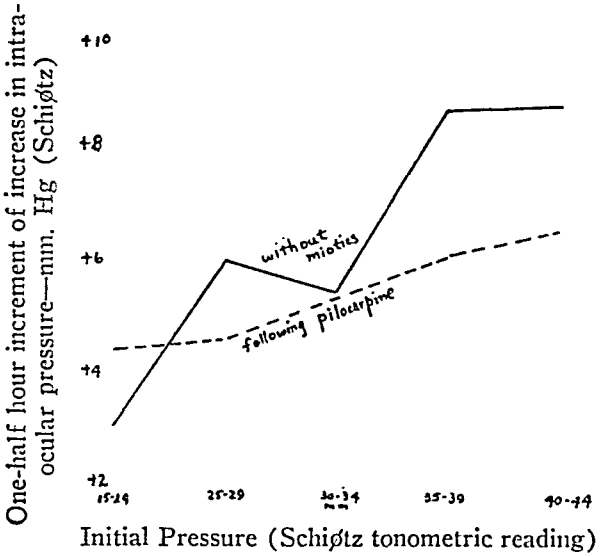


Fig. 1 (Sugar). The relation between the initial pressure and the increments of pressure increase at the half-hour readings of the water test in eyes with unoperated simple glaucoma.

the use of pilocarpine, although the increment of pressure rise is somewhat less (fig. 1).

Although the tested group of operated eyes with simple glaucoma and of eyes with the other glaucomas was too small for conclusions to be drawn, the water test caused a significant increase in intraocular pressure in some of them, in spite of an increase in the controls in the eyes with narrow-angle glaucoma and with glaucoma secondary to posterior lens dislocation. One should, therefore, be careful in using the water test as one of the differential criteria in separating the various glaucomas. It is probable that positive results with this test are not confined to eyes with simple glaucoma.

In the small number of successfully operated cases with well-filtering blebs, there was no significant difference in the rise in pressure produced by the water test in these eyes as compared to the tests on unoperated eyes with normal initial pressures. This suggests that the increase in pressure is too rapid to allow the blebs effectively to prevent it. It is evidence that the concept that these operations control but do not cure the glaucomatous process is correct.

The caffeine test

Lohlein[4] introduced this test which was originally carried out by giving an intravenous injection of 0.2 gm. of caffeine. Later, the test was carried out by having the patient drink 150 cc. of water containing 45 gm. of coffee. In the glaucomatous eye there is said to be a rise of up to 15 to 25 mm. Hg (Schiøtz) in 20 to 40 minutes. The use of black coffee has the disadvantage for investigative purposes that it introduces to some extent the factor of fluid volume involved in the water test.

Thirty-two unoperated eyes with simple glaucoma were studied using 0.5 gm. of caffeine sodium benzoate intramuscularly. The intraocular pressure was measured after a half hour, and again after one hour. All had initial tensions of less than 40 mm. Hg (Schiøtz). Twenty subjects were coffee drinkers while the remaining 12 used no coffee or tea. The coffee drinkers showed an average rise of 2.1 mm. (range —2 to +6 mm.) one-half hour after the caffeine injection and a subsequent average decrease of 0.1 mm. during the second half hour (range —9 to +7). The nonusers of caffeine-containing beverages showed an average decrease of 0.1 mm. at the half-hour reading (range —6 to +8 mm.) and a subsequent average rise of 0.5 mm. during the second half hour (range —6 to +3 mm.). These results did not indicate sufficient value to continue the investigation of caffeine by intramuscular injection as a provocative test.

The mydriasis test

The mydriasis test for glaucoma was used by Jackson[5] in the form of 2-percent cocaine, and with 2-percent euphthalmine by Gradle.[6] The tonometric readings were taken 90 to 120 minutes after the instillation. An increase of 7 mm. Hg or more (Schiøtz) was considered as evidence of a pathologic condition.

When the pupil is dilated there is an increase in the anteroposterior thickness of the iris at its root. In eyes with narrow angles, this leads to further narrowing of the entrance to the angle and may lead to partial or complete obstruction with resultant increased intraocular pressure. When the latter occurs, a definite relationship is found to exist between the chamber angle depth, the pupil size, and the thickness of the iris root.

In gonioscopic studies[7] of the effect of various mydriatic drugs on the fellow eyes of patients with unilateral acute glaucoma and on eyes which had suffered an acute episode but had become normal following the use of miotics, it was found that in each of the cases in which mydriasis caused an increase in intraocular pressure, the angle was open before pupillary dilatation, but closed by the iris at the end of dilatation. In the negative cases, the angle entrance remained open, although narrowed. The provocative dilatations were done with 2-percent euphthalmine, with 1-percent paredrine, or with 2-percent homatropine, and gave positive results in 7 of 20 eyes.

Method

In the present study, the pupils of 51 unoperated eyes with simple glaucoma were dilated with 4-percent homatropine hydrobromide, and the pupils of 49 eyes, nearly all of them the fellow eyes of those dilated with homatropine, were dilated with 10-percent neosynephrine. The initial tonometric readings were under 40 mm. Hg Schiøtz in these cases. No miotics had been used on the morning of the test. The tension observations and pupillary measurements were made a half hour and one hour after the instillations.

Results

The average rise in intraocular pressure in the homatropine group after a half hour was 0.5 mm. Hg (range −4 to +8 mm.), with another 0.5 mm. increase during the second half hour (range −4 to +6). In the eyes in which neosynephrine was instilled, there was an average fall of 1.7 mm. during the first half hour (range −8 to +7 mm.), with an average recovery of 0.2 mm. during the second half hour (range −6 to +8). The pupils dilated on the average 1 to 2 mm. more with neosynephrine than with homatropine but dilated well. There was no instance of an increase of intraocular pressure of over 8 mm. in any case of simple glaucoma. No instance of congestive reaction occurred even though the patients were permitted to leave the clinic while the pupils were still dilated.

In contrast to the above findings were the results in 7 quiescent eyes which had either had acute glaucomatous attacks with congestion previously or were the fellows of such eyes. The pupils of the remaining 3 were dilated with 10-percent neosynephrine. In one eye of the homatropine group neosynephrine was later used for the mydriasis test.

Of the 4 homatropinized eyes, 2 showed no rise in tension, while 2 showed significant increase, one from 29 to 70 mm. Hg in one-half hour; the second, from 25 to 41 mm. Hg in one hour. Of the eyes in which neosynephrin was used, 2 showed no rise in pressure, and 2 showed significant increase, one from 38 to 70 mm. Hg in one-half hour, and the second showed no rise during the first 5 hours but during the 6th hour tension rose from 22 to 51 mm.

Comment

In 1941, as the result of the previously mentioned gonioscopic studies, I pointed out[8] that the provocative tests for glaucoma may be divided into two groups, one group for eyes with normal anterior-chamber depth, including the caffeine test, the water test, and anterior-chamber puncture in the order named (these tests no longer have the same significance, as indicated elsewhere in the paper), and a second group with shallow chambers and narrow angles for which the mydriatic tests were indicated.

It appeared then, as it does now, that as a provocative test pupillary dilatation can be of various degrees, from mere discontinuance of miotic medication in a controlled narrow-angle glaucoma patient with very shallow chambers, to the next degree—the darkroom test, and then the use of weaker and then stronger mydriatic drugs. Only when adequate pupillary dilatation has been obtained is the mydriatic test of any value.

Additional factors should be considered. The first is the time factor which is required for dilatation and the building up of tension. In my experience, once the angle is blocked, the pressure rises within 20 to 30 minutes to high levels. Patients provoked with mydriatic drugs should be observed for about 4 to 5 hours before considering the test negative. There should be no hesitancy in using any of the mydriatic drugs except scopolamine and atropine for these tests, since the other mydriatics can be counteracted without too much difficulty.

Another factor in using mydriatic drugs is that some of the drugs, especially the spastic mydriatics, are also vasoconstrictors. The latter action tends to thin the iris while it dilates, so that these drugs require greater dilatation to get angle blockage than do drugs like homatropine.

The findings of the present study reiterate the lack of danger of mydriasis in simple glaucoma, and its danger in narrow-angle glaucoma. No mydriatic is free of danger in preacute glaucomatous eyes.

The pressor-congestion test

The pressor-congestion test, the so-called lability test of Bloomfield and Lambert,[9] was presented by these two investigators in 1945. It was based on a combination of the cold pressor test of Hines and Brown[10] which is a vasopressor reaction of probable neurogenic origin and the jugular compression test of Wessely and Schoenberg.[11]

Method

The pressor-congestion test is performed in the following manner: An initial tonometric reading is made with the patient lying supine. A sphygmomanometer cuff is placed loosely about his neck with the rubber portion anteriorly, over the jugulars. One of the patient's hands is immersed to the wrists in chipped ice and water and the cervical cuff inflated to between 50 and 60 mm. of mercury for one minute. A tonometric reading is then made and the hand removed from the ice water, and the cervical cuff deflated. The tension returns to the level of the initial reading almost immediately.

In the pressor-congestion tests made in this study the rubber portion of the cuff was folded and taped in this position to make it narrower before applying it to the neck.

Results

In 192 normal eyes, this test gave an average increase of 3.6 mm. Hg (Schiøtz) (range −2 to +9 mm.). Only 6 showed a decrease of up to 2 mm. Of the 192 eyes, 39 (20.3 percent) showed a rise of intraocular pressure from an initial reading of 23 to 28 mm. to up to 33 mm. as follows: 18 increased to 30 mm., 5 to 31 mm., 9 to 32 mm., and 7 to 33 mm.

The pressor-congestion test was performed in 112 unoperated eyes with simple

glaucoma and 13 operated ones as well as in 4 unoperated eyes with narrow angles and a history of previous acute glaucoma. The results are shown in Table 2.

Comments

According to Bloomfield and Lambert,[9] the most important factors in determining the intraocular pressure at any time are the variations in the volume of the intraocular fluids. This volume depends on the blood flow, so the transient vascular congestion induced by the pressor-congestion test tends to produce an increase in intraocular pressure which is particularly evident when the mechanisms controlling the intraocular pressure are defective.

There is one mechanism which has not been considered by Bloomfield and Lambert in the transient rise of intraocular pressure produced by the pressor-congestion test. This is the effect on the extraocular musculature. Any test such as the one under consideration, whereby the tonus of the extraocular muscles as well as the tonus of all the voluntary muscles is increased, would cause an increase in intraocular pressure. I am under the impression that those patients who are most tense under the conditions of the test have a greater increase in intraocular pressure.

Bloomfield and Lambert claimed that if this procedure produced a rise in ocular tension of over 9 mm. the diagnosis of chronic simple glaucoma was strongly suggested and, if the height to which the tension rose in the tested eye exceeded the normal limit of 30 mm., whether or not the actual rise in tension was more than 9 mm., such a diagnosis was even more conclusively indicated. In the glaucomatous eyes of my series the rise of intraocular pressure from application of the pressor-congestion test did not exceed the 9 mm. level mentioned by Bloomfield and Lambert in even half of the cases.

In the normal series of eyes, the occurrence of an increase of intraocular pressure to 30 mm. or above in 20 percent of the eyes does not agree with the second portion of the above claim.

Four patients of the normals who showed an increase in tension to 30 mm. or above with the pressor-congestion test were subjected to anterior-chamber puncture. All gave responses which I consider normal. The results are shown in Table 3. In each case there was no evidence of leakage from the puncture wound as shown by the application of fluorescein. A single control puncture in an eye with definite early simple glaucoma, with an initial tension of 26 mm. and a rise to 35 mm. following the pressor-congestion test, was followed by a rise to 56 mm. at the 2-hour reading, a definitely glaucomatous response.

The anterior-chamber puncture test[12] in

TABLE 2

Results of pressor-congestion tests in glaucomatous eyes

Initial Tension (mm. Hg [Schiøtz])	Simple Glaucoma						Quiescent Narrow-Angle Glaucoma Unoperated		
	Unoperated			Operated					
	No. Cases	Average Increase	Range	No. Cases	Average Increase	Range	No. Cases	Average Increase	Range
		mm.	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*
15–24	12	+7.1	0 to +13	3	+ 7.0	+3 to +10	4	+2.5	0 to +9
25–29	47	+4.2	0 to + 9	4	+ 4.5	0 to +10			
30–34	38	+4.3	0 to +16	2	+11	+4, +18			
35–39	11	+2.9	0 to + 9	2	+ 3.5	+2, + 5			
40–44	4	+8.2	0 to +15	2	+ 7	+7, + 7			

TABLE 3

RESPONSE TO ANTERIOR-CHAMBER PUNCTURE IN 4 NORMAL EYES WITH INCREASED TENSION WITH THE PRESSOR-CONGESTION TEST

	Initial Tension (mm. Hg [Schiøtz])	Tension After Test	Response to Anterior Chamber Puncture (Maximum Tension)
1.	25 mm.	30 mm.	36 mm.
2.	23 mm.	32 mm.	28 mm.
3.	26 mm.	32 mm.	32 mm.
4.	28 mm.	32 mm.	33 mm.

my experience is an excellent test for simple glaucoma and one which is useful in investigative work, although in office practice and even in the clinic rarely is indicated. It is not without danger, and should not be repeated too often with total evacuation of the aqueous as it may lead to stretching of the zonule.

In this test a normal response may be considered to be anywhere in the low 30's. I see no reason why a provocative rise in intraocular pressure to 30 mm. or above in normal eyes may not occur with the water and pressor-congestion tests as it does in the chamber puncture test.

THE WATER AND PRESSOR-CONGESTION TEST

METHOD

In order to increase the strain on the regulatory mechanism of the ocular tension, in line with the idea of the pressor-congestion test, a combination of the water test and the pressor-congestion test was studied in 71 normal eyes and in 107 glaucomatous eyes. This test was started at least two hours after breakfast or lunch. An initial tension reading was made and the patient given a liter of water to drink within a period of about five minutes. At the end of a half hour, the pressor-congestion test was done. The difference in tension between the initial reading and that at the end of the pressor-congestion portion of the test was recorded.

RESULTS

In 71 normal eyes the average rise in intraocular pressure after this test was 5 mm. (range −3 to +10). Of these, 24 (33.8 percent) rose from a normal of 23 to 28 mm. to 30 mm. or over, as follows: 10 increased to 30 mm., 6 to 32 mm., 2 to 33 mm., 3 to 36 mm., and 3 to 38 mm.

The results of the combined test in glaucomatous eyes are shown in Table 4. They indicate a greater increase is tension with this test than in any of the previous ones. A comparison of the results of the water test, the pressor-congestion test, and the combined test shows these results more clearly. In Table 5 are shown the compared results in normal eyes and in Table 6 those in glaucomatous eyes.

Further comparison of the tests was made by doing the various tests at different times in the same eyes. In normal eyes a comparison of the water test with the pressor-

TABLE 4

RESULTS OF COMBINED WATER AND PRESSOR-CONGESTION TESTS IN GLAUCOMATOUS EYES

Initial Tension (mm. Hg [Schiøtz])	Simple Glaucoma						Narrow-Angle Glaucoma Unoperated		
	Unoperated			Operated					
	No. Cases	Average Increase	Range	No. Cases	Average Increase	Range	No. Cases	Average Increase	Range
		mm.	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*
15–24	24	+ 9.7	+2 to +29	2	+ 1.8	+10, 26	3	+9.0	+4 to +14
25–29	39	+ 8.3	+2 to +22	3	+11	+ 7 to +13			
30–34	16	+11.5	−4 to +32	3	+ 4.6	0 to +12			
35–39	8	+ 7.9	0 to +22	2	+ 6	0, +12			
40–44	5	+17	+7 to +29	2	+ 8.5	+ 7, +10			

TABLE 5

A COMPARISON OF THE WATER, PRESSOR-CONGESTION, AND COMBINED TESTS IN NORMAL EYES

	Number of Eyes	Average Increase in Tension	Range	% of Increase to 30 mm. or Above
		mm.	*mm.*	
Water test	143	½ hr. +1.9 1 hr. −0.5	−2 to + 9	6.3%
Pressor-congestion test	192	+3.6	−2 to + 9	20.3%
Combined water and pressor-congestion test	71	+5.0	−3 to +10	33.8%

congestion test was made in 38 eyes. The water test gave an average increase of 2.5 mm. in a half hour, followed by an average decrease of 0.8 mm. during the second half hour. The pressor-congestion test in these same eyes gave an average increase of 3.3 mm.

A further comparison of the water test and the combined water and pressor-congestion test was made in 27 normal eyes. In the water test, there was an average increase of 2.8 mm. in a half hour and an average decrease of 0.8 mm. during the second half hour.

The eyes on which the combined test was done had tonometric readings both before and after the pressor-congestion portion of the test. The reading after the water portion and just before the pressor-congestion portion indicated an average increase of 2.8 mm. At the end of the pressor-congestion portion it had risen an additional average of 2.2 mm., a total of 5.0 mm. for the test.

TABLE 6

A COMPARISON OF THE AVERAGE INCREASE IN TENSION PRODUCED BY THE WATER, PRESSOR-CONGESTION, AND COMBINED TESTS IN UNOPERATED SIMPLE GLAUCOMATOUS EYES

Initial Tension (mm. Hg [Schiøtz])	Water Test (no drops) ½ hr.	Pressor-congestion Test	Water and Pressor-congestion Test
	mm.	*mm.*	*mm.*
15–24	+2.9	+7.1	+ 9.7
25–29	+5.9	+4.2	+ 8.3
30–34	+5.4	+4.3	+11.5
35–39	+8.7	+2.9	+ 7.9
40–44	+8.2	+8.2	+17.0

All three tests were made at different times on the same group of 81 unoperated and 10 operated eyes with simple glaucoma. The initial tensions were under 40 mm. Hg (Schiøtz). A comparison of the results is shown in Table 7.

COMMENTS

It is apparent, in comparing the three tests, that the average tension rise is greater in the pressor-congestion test than in the water test, and highest of all in the combined test but that there is also a proportional increase in the number of normals rising to 30 mm. or above.

Since the range of tension rise in the normal eyes studied with the combined test was practically the same as with the other two tests, one would be justified in saying that an increase of over 10 mm. indicates a positive test. However, most of the glaucomatous eyes showed lesser increases than this. As with the other provocative tests, a negative result does not rule out glaucoma.

TABLE 7

A COMPARISON OF THE WATER, PRESSOR-CONGESTION, AND COMBINED TESTS IN THE SAME SERIES OF EYES WITH SIMPLE GLAUCOMA

	Average Rise in Tension in mm. Hg (Schiøtz)	
	Unoperated	Operated
Water test		
½ hr.	+5.6	+6.0
1 hr.	−2.1	−2.0
Pressor-congestion-test	+4.8	+6.5
Water and pressor-congestion test	+8.9	+8.8

Conclusions

The combined water and pressor-congestion test gives evidence of higher responses in glaucoma than do the water or pressor-congestion tests alone.

With the water test, a positive result may be considered to be a rise of over 9 mm. or a rise to over 32 mm. With the pressor-congestion test, a rise of over 9 mm. or a rise to over 33 mm. may be considered a positive result. With the combined test, a positive test may be considered to be a rise of over 10 mm. or to over 38 mm. Unless the ceilings mentioned above are used, there is danger of diagnosing glaucoma in normal eyes.

The caffeine test, as performed in this study, gives no consistent results.

Mydriasis in simple glaucoma is harmless and has not given a single significant increase in pressure. In eyes with narrow angles, it is the best available provocative test but is dangerous if not adequately followed by miotics. Although the vasoconstricting spastic mydriatics are relatively less dangerous than the others, they do cause angle blockage in some cases. No mydriatic is without danger in such eyes.

No provocative test is of greater diagnostic value than the practice of routine and repeated tonometry in all patients 40 years of age or older, especially in early simple glaucoma where no field changes have occurred, and where the tension is at the borderline of normal. In a minority of instances these tests will give some aid in diagnosis.

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The author wishes to acknowledge the kind aid of the following in his work with the provocative tests: Dr. Benjamin Lyons, Dr. Peter Petravice, Dr. Leonard Fox, and Dr. Lawrence Stocker.

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THE PRESSOR TEST FOR GLAUCOMA*

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This study was undertaken in an attempt to confirm the lability pressor test for chronic simple glaucoma described by Bloomfield and Lambert.[4] The test was found to be not only quick and easy to perform, but was without question the most reliable test yet proposed for the diagnosis of one type of glaucoma. It was, however, found to be distinctly unreliable in another type of glaucoma.

THE PRESSOR TEST

Probably the most potent factor determining the intraocular pressure at any given time is the distensible vascular network of the globe. This vascular bed is under both nervous and hormonal control the same as any other vascular bed in the body. While the eye's capillary bed is not the sole regulatory mechanism of the intraocular pressure, it is probably the one subject to the most variations from time to time.

Although it is obvious that there are many other factors present in the control of intraocular pressure, the pressor test attempts to utilize the vascular variations within the semirigid coat of the globe to detect the presence of abnormal variations in the intraocular pressure.

As many authors have stated, the increased lability of the intraocular pressure is one of the most reliable signs of incipient glaucoma, and the test herein described is a method whereby a sudden strain is thrown on the regulatory mechanism of the eye so that increased lability will be made clinically appreciable.

Bloomfield and Lambert[4] state that, "The idea of a test to indicate the increased lability of [the intraocular pressure] is not new. In cases of diabetes mellitus and of vascular hypertension, for example, evidence of an increased lability in the regulation of levels of the blood sugar and the blood pressure, as indicated by the dextrose tolerance and the cold pressor test respectively, is considered a valuable indication of impending morbidity. The basic idea in such tests is to throw a sudden strain on [the control system] by means of a standardized stimulus and to record quantitatively the degree of deviation that occurs and the time necessary for the restoration of the physiologic norm."

With this idea in mind Bloomfield and Lambert[4] attempted to find some method whereby the flow of blood into the eye could be increased and the outflow decreased, thereby throwing a sudden strain upon the regulatory mechanism of the eye.

Hines and Brown,[6] in 1933 and 1936, described their cold pressor test, whereby sudden elevations of blood pressure, ranging from 10 mm. Hg rise in diastolic and systolic pressures up to approximately 40 mm. Hg rise in both diastolic and systolic pressures, could be obtained by the immersion of some part of the body in ice water. The amount of the rise was dependent up the vascular lability of the patient, *but there was some degree of rise found constantly in all persons!*

Wessely, Schultz, Thiel, and Schoenberg all wrote of the effects of venous congestion upon the intraocular pressure. Therefore, following the Schoenberg line of thinking, Bloomfield and Lambert used a blood-pressure cuff, applied so as to make jugular compression, in order to interfere with the drainage of fluid from the eye. By combining the cold pressor test with jugular compression, they then had a means whereby the flow of blood into the eye could be increased and at the same time the flow of blood out of the eye decreased. This forms the basis of the pressor test. For a complete history and background of the test the reader is referred

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to the excellent descriptions by the original authors.[4]

Technique

The technique used in this test is briefly as follows: The patient is seated in a reclining treatment chair at about 30 degrees from the horizontal. A sphygmomanometer cuff is loosely applied to the neck so that the balloon is in front making pressure on the jugular veins. Pontocaine (½ percent) is instilled into the eyes and the tension measured with a regular Schiøtz tonometer. The patient is then fully instructed as to the procedure of the test. Following this, the hand and wrist of the patient are immersed in water that has previously been cooled to a temperature of approximately 4°C. Simultaneously, the sphygmomanometer cuff is inflated to a pressure of 50 to 60 mm. Hg and held there during the period of the test. At the end of one minute the ocular tension is taken while the patient still has his hand in ice water and the cervical compression is maintained. The ice water is then removed and the cuff deflated.

Subjects

For the purpose of this study, the patients selected were divided into two groups. One group, in so far as it was possible to determine, had no indications of abnormal intraocular pressure, while the other group consisted of patients with proven cases of glaucoma.

The patients in the latter group all had classical findings of glaucoma; that is, cupping of the discs, increased intraocular pressure measured on numerous occasions, and field changes compatible with glaucoma. Most of them had had other types of provocative tests as well. An attempt was made to exclude all inflammatory or postinflammatory types of glaucoma.

Early in the study no attempt was made to separate the wide-angle from the narrow-angle types of glaucoma, but it was soon noted that *there was a difference in the response to the test of these two types,* and so the two were separated. An attempt was made to find and test narrow-angle types of glaucoma for the purpose of this series and so the distribution of the wide-angle and narrow-angle types is not that normally found in a group of glaucomatous patients selected at random.

The "normal" group was made up of 35 eyes (19 patients), while the "glaucomatous" group was made up of 44 eyes (24 patients). The ages ranged from 21 to 82 years with a mean of 59.5 years for the normal group, and 62.7 years for the glaucomatous group. There were 14 males and 21 females in the normal group, and 16 males and 39 females in the glaucomatous group.

Results

The results of testing these groups revealed that first of all the test is highly dependable for the detection of early chronic simple glaucoma of the wide-angle type. However, several pitfalls were revealed that must be taken into consideration in the routine use of the test.

A statistical study of the results by the method of the analysis of variance revealed that the possibility of their being obtained by chance was less than one in a thousand ($p = .001$), which means that the results are highly significant.

It will be noted in Table 1 that the mean rise in pressure with the pressor test in the normal group was 1.94 mm. Hg. This may be compared with the mean rise in the intraocular pressure of 13.82 mm. Hg in the group of wide-angle glaucoma. The mean rise of intraocular pressure with the pressor test of the narrow-angle group of glaucoma was only 2.9 mm. Hg.

When the method of analysis of variance is applied to only these two selected groups, that is, the narrow-angle group versus the normal group, p is greater than .05. This means that such a small difference could easily have arisen on the basis of chance, and, therefore, the nil hypothesis—that there

is no difference between the means other than that due to sampling variation—would have to be considered true in so far as these groups are concerned. Some of the reasons for this variation will be discussed later. The fact that the pressor test reveals no significant rise in patients with narrow-angle glaucoma means that such cases *could not be detected with this test alone!*

Another very important consideration of any test is its validity. Here again, the pressor test stands up very well, in fact far above the results of other tests, with the possible exception of the water-drinking test of Marx. Bloomfield and Kellerman[3] used the pressor test in 34 known cases of glaucoma and had 31 positives and 3 doubtfuls. Inasmuch as they apparently did not correlate their results with the gonioscopic findings, this small percentage of missed cases may well represent narrow-angle cases. In the present series of 35 known wide-angle glaucomatous eyes the pressor test was positive in every case (table 1).

It should be noted here that the criteria used for a positive test were: (1) a rise of greater than 9 mm. Hg and/or (2) a rise to a ceiling level of more than 30 mm. Hg.

TABLE 1

SHOWING THE EFFECT OF THE PRESSOR TEST UPON THE INTRAOCULAR PRESSURE IN WIDE-ANGLE GLAUCOMA, NARROW-ANGLE GLAUCOMA, AND NORMAL EYES

Wide-Angle Glaucoma			Narrow-Angle Glaucoma			Normal		
Case No.	Initial Pressure	Final Pressure	Case No.	Initial Pressure	Final Pressure	Case No.	Initial Pressure	Final Pressure
4	27	38	1	35	35	25	13	19
7	22	34	24	15	15	26	11	15
8	19	35	5	17	22	27	13	13
9	30	40	6	15	22	28	10	13
10	40	56	11	22	29	29	17	19
21	17	39	13	17	19	30	13	15
22	22	35	14	17	17	31	17	19
43	17	35	15	22	29	32	19	22
44	15	29	16	22	29	33	15	15
45	15	40	17	17	22	34	15	15
46	25	40	18	17	19	35	13	13
47	29	40	19	25	29	36	13	13
48	25	35	20	17	22	37	17	19
49	22	35	88	26	26	38	17	19
50	22	35	89	26	26	39	22	25
51	26	35	70	19	22	40	17	22
52	26	35	97	19	19	41	15	17
53	19	35	92	17	22	42	15	17
54	17	35	94	17	19	71	13	15
55	13	25	95	22	22	72	15	15
56	22	35				73	17	17
57	17	33				74	15	17
58	15	35				75	19	22
63	19	29				76	19	19
64	19	29				77	22	22
67	25	40				78	25	25
68	17	30				79	22	25
86	26	38				80	17	19
87	24	35				81	19	19
90	26	35				82	17	17
91	30	40				83	17	17
93	22	37				84	15	17
96	25	35				85	17	29
97	25	39				69	19	22
98	22	40				70	19	19
Total eyes		35			20			35
Mean rise in IOP		13.82			2.85			1.94
Mean ceiling pressure		36.0			18.25			18.45

Bloomfield and Lambert[4,2] felt that the latter was the more reliable of the two. One must agree with them, but it should be reëmphasized that the rise of 9 mm. Hg should not be overlooked. In this series there were only four cases whose tension failed to rise above

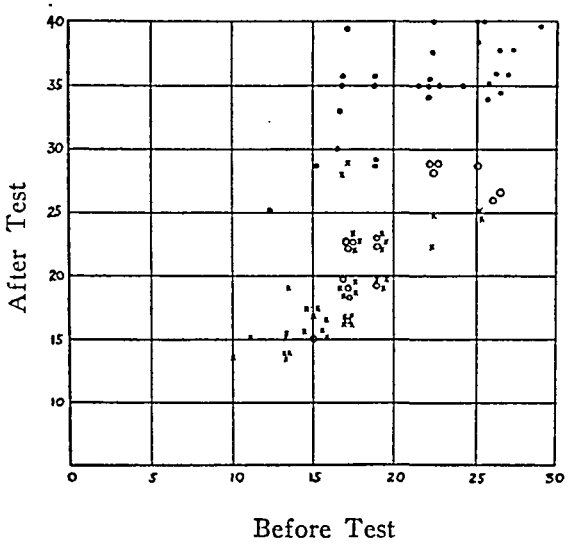


Fig. 1 (Stine). Effect of the pressor test on intraocular pressure. • = Wide-angle glaucoma. O = Narrow-angle glaucoma. × = Normal.

30 mm. Hg following the test. Case 44 showed a rise of 10 mm.; Case 55, a rise of 12 mm.; while Case 63 and Case 64 each showed a rise of 10 mm. Hg.

The mean ceiling of the wide-angle group of glaucomas was 36 mm. Hg, while that of the narrow-angle group was only 18.25 mm. Hg. The ceiling of the normal group was 18.45 mm. Hg.

Figure 1 is a scattergraph showing the correlation between the three groups being tested in this study when the pressure before test is plotted against the pressure after the test. It will be noted that the plotted points of the cases of narrow-angle glaucoma are practically superimposed upon those of the normal cases. This is in sharp contradistinction to the grouping of the wide-angle group. This scattergraph graphically illustrates the facts brought out by the numerical tabulation of the results, that narrow-angle glaucoma cases respond to the pressor test in the same manner as does a normal individual.

Bloomfield and Kellerman[3] tested 77 normal eyes with this test and had only one positive. This series shows 35 normal eyes and likewise one positive which was apparently a false positive in the sense that no signs of glaucoma were present at that time If we combine the two series, we get a total of 112 known normal eyes in persons subjected to the test and only two false positives. The misclassifications amounted to 1.7 per cent.

An analysis of the group with narrow-angle glaucoma showed that the mean rise in tension with the test was only 2.9 mm. Hg. The ceiling levels reached did not vary significantly from the normals. These cases were all proven to have glaucoma, however, by the presence of typical field changes, fundus pictures, and a positive provocative test with mydriasis. *These cases would have all been missed if reliance had been placed solely on the pressor test!*

A total of 82 eyes were subjected to mydriasis. Of these there were 33 with wide-angle glaucoma, 18 with narrow-angle glaucoma, and 31 normal eyes. Of the latter group, 5 had what would be classed as narrow angles.

TABLE 2

COMPARISON OF THE EFFECT OF PAREDRINE AND EUPHTHALMINE DILATION UPON THE INTRAOCULAR PRESSURE

Case No.	Initial Press.	Paredrine Dilation Pupil Size	Paredrine Dilation Final Press.	Euphthalmine Dilation Pupil Size	Euphthalmine Dilation Final Press.
6	17	6 mm.	22	7.0 mm.	35
13	17	7.5 mm.	19	8.0 mm.	29
17	19	7.0 mm.	22	7.0 mm.	28
88	22	7.0 mm.	25	8.0 mm.	35

From an examination of Table 3 it will be seen that the rise in pressure with mydriasis in the normal group was less than 1 mm. Hg, while the mean rise in the narrow-angle group was 14.33 mm. Hg. This should be contrasted with the mean rise of 3.69 mm. Hg in the wide-angle group of glaucomas with mydriasis.

In this study the mydriatics used were 2-percent or 5-percent homatropine, 5-percent euphthalmine, or 4-percent cocaine and 5-percent euphthalmine. Paredrine and neosynephrin were not included in this study because it was believed that their vasoconstrictive effects would often overbalance the mydriatic effect and thus introduce another variable.

It has been noted by other observers that paredrine is probably the safest of the mydriatics to use in the routine dilation of patients' eyes because it so infrequently causes a rise in intraocular pressure. Several of the eyes included in this study were dilated widely with paredrine with no appreciable effect upon the intraocular pressure; whereas, with euphthalmine and the same amount

TABLE 3

SHOWING THE COMPARISON OF THE EFFECT OF MYDRIASIS UPON EYES WITH WIDE-ANGLE GLAUCOMA, NARROW-ANGLE GLAUCOMA, AND NORMAL EYES

Wide-Angle Glaucoma				Narrow-Angle Glaucoma				Normal			
Case	Initial Press.	Final Press.	Pupil Size	Case	Initial Press.	Final Press.	Pupil Size	Case	Initial Press.	Final Press.	Pupil Size
4	26 H*	29	5.0 mm.	1	35 E′	60	8.0 mm.	25	15 H	15	7.5 mm.
7	22 H	25	7.5 mm.	5	19 E′	28	6.5 mm.	26	15 H	15	8.5 mm.
8	17 H	22	6.5 mm.	6	17 E′	35	7.0 mm.	27	13 H	13	7.0 mm.
9	29 E	32	6.0 mm.	13	17 E	29	8.0 mm.	28	13 H	13	8.0 mm.
10	40 E	40	7.0 mm.	14	17 E′	29	6.5 mm.	29	17 H	17	6.5 mm.
21	19 E′	40	8.0 mm.	15	19 E′	27	6.0 mm.	30	13 H	13	7.5 mm.
22	22 E′	35	6.5 mm.	16	19 E′	35	8.0 mm.	31	19 H	19	7.0 mm.
43	15 H	17	8.0 mm.	17	19 H	28	7.0 mm.	32	19 H	19	6.5 mm.
44	15 H	18	7.0 mm.	18	19 H	27	7.0 mm.	33	15 H	17	7.5 mm.
45	17 H	17	8.0 mm.	19	25 E′	35	6.5 mm.	34	15 H	17	8.0 mm.
46	25 E′	25	6.5 mm.	20	17 E′	25	5.5 mm.	37	19 H	19	8.0 mm.
47	27 E′	29	7.5 mm.	88	23 H	35	8.0 mm.	38	17 H	19	8.0 mm.
48	25 E′	25	7.0 mm.	89	22 E′	48	7.0 mm.	39	22 H	25	6.5 mm.
49	22 H	25	6.0 mm.	70	19 H	40	7.5 mm.	40	22 H	22	7.0 mm.
50	22 H	27	5.5 mm.	97	19 E′	35	8.0 mm.	41	15 H	15	7.0 mm.
53	17 H	20	8.0 mm.	92	17 E	40	6.5 mm.	42	15 H	15	7.5 mm.
54	17 H	19	6.0 mm.	94	19 E	35	7.0 mm.	71	17 H	17	6.0 mm.
55	15 H	15	5.0 mm.	95	22 E	40	7.5 mm.	72	15 H	15	6.5 mm.
56	19 H	22	7.0 mm.					75	19 H	22	7.0 mm.
57	17 H	19	6.5 mm.					76	19 H	19	6.5 mm.
58	15 H	17	7.5 mm.					77	22 H	22	8.0 mm.
63	17 H	22	8.0 mm.					78	25 H	25	8.5 mm.
64	22 H	22	5.0 mm.					79	19 H	22	6.5 mm.
67	22 E′	22	6.5 mm.					80	17 H	17	7.0 mm.
68	17 E′	17	7.0 mm.					81	22 H	22	7.5 mm.
86	25 E′	44	7.0 mm.					82	17 H	19	7.0 mm.
87	24 E′	38	7.5 mm.					83	17 H	17	8.0 mm.
90	25 H	25	6.0 mm.					84	17 H	17	6.5 mm.
91	29 H	30	5.5 mm.					85	17 H	19	7.5 mm.
93	22 H	25	6.5 mm.					69	19 H	19	7.0 mm.
96	25 E′	26	5.5 mm.					70	19 H	19	7.0 mm.
97	22 H	27	7.0 mm.								
98	22 E′	22	7.5 mm.								
Total Eyes		33				18				31	
Mean Press. Rise		3.69 mm. Hg				14.33 mm. Hg				0.51 mm. Hg	

* H denotes case where either 2% or 5% homatropine was used.
E denotes case where 5% euphthalmine was used.
E′ denotes case where 5% euphthalmine and 4% cocaine were used.

of dilation, there was a significant rise in pressure (table 2).

In this study the effect of mydriasis was studied by measuring the intraocular pressure before the installation of a mydriatic and then again at least every hour until it ceased rising. This procedure was followed in all the cases except the eyes with narrow-angle glaucoma, in which a miotic was instilled after it was found that a significant rise had occurred.

From Table 3 it will be seen that every case classed as narrow-angle glaucoma in this series gave a positive mydriatic test using as a criterion the commonly accepted figure of a rise of more than 6 mm. Hg. In the 33 eyes with wide-angle glaucoma only 4 showed a significant rise in tension under the influence of mydriatics. (See discussion of these cases later.)

Discussion

An examination of the above results suggest several important facts and possible clues to some of the factors in the production of the glaucomatous state. The pressor test of Bloomfield and Lambert has been confirmed as a valuable diagnostic procedure in the study of glaucoma. It now seems obvious that the test is highly reliable in detecting chronic simple glaucoma of the wide-angle type, but almost useless in detecting narrow-angle glaucoma, a point not brought out by their work. However, several side issues were raised which, upon investigation, may be of distinct importance.

It would appear from the results of this study that there are two distinct mechanisms operating in the production of wide-angle glaucoma as opposed to narrow-angle glaucoma. This is not a new idea and has been proposed by Barkan,[1] Kronfeld,[7,8] Sugar,[9] and others. There is not complete acceptance of the idea, however, since Troncoso[10] in his recent book, *Gonioscopy,* says, "At this time a warning should be sounded not to believe that the mechanical application of the iris base against the cornea is the cause, the *primum movens,* of the development of acute or subacute attacks of glaucoma. Narrowing of the angle is only a predisposing factor as will be explained later."

Kronfeld and others[7] studied the effect of mydriasis in patients with wide-angle glaucoma and came to the conclusion that the intraocular pressure is not grossly influenced by the administration of mydriatics. They did, however, elicit a small rise. This was confirmed in this study, where the mean rise in intraocular pressure in the normal group was only 0.5 mm. Hg, as contrasted with the mean rise of 3.69 mm. Hg in the group of wide-angle glaucoma.

It will be noted that in four eyes the intraocular pressure rose precipitously with mydriasis, but fell promptly with miosis. These cases were included in this group because it was felt from clinical course and examination that, although the angles were narrow with many anterior peripheral synechias, the primary etiology of the glaucoma was that of a disturbance of the trabeculum—canal of Schlemm—mechanism typical of the wide-angle glaucoma. It is believed that the rise in tension with mydriasis was due to the narrowness of the angle and the anterior peripheral synechias, making it possible for the iris base to block the angle.

The fact that in this study all of the eyes with wide-angle glaucoma responded with a significant rise in intraocular pressure to the pressor test, while the group of narrow-angle glaucoma responded with a rise not significantly different from that of the normals, seems to indicate that there is an entirely different mechanism operating in the production of the glaucomatous state in the two conditions.

The pressor test is a method of throwing a sudden strain upon the reserve capacity of the pressure-regulating mechanism of the eye, acting through the vascular bed, which is thought to be the effector organ of the pressure-regulating mechanism.

Inasmuch as there is no angle-crowding effect resulting from this test, it seems to in-

dicate definitely that the etiology of the glaucoma in the wide-angle type of glaucoma is due to some pathologic condition in the drainage mechanism in the trabeculum and canal of Schlemm, and not directly related to the base of the iris.

Friedenwald[5] has demonstrated that with a rise of 5 to 10 mm. Hg in intraocular pressure, the rate of outflow of the aqueous is more than doubled. It then stabilizes on the "Friedenwald plateau" where a rise in pressure up to about 30 mm. Hg does not increase the rate of outflow. He interpreted this initial rise as a reserve of safety in the pressure-regulating mechanism, and thought that normal eyes maintain their intraocular pressure by staying within the limits of the plateau. However, in a glaucomatous eye that has no such margin of safety, any sudden strain upon the outflow mechanism would lead to an increase in the intraocular pressure. This is the elevation that is being measured by the pressor test.

On the other hand, the fact that the group with narrow-angle glaucoma did not respond by a rise in pressure with the test would make it appear that the filtration mechanism of the trabeculum and canal of Schlemm is functioning normally or at least almost normally in this latter type of case. These cases did respond with a rapid and significant rise coincident with mydriasis, the rise occurring presumably as soon as the pupil had dilated sufficiently to crowd or even partially block the angle.

Such patients, when examined with the gonioscope while the intraocular pressure was elevated, showed that the angle which had been narrow before was now almost invariably completely closed with the iris in apposition to the cornea or sclera. When a miotic was instilled and the pupil began to contract, reëxamination with the gonioscope revealed the previously crowded angle to be opening and the pressure soon fell rapidly to its previous level.

This evidence seems too conclusive to be denied and appears to be a powerful supporting girder in the structure of the "iris-block" mechanism built up by Barkan,[1] Kronfeld,[7, 8] Sugar,[9] and others. It certainly must be admitted, however, that there are eyes that at the time of examination show a narrow angle and yet have normal tensions and no other evidence of glaucoma, but there is no assurance that these same eyes will not develop narrow-angle glaucoma sometime in the future.

Another fact brought to light by this investigation was a probable correlation be-

TABLE 4

SHOWING THE CORRELATION BETWEEN A POSITIVE PRESSOR TEST WHILE ON MIOTICS AND THE VISUAL-FIELD LOSS

Case No.	Tension Range on Miotics	Pressor Test on Miotics	Pressor Test no Miotic	Visual Fields
4	17–22	19 to 22	27 to 38	No loss for six months
7	15–24	17 to 24	22 to 34	No loss for two years
8	17–22	19 to 29	19 to 35	Steadily progressive loss
9	15–25	17 to 22	30 to 40	No appreciable loss for two years
10	19–25	19 to 25	40 to 56	Very slight loss over period of two years
21	15–27	17 to 35	17 to 37	Progressive loss
22	19–25	22 to 35	22 to 35	Progressive loss, central and peripheral
51	13–22	15 to 17	26 to 35	No loss over period of six months
67	17–28	19 to 35	25 to 40	Slow progressive loss past ten years
68	15–22	15 to 25	17 to 30	Slight, but definite loss, ten years
90	19–25	25 to 29	26 to 35	No significant loss for past year
91	19–28	25 to 35	30 to 40	Definite central and peripheral loss
93	17–22	22 to 25	22 to 40	No loss
98	15–25	19 to 35	22 to 37	Steady loss of peripheral field

tween a positive pressor test in eyes under the influence of miotics and the amount of visual field loss. Bloomfield and Lambert[4] in their paper noted that patients under the influence of pilocarpine did not show the expected rise in tension with the pressor test. This fact was confirmed early in the present study.

Subsequent investigation revealed that these patients who had a positive pressor test *despite normal tensions under miotics* were all gradually losing visual field and visual acuity and were, therefore, not really controlled. On the other hand, those patients that had a negative pressor test while under the influence of miotics had been without appreciable field loss for a considerable time. This series is illustrated in Table 4.

It will be seen that of 14 eyes, 7 had had a progressive field loss despite the fact that the tension had always been noted to be well within the so-called normal zone. The tension in the other seven eyes stayed essentially within the same range, but these eyes had sustained no significant visual-field loss over a rather lengthy period of observation. In every case where there had been progressive field loss, the pressor test was positive while the patient was on his usual miotic regime and, conversely, the pressor test was negative in those patients that did not show a progressive loss of the visual fields.

The small number of cases certainly does not entitle one to draw any very valid conclusions as to the prognostic value of the pressor test, but does provide a clue that is being investigated further in an attempt to establish the pressor test as a prognostic procedure which will enable the clinician to foretell what course a given case of glaucoma may take on conservative therapy.

Summary

The pressor test was found to be a safe, easily performed test for the detection of chronic simple glaucoma of the wide-angle type. It was found to be completely unreliable for the detection of glaucoma of the narrow-angle type. Therefore, it is recommended that the test be used only in conjunction with the gonioscopic examination when there is any question of its validity.

Mydriasis was found to be a very reliable provocative test for the detection of narrow-angle glaucoma, but, contrary to popular belief, had practically no effect on the intraocular pressure in the wide-angle type of glaucoma.

The response to the pressor test and mydriasis of the two types of glaucoma suggests that there are entirely different mechanisms operating in their etiology.

The pressor test may, by further investigation, be found to have very definite prognostic value in cases of wide angle glaucoma with respect to possible visual field loss.

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I wish to express my gratitude to Dr. L. T. Post, ophthalmologist-in-chief, and Dr. P. T. Shahan, chief of the glaucoma clinic, for making the facilities of the Washington University Eye Clinic available to me, and to Dr. R. G. Scobee for his very valuable advice in the preparation of this paper. The credit for the statistical analysis of the cases must go to Mrs. Hixson of the department of mathematics of Washington University.

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THE USE OF BACITRACIN IN OCULAR INFECTIONS*

Part II. Bacitracin Therapy of Experimental and Clinical Ocular Infections

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In the first part of this report,[1] we have shown that bacitracin may be safely employed on the external surface of the globe in concentrations up to 1,000 units per ml. saline. Bacitracin does not penetrate the normal cornea in appreciable amounts but does penetrate into the aqueous humor when the corneal epithelium is injured by physical, chemical, or infectious agents. Concentrations up to 100 units in 0.05 to 0.1 ml. saline, when injected into the vitreous humor, produced only minimal opacities. No fundus lesions were detectable with the opthhalmoscope. Because of this tolerance of ocular tissues to bacitracin, studies were undertaken to determine its value in experimental and clinical ocular infections.

A. Treatment of experimentally produced corneal infections

The organism used was a pathogenic strain of hemolytic Staphylococcus aureus, was coagulase positive, mannite fermenting, and sensitive to bacitracin. Broth cultures (18 to 24 hours) were used in concentrations varying from the undiluted broth to a concentration of 10^{-6}.

Using a specifically short bevelled 27-mm.-gauge needle attached to a tuberculin syringe, we injected into the corneal stroma in the pupillary area a sufficient amount of the culture to produce a 4-mm. bleb in both eyes. This procedure invariably produced within 24 hours a purulent conjunctivitis with corneal abscess followed by hypopyon and inflammation of the entire anterior segment. If untreated, the infection progressed until it involved most of the cornea, eventually healing with a dense, vascularized scar. In some instances the infection resulted in endophthalmitis or panophthalmitis leading to a granulomatous mass or phthisis bulbi.

For treatment of the corneal infections, bacitracin was used in a concentration of 1,000 units per ml. saline. The experimental procedures are grouped according to the period of time elapsing between inoculation and commencement of therapy, which varied from 30 minutes to 8 hours. In all cases the right eye received treatment, while the left served as a control.

Experimental procedures

In 15 rabbits the undiluted broth culture was employed. In 5 of these animals 2 drops of bacitracin solution (1,000 units per ml. of saline) were applied to the cornea within 30 minutes after inoculation and repeated every half hour for six doses. In no instances was there complete prophylaxis. However, in 4 out of 5 rabbits, the infection in the treated eye was much less severe than in the untreated.

In the next 5 rabbits of this group, treatment was initiated 1½ to 3 hours after inoculation. In these animals the infections in the treated and untreated eyes were equal.

The remaining 5 rabbits of this group received after an interval of one hour, a continuous corneal bath for half an hour in the right and a saline bath in the left eye.

* Read before the Ophthalmic Section, New York Academy of Medicine, November, 1947. This research was done under a contract between the Office of Naval Research and Northwestern University.

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TABLE 1

CLINICAL CASES TREATED WITH BACITRACIN

No. of Cases	Bacteriology	Coagulase Test	Sensitivity to Bacitracin	Results
	ACUTE CONJUNCTIVITIS			
16	*Unmixed Cultures*			
	7 with hem. Staph. aureus	2 positive 4 negative 1 not done	all sensitive to bacitracin	5 rapid recovery 2 questionable effect
	Mixed Cultures			
	6 hem. Staph. aureus 1 with subtilis 1 with diplococcus 1 with gram-pos. rod 1 with diphtheroid and proteus 1 with diphtheroid 1 with streptococcus	3 positive 2 negative 1 not done	3 sensitive to 0.5 units bacitracin 3 hem. Staph. aureus 3 hem. Staph. aureus sensitive to 10.0 units of bacitracin	1 rapid recovery 3 improved 2 questionable effect
	2 Pneumococcus		2 sensitive to bacitracin	2 rapid recovery
	1 nonhem. Staph. aureus with Strept. hem.	Negative	1 not done	1 questionable effect
	ACUTE KERATOCONJUNCTIVITIS			
3	No growth	—	—	2 recovery in 5 days 1 failure
	ACUTE EXACERBATION OF CHRONIC CONJUNCTIVITIS			
5	*Unmixed Cultures* 5 hem. Staph. aureus	4 positive 1 negative	4 sensitive 1 not done	5 improved
	CHRONIC CONJUNCTIVITIS			
18	*Unmixed Cultures* 13 hem. Staph. aureus	5 positive 7 negative	11 sensitive to bacitracin 2 not done	6 improved 12 questionable effect and/or complete failure
	Mixed Cultures 3 hem. Staph. aureus with diphtheroid	2 negative 1 not done	not done	
	1 hem. Staph. albus with diphtheroid	1 negative	not done	
	1 no growth	—	—	
	CORNEAL ULCER			
1	Gram-negative rod (atypical Ps. aeruginosa)		sensitive to 12 units of bacitracin	rapid recovery

cus aureus were cultured. In 4, the coagulase test was positive and one was negative. In 4, the organisms were found to be sensitive to bacitracin and in one the sensitivity tests were not done. All 5 showed rapid improvement of the acute symptoms with bacitracin therapy. In this group, as in the cases of an acute conjunctivitis, the number of cases is too few upon which to base any final judgment. However, all indications

pointed to the fact that the antibiotic helped in clearing the acute phases of the disease.

Bacitracin therapy in the 18 cases of chronic conjunctivitis treated with bacitracin leaves much to be desired. It appeared ineffective or only of slight value in 12 cases but a rapid improvement followed bacitracin therapy in 6 cases. Therefore, in chronic conjunctivitis, bacitracin was found to be no more effective than sulfonamide, penicillin, or streptomycin used in similar cases.

In the one case of corneal ulcer in which an atypical Pseudomonas aeruginosa was found, rapid recovery followed the institution of bacitracin therapy. Earlier treatment with sulfonamides and penicillin was ineffective.

Discussion

Experimental infections of the cornea and vitreous humor produced by a sensitive strain of hemolytic Staphylococcus aureus can be prevented by bacitracin. Prophylaxis is effective up to 4 hours for the cornea and up to 12 hours for the vitreous infection. In the vitreous, bacitracin will stop the infection even if the antibiotic is injected intravitreally up to 48 hours following the inoculation. This difference in the length of time that prophylaxis is effective in the cornea and in the vitreous humor is explained by the fact that in the latter media the contact between the antibiotic and the infectious agent is constant for a longer period of time.

The safety and effectiveness of bacitracin therapy in experimentally produced infections in the rabbit were sufficiently encouraging to us to use this new antibiotic in clinical ocular infections. Our clinical material consisted entirely of external infections of the eyeball and the adnexa. With the exception of one corneal infection, all cases were of conjunctivitis or blepharoconjunctivitis.

The rapid response to bacitracin in the corneal infection due to an atypical Ps. aeruginosa and in 2 of 3 cases of acute keratoconjunctivitis was significant because the patients had been treated previously unsuccessfully with sulfonamides and penicillin. The effect of bacitracin in the cases of conjunctivitis and blepharoconjunctivitis seemed to depend upon the duration of the infection.

Results in the acute infections or acute exacerbations of the chronic infections, particularly in those in which the organisms were susceptible to bacitracin, were good. In the chronic infections the results were disappointing, leading to the conclusion that bacitracin is no different from the other numerous therapeutic agents, including antibiotics, all of which have been found wanting in chronic conjunctivitis. It is possible that the combination of two or more agents to which the organisms are susceptible may prove to be more satisfactory and should be tried.

Although a suitable case for intraocular injection of bacitracin did not present itself during the time of these investigations, it seems reasonable to assume that in selected clinical cases this procedure should prove valuable. Thus in impending purulent ophthalmia, where the old, conservative measures have invariably failed, a direct intravitreal injection of bacitracin, combined with either penicillin or streptomycin or both, is indicated.

Summary

Bacitracin was found to be well tolerated by the intact eye when applied topically either as a fine powder or in saline solutions containing 1,000 to 5,000 units per ml. On the denuded corneas, solutions containing 1,000 units bacitracin per ml. did not appreciably delay the regeneration of the corneal epithelium. However, a solution containing 5,000 units per ml. caused a definite retardation of the epithelial regeneration with subsequent vascularization and scarring of the cornea.

Bacitracin did not penetrate through the normal cornea but did penetrate injured and inflamed corneas. The penetration following

abrasion of the cornea, vaccinia infection, addition of a surface-active chemical agent (aerosol O. T.), or during ion-transfer, was roughly proportional to the surface area affected. From this we conclude that the penetration depends not so much upon the agent as upon the amount of epithelial damage produced by the agent.

Bacitracin injected into the vitreous in concentrations up to 100 units in 0.1 cc. saline solution resulted in the immediate appearance of vitreous opacities. These frequently disappeared within a period of several weeks. Ophthalmoscopic examination of the oculi fundi failed to reveal any alterations.

Experimentally produced corneal and vitreous infections by the inoculation of a bacitracin-sensitive hemolytic Staphylococcus aureus can be prevented when treated with bacitracin within a definite time interval. Bacitracin will check vitreous-humor infections if injected intravitreally even 48 hours after the inoculation. A single case of corneal infection from which an atypical Ps. aeruginosa was isolated, responded promptly to bacitracin applied locally. Forty-two clinical cases of conjunctivitis and blepharoconjunctivitis were treated with bacitracin. The results on a whole were good in acute infections, in 18 chronic cases improvement followed bacitracin therapy in 6 patients while in 12, the response was less satisfactory or failed completely.

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Historical Miniature

Nero is said to have viewed the games through a piece of green beryl. The German name for spectacles, Brillen, arose from the word beryl. Nero may have used the beryl merely as filter for strong sunlight, but it has also been suggested that it may have been a concave monocle for a myopic eye. There is no evidence to substantiate this speculation.

OPERATIVE TREATMENT OF VERTICAL TROPIAS*

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Surgical relief for the discomfort of vertical tropias has progressed remarkably since Duane and his pupil, White,[1] performed one of the first tenotomies on the inferior oblique muscle. The operation was so successful that the squint was improved, the head tilt was relieved, and the torticollis disappeared. Duane and his protégés continued study and operations on the obliques in spite of the prejudice incited by von Graefe's warning of "hands off the obliques."

The new appreciation of the function and action of the vertically acting muscles resulted in the development of better surgical procedures based on more accurate diagnoses. Just as Duane and White and later Brown[2] have contributed so greatly, Wheeler,[3] Dunnington,[4] Berens,[5] and others have developed new operations and added refinements and innovations to various techniques. Although perfection has not been attained in the field of vertical surgery, the results are improving due to a better understanding of the problems involved.

ROUTINE OF EXAMINATION

Accurate diagosis of the muscle or muscles involved in vertical tropias has such an important bearing on the outcome of surgery that a routine for examination is suggested:

1. History, general and ophthalmic
2. Visual acuity and accommodation determinations, without and with glasses
3. Muscle balance and fusion tests
4. Refraction and correction with glasses
5. Orthoptic treatment
6. Operation and follow up

It is generally agreed that a carefully recorded history of the patient and his antecedents may give valuable information as to the development of strabismus and have considerable influence on the procedure to be followed. The possibility of general disease and nervous manifestations, as well as birth accidents and injuries, should be considered.

In the examination of the patient, a determination of the uncorrected visual acuity should be followed by a record of the vision with glasses. The amount of squint relieved by lenses, if due to accommodation, may alter the extent of the operation.

Estimation of the amount of phoria or tropia in the primary position and in the six cardinal directions of gaze should be performed by means of an opaque disc and square prisms to neutralize the shift of the eyes. A careful observation of the associated parallel movements in the various fields of gaze may give the evidence needed for the diagnosis. Eye dominance is determined because most surgeons prefer to operate on the nondominant eye. The near point of convergence, if present, should be measured. Tests for binocular single vision should include some variation of stereoscopic tests to determine the degree of fusion.

Proper lens corrections, incluring small vertical prisms when needed, should be worn for a reasonable time. If glasses and orthoptic exercises fail to improve the condition, the patient should have the benefit of intelligent surgery. Orthoptic exercises should follow surgery if the degree of fusion warrants it.

Before operating, the surgeon should have a clear picture of the condition as it exists and be sure that surgery will help the condi-

* Presented at the clinical congress of the American College of Surgeons in New York City, September 9, 1947.

Note: The material reviewed for this paper was taken from the six ophthalmic services of the New York Eye and Ear Infirmary with the assistance of Dr. W. F. Johnson, Dr. Carey Legett, Jr., Dr. George O. Emerson, and Dr. Donald S. McCann.

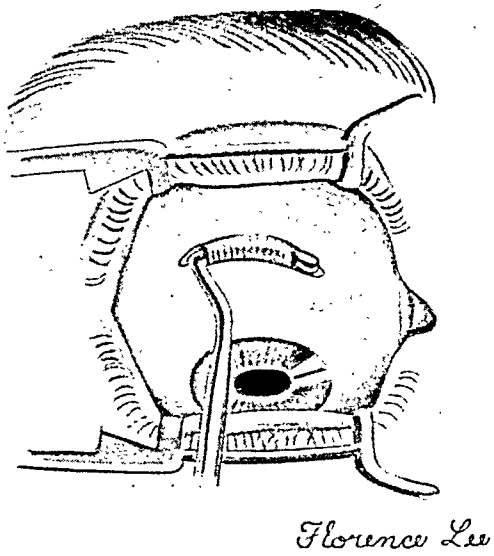


Fig. 1 (Payne). Exposure of the superior rectus muscle for resection.

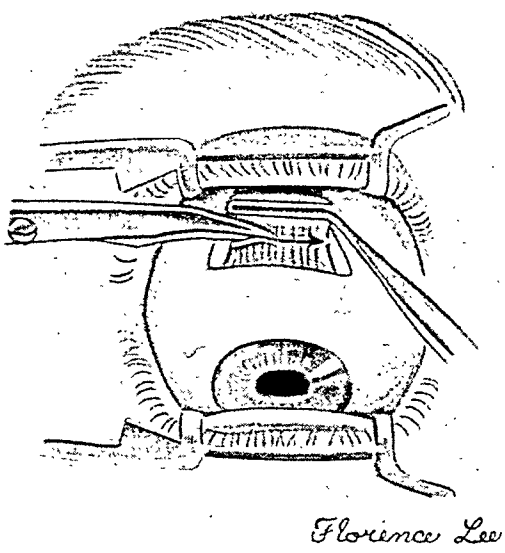


Fig. 2 (Payne). Severance of the superior rectus muscle with fixation clamp applied.

tion and not make it worse. If the patient has no symptoms and is content with his appearance he should be left alone.

Operative objective

The operative objective in the correction of vertical tropias is to give horizontal alignment to the visual axes of the two eyes. This may be done in one of three ways or by a combination of the three.

1. Strengthening the weak or paralyzed muscle by a shortening operation.

2. Weakening the contralateral synergist by a tenotomy or recession.

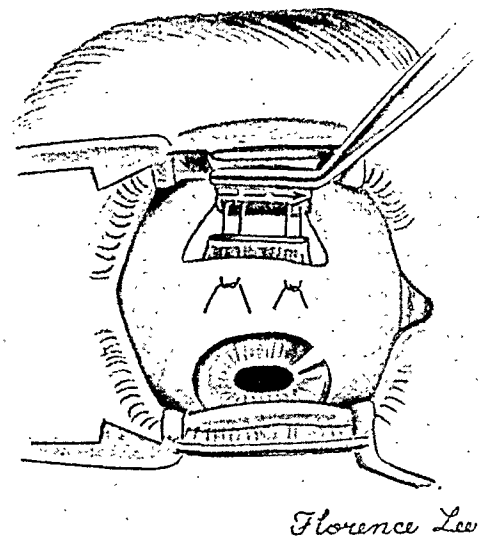


Fig. 3 (Payne). Application of two double-armed sutures posterior to the line of severance.

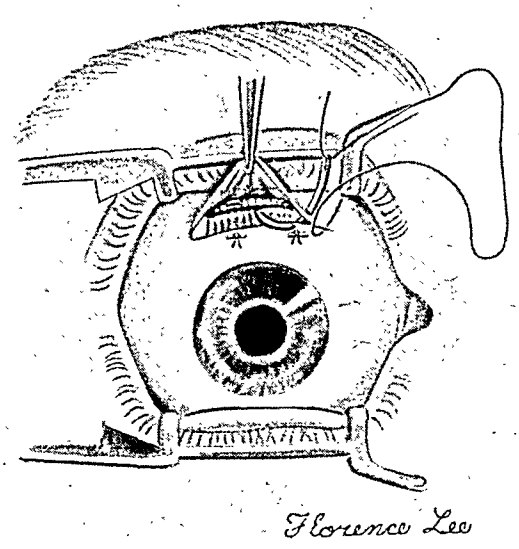


Fig. 4 (Payne). Sutures tied after muscle shortening and beginning of conjunctival closure with continuous stitch.

3. Weakening the antagonist of the same side by recession or tenotomy.

In small degrees of hypertropia, a resection of the semiparetic muscle is preferred to weakening the synergist of the opposite side. A marked upshoot of the synergistic eye caused by an overactive muscle usually needs correction by operation.

Review of cases

A review of 50 of the cases operated on for the correction of vertical tropia on the six ophthalmic services at the New York Eye and Ear Infirmary during the past two years showed that the inferior oblique muscle was selected for surgery in 90 percent of the operations. With the exception of six patients, on whom the inferior oblique alone was operated, either the lateral muscles or the opposite superior rectus were included in the surgery. From these observations it

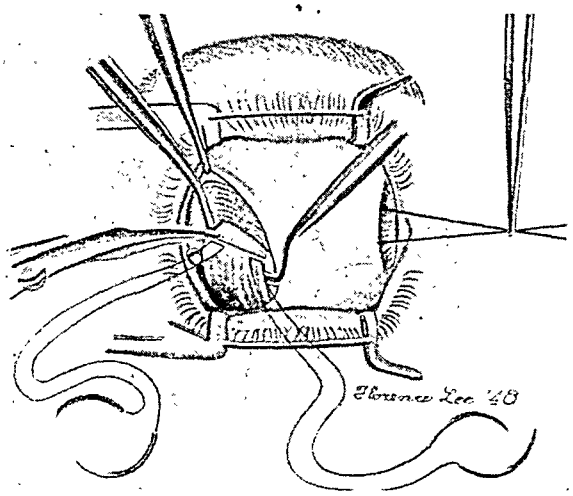


Fig. 5 (Payne). Line of incision and placing of sutures for recession of the right inferior oblique muscle.

would seem that practically all cases of vertical tropia are associated with lateral deviations but that, once the vertical deviation is corrected, either by prisms or operation, the lateral position is diminished and, in small amounts, disappears entirely.

The prevailing operation was recession of the inferior oblique in conjunction with

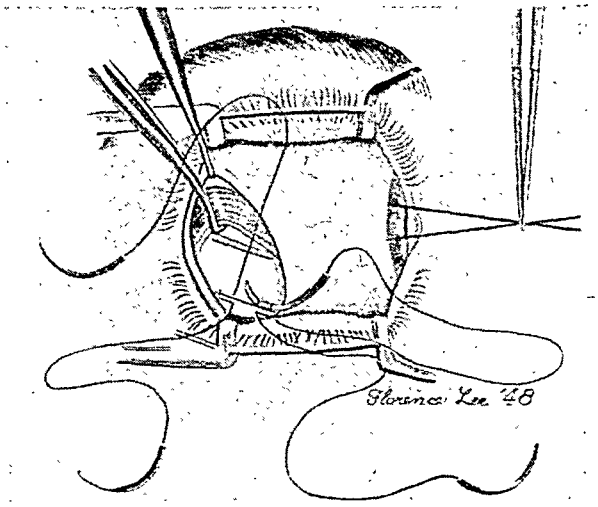


Fig. 6 (Payne). Insertion of sutures into episclera.

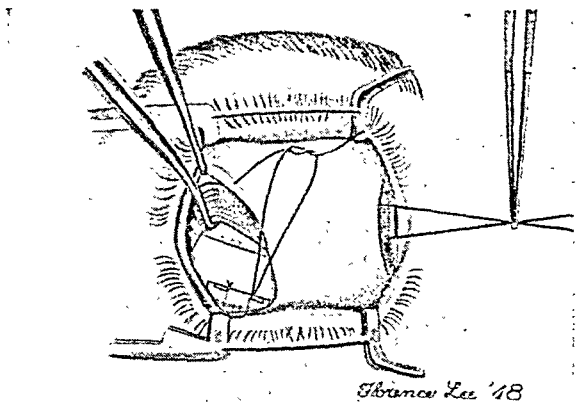


Fig. 7 (Payne). Sutures fixed and tied in episclera.

operations on the horizontally acting muscles. The results were good in 80 percent of the cases but when the diagnosis was uncertain and the operator failed to follow the teachings of Duane, White, Dunnington, and others, he was embarrassed and the patient suffered. There were no operations on the superior oblique in this group.

The following cases illustrated good and bad results in operations for vertical deviations of the eye.

Case reports

Case 1 (C55627). A child, aged 11 years, having 20/40 vision in the right eye with a +0.5D. sph. and 20/30 in the left eye with

the same correction, presented a head tilt to the left shoulder. The near point of convergence was 150 mm. and in the primary position measured an esotropia of 8 prism diopters (p.d.), with a right hypertropia of 25 p.d. both for distance and for near.

On looking up and to the right, there was an exotropia of 3 p.d. On looking to the right, there was an esotropia of 6 p.d. with a right hypertropia of 14 p.d. On looking to the right and down, there was an esotropia of 16 p.d. with a right hypertropia of 14 p.d.

On looking up and to the left, there was a right hypertropia of 40 p.d.; looking to the left, there was a right hypertropia of 50 p.d.; and looking to the left and down, there was an esotropia of 4 p.d. with a right hypertropia of 30 p.d.

The surgery in this case consisted of a 9-mm. recession of the right inferior oblique. This resulted in a change in the near point of convergence from 150 to 55 mm. The right hypertropia for distance and near was reduced from 25 to 5 p.d.

On looking up and to the right, there was a left hypertropia of 3 p.d.; on looking to the right, orthophoria; on looking to the right and down, a right hypertropia of 7 p.d., with an esotropia of 3; on looking to the left and up, there was a right hypertropia of 5 p.d.; on looking to the left, a right hypertropia of 7 p.d.; and on looking to the left and down, a right hypertropia of 12 p.d., with an esotropia of 3 p.d.

In this case there was a change of approximately 2.1 diopters for each millimeter of recession when measured in the primary position and approximately 4 diopters per millimeter of recession when measured in the field of action of the muscle.

Case 2 (C193565). A child, aged 5 years, had 20/30 vision in the right eye, and 20/70 vision in the left eye. The measurements in the primary position at 6 meters were an esotropia of 20 p.d. with a right hypertropia of 2 p.d.; while at 25 cm., there was an esotropia of 25 p.d. and the right hypertropia remained constant at 2. On looking up and to the right, there was a left hypertropia of 10 p.d., plus, and an esotropia of 30. On looking up and to the left, there was a right hypertropia of 12 p.d. (double hypertropia) and an esotropia of 35 p.d.

The following recessions were done: right inferior oblique, 5 mm.; left inferior oblique, 4 mm.; and the left medial rectus, 3 mm.

This resulted in an esotropia of 9 p.d. for distance and 12 p.d. for near with a question of a slight right hypertropia with correction.

On looking up and to the right, there was an esotropia of 8 p.d.; and on looking up and to the left, there was an esotropia of 8 and a right hypertropia of 2 p.d. This resulted in a change of 2½ diopters for each millimeter of recession (the change being measured in the field of action of the muscle).

Case 3 (C21679). A child, 11½ years of age, having 20/30 vision in the right eye with a +3D. sph., and 20/200 n the left eye with a +4D. sph., had a near point of convergence of 40 mm. without correction, and 70, with correction.

The measurements in the primary position at 6 meters were an esotropia of 12 p.d., with correction and 20 without correction; while for near, there was an esotropia of 15 p.d., with correction and 35 without correction.

On looking to the right and up, there was an esotropia of 20 p.d., plus, and a left hypertropia of 2 p.d.

On looking to the right and to the right and down, there was an esotropia of 20 p.d. On looking up and to the left, there was an esotropia of 5 p.d. and a right hypertropia of 2 p.d. (double hypertropia). On looking to the left, there was an esotropia of 18 p.d., and on looking to the left and down, there was an esotropia of 16 p.d.

A diagnosis of convergence excess and bilateral superior rectus paralysis was made.

The following surgery was done: resection of the left lateral rectus, 8 mm.; recession of the left inferior oblique, 5 mm. While this case showed a double hypertropia of 2 p.d. before surgery, it still shows about 2½

diopters for each of the 5 mm. that the left inferior oblique was recessed.

The results were as follows: On looking up and to the right, there was an esotropia of 14 p.d., plus, with a right hypertropia of 10 p.d., on looking to the right, there was an esotropia of 12 p.d., with a right hypertropia of 10; on looking to the right and down, there was an estropia of 10 p.d., plus, with a slight right hypertropia; on looking up and to the left, there was an esotropia of 12 p.d. with a right hypertropia of 14; on looking to the left, there was a question of an exotropia with a right hypertropia of 10 p.d., and on looking to the left and down, there was an esotropia of 12 p.d., with a variable right hypertropia.

Case 4 (C53306). A child, aged 9 years, had 20/30 vision in both eyes and showed, on looking up and to the right, a left hypertropia of 20 p.d. and an esotropia of 40 p.d. On looking to the right, there was a left hypertropia of 8 p.d. and an esotropia of 55. On looking up and to the left, there was a right hypertropia (double hypertropia) of 12 to 15 p.d. and an esotropia of 35 to 40 p.d.

On looking to the left, there was a right hypertropia of 7 to 8 p.d. and an esotropia of 35 to 40 p.d. On looking to the left and down, there was a right hypertropia of 5 p.d. and an esotropia of 50.

The following recessions were done: left inferior oblique, 5 mm.; left medial rectus, 3 mm.; right inferior oblique, 3 mm.; and the right medial rectus 2½ mm. This resulted in an esophoria of 12 p.d. in the primary position.

Apparently, the surgery to the obliques resulted in a change to the hypertropias of about 1½ to 2½ diopters for each millimeter of recession if measured in the lateral positions, and about 4 diopters for each millimeter of recession when measured in the superior cardinal positions.

Case 5 (C72044). This young adult, aged 15 years, had a squint of 9 years' duration. His vision was 20/20 in both eyes and he measured, in the primary position, an esotropia varying between 60 and 70 p.d., with a left hypertropia of 10 p.d.

Looking up and to the right, there was a left hypertropia of 14 p.d., and in the other cardinal positions of gaze there was a left hypertropia of 8 to 10 p.d.

After a resection of 10 mm. on the right lateral rectus, 9 mm. on the left lateral rectus, and a recession of 3 to 4 mm. on the left inferior oblique, there resulted in the primary position an esotropia of 12 p.d. and no hypertropia. In this case the surgery to the left inferior oblique resulted in a change of about 3 diopters for each millimeter of recession.

Case 6 (B91919). This last case is included through the courtesty of Dr. W. F. Johnson and preoperatively presented a head tilt to the left, and a near point of convergence of 130 mm. In the primary position, without correction, there was a right hypertropia of 35 p.d., with an exotropia of 15 p.d. for distance; while for near, there was a right hypertropia of 18 p.d. and an exotropia of 18. The field of binocular single vision extended from the right to eyes front. On looking up and to the left, there was a right hypertropia of 30 p.d.

In this case, a 9-mm. recession of the right inferior oblique was performed. Following surgery, the field of binocular single vision was enlarged to the left; the head was held straight, the near point of convergence was reduced from 130 to 60 mm.

In the primary position, without correction, for distance and near, there was an exophoria of 5 to 8 p.d., with a slight right hypertropia. On looking up and to the left, there was a right hypertropia of 5 p.d. So in this case, for each millimeter the right inferior oblique was recessed, there was a change of 2 to 2½ diopters.

Discussion

From the above cases it will be seen that, with each millimeter of recession of the inferior oblique, approximately 2½ prism diopters of correction was attained. These

operations were performed by both residents and surgeons and included the lateral muscles. The evidence is not uniform and it is doubtful if the figure is of any practical value. It is interesting to note, however, that the same findings hold true in the unsuccessful case mentioned above.

Aside from Johnson's[6] simplified approach to the inferior oblique, which is similar to the linear incision parallel to the lower border of the lateral rectus used by Berens,[7] no new procedure has been developed at the New York Eye and Ear Infirmary. There is a tendency of some surgeons to use 4-0 plain catgut sutures rather than nylon or silk for the scleral reattachment of the muscle. Absorbable sutures hold the muscle in place for a sufficient length of time and there is little reaction to them.

A word of warning with reference to the important structures in the neighborhood of the scleral attachment of the oblique muscles is directed to the neophyte. There is danger of injury to the long ciliary nerve and parts of the muscular attachments are very close to the macular region. The vortex vein is exposed frequently and subject to trauma and the surgeon should remember that anomalous attachments between the oblique muscles and the lateral rectus may be found.

It is well to repeat Krewson's[8] conclusions that, if a choice is permitted, weakening of a depressor muscle is undesirable; strengthening of a depressor or weakening of an elevator muscle is preferable, for there is greater need for binocular vision in the lower than in the upper fields.

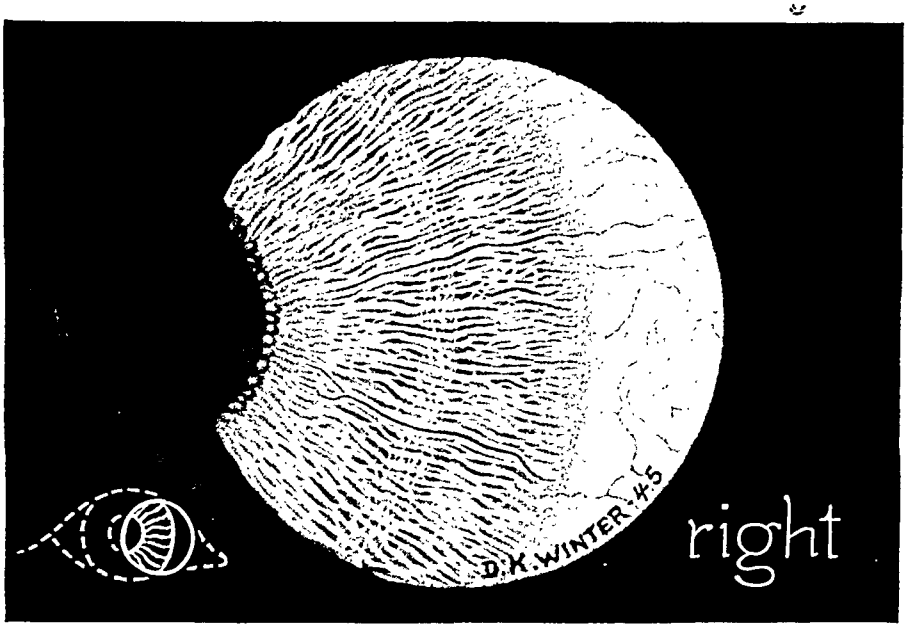
Conclusions

1. Carefully planned operations for the relief of vertical tropias are successful if the diagnosis is correct.
2. A clear understanding of the muscle or muscles involved is essential.
3. The type and extent of the operation will be determined by the points brought out in the complete examination.
4. Injury to neighboring structures should be avoided.

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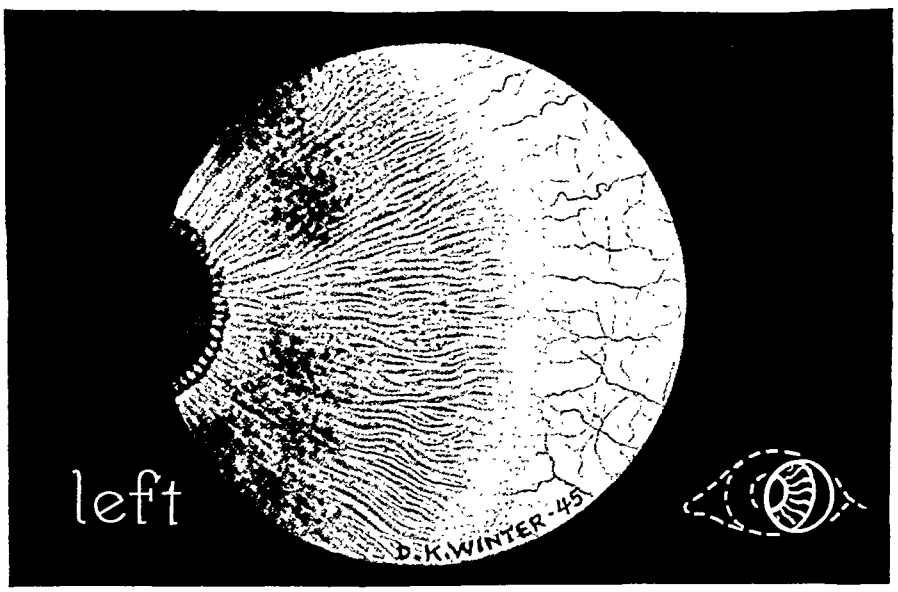


FIG. 1 (RICHARDSON). CASE 1. DRAWINGS OF QUADRANTS OF IRIS. RIGHT, THE UNAFFECTED EYE. LEFT, THE AFFECTED EYE.

DIFFUSE MALIGNANT MELANOMA OF THE IRIS*

Report of two cases

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A survey of the literature offers convincing evidence of the rarity of primary malignant melanoma of the iris. The number of recorded cases is estimated by Duke-Elder[1] at 150 and by Doherty[2] at about 175. It is generally stated that of malignant melanomas in the uveal tract, 85 percent occur in the choroid, 9 percent in the ciliary body, and 6 percent in the iris. McKee[3] observed that this ratio is somewhat proportional to the amount of uveal pigment present.

Usually circumscribed, this lesion of the iris may be diffuse, and it may also be pigmented or unpigmented. Although the descriptive literature is often not explicit enough to make differentiation between the circumscribed and the diffuse types clear, the diffuse tumor appears to be extremely rare. Recently, Wilder[4a] stated that there are 7 instances of diffuse malignant melanoma of the iris in the files of the Army Institute of Pathology. In presenting 1 case in 1923, Li[5] was able to collect only 5 cases in the literature. Doherty[2] in 1939 included in his complete bibliography (1919-1937) but 5 additional cases, designated as ring sarcoma of the iris. Among the 263 cases of uveal sarcoma in Martin-Jones's recent comprehensive study,[6] there was 1 case of ring sarcoma. Two cases that came under my care within a period of 13 months are reported here.

Nomenclature

Malignant melanoma of the iris is variously referred to in the literature as sarcoma, melanosarcoma, and ring sarcoma. Malignant melanoma is, however, to be preferred. In the view of some authors, melanoma carries with it the connotation of malignancy, and nevus is applied to the nonmalignant pigmented tumor. Nevertheless, in opthalmology there is need for the more exact definition of benign or malignant melanoma, for in the eye are present mesodermal melanoblasts, from which arise both benign and malignant tumors.[7] When not circumscribed, the malignant melanoma of the iris is appropriately described as diffuse or infiltrating. First differentiated by Fuchs,[8] this type came to be described as flat sarcoma, and, in 1898, Ewetzky[9] suggested the term ring sarcoma, which seems to have the preference in the literature.

Age and sex incidence

Most authorities are agreed that malignant melanoma of the uveal tract is more prone to develop in persons in the sixth decade. It has been noted, however, that in the iris this tumor occurs on the average some 10 years earlier than those in the ciliary body and choroid, at approximately the age of 40 years instead of 50 years. This conclusion is borne out in my cases. Wilder[4b] mentioned a series of 137 malignant melanomas of the iris in which 51, or 37 percent, were from patients under 40 years of age, confirming Duke-Elder's statement that the average age of occurrence for tumors of the iris is lower than for the remainder of the uveal tract.[1]

Martin-Jones[6] concluded that this neoplasm of the iris occurs with greater frequency in women. Three of the 4 cases in his recent series, including the 1 case of ring sarcoma, were in women, and he cited Pflüger's 23 cases with 15 in women and Treacher Collins' 18 cases with 10 in women. Five cases of ring sarcoma cited by Li[5] were in women, although his 1 case was not, nor was Bruner's case.[10] In 1 of my 2 cases the patient was a woman.

* Presented at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947.

Etiology

The method of origin of the malignant melanoma remains a matter of controversy. Opinions vary as to whether it arises from endothelium, epithelium, or chromatophores. In contradistinction to the epiblastic theory of Verhoeff,[11] there is the more recent neuroectodermal theory advanced by Masson[12] and supported by the later researches of Theobald.[13]

The role of injury in the etiology of this tumor is problematical, as is that of prolonged inflammation. It is, however, well known that benign melanomas of the iris undergo malignant changes and should rightly be regarded with suspicion. Martin-Jones[6] concluded that abnormal ocular pigmentation is an etiologic factor in some cases of sarcoma of the uveal tract, the evidence being more in favor of abnormal masses of pigmentation in the iris becoming malignant than those of the choroid.

Reese[7] concluded that a melanoma of the uvea may be malignant at one site and benign at one or several other sites, thus representing multiple origins of the tumor. Noting that the iris is a common site for the benign feature, he regarded this lesion of the iris as a diagnostic aid when observed clinically. He commented that the ring nature of a melanoma may be accounted for in part by multiple diffuse origins as well as implantation growths which logically occur around the filtration angle, where disseminated tumor cells in the anterior chamber would tend to gather. Too, he was of the opinion that an important difference between a localized malignant melanoma of the uvea with benign melanomas elsewhere and a diffuse and ring type of melanoma lies in a malignant effect of the cancerigenic agent at one site and a benign effect elsewhere in the one case, and a diffuse, multiple, malignant effect in the other cases.

Pathology

The cell types on which the classification of Callender[14] is based include spindle cell with subtypes A and B, fascicular, epithelioid, mixed, and necrotic. From their study of 500 cases of malignant melanoma of the choroid and ciliary body, Callender, Wilder, and Ash[15] concluded that the pure spindle cell types, particularly subtype A, are of a relatively low degree of malignancy, that an increased degree of malignancy is associated with the presence of epithelioid cells, and that a low degree of malignancy is usually associated with a heavy fiber content. Wilder[4b] explained the observation that melanomas of the iris behave less malignantly than do those of the choroid on the ground that they are readily visible and consequently recognized earlier.

Whether the tumor starts at the root of the iris or in the region of the ligamentum pectinatum, these structures as a rule become rapidly involved. An increase in size denotes the extension in a definite pigmented nevus. If, however, the growth originates in the deeper layers of the iris near its root, it may spread beneath the stroma, causing discolorations varying from light yellow to dark brown. This type of growth tends to metastasize into the fibers of the ligamentum pectinatum and the canal of Schlemm, with resulting increased tension. Metastasis around the angle of the anterior chamber produces the diffuse or ring type of tumor.[2]

In its evolution, the diffuse tumor is distinguished from the circumscribed variety by its slow growth with long preservation of vision and lack of objective signs, its diffuse infiltration of the uveal tract, and the extent of its metastatic spread. Duke-Elder[1] estimated the length of the history from 7 months to 10 years and regarded it as the most conspicuous feature. In this connection it is of interest that in Bruner's case,[10] the patient "had always noticed a little colored spot on the inner half of the iris." In Li's case,[5] there was a history of trauma 2 years previously. Of the cases collected by Li,[5] in Solomon's case,[16] the patient had observed for 20 years a speck on the iris gradually increasing in size; in Hanke's case,[17] the

growth evidently antedated the failing vision of 9 months' duration by a considerable period; in Alt's case,[18] the patient had observed a spot on the iris for several years; in Levan's case,[19] a pigmented nevus was observed for several years with increase in size and several pigmented spots not noted previously appearing 1 year before removal of the eye; and in Pindikowski's case,[20] the patient had noticed the tumor for some time. In my cases, 1 patient thought that the affected eye had been discolored for several months, and the other patient had been aware of a dark brown spot on the iris of the involved left eye for many years with gradual change in color of the iris to dark brown over an indefinite period of years, the iris of the right eye being blue.

Diagnosis

It may be impossible at first to distinguish between benign and malignant melanomas unless microscopic examination is made possible by iridectomy. The benign lesion characteristically attains a certain size and remains so; it does not project much above the plane of the iris. Too, vascularization is uncommon in the innocent tumor. Beginning malignancy manifests itself clinically by an increase in size, varying discolorations in the same growth, an increased blood supply, an elliptical pupil, and development of abnormal tension.[2]

Martin-Jones[6] observed that malignant melanoma of the iris may give rise in some cases to no subjective symptoms, being discovered only on routine examination; in other cases, the patient may seek advice because of a small brown or blackish spot on the iris, present as long as he could remember or since birth, and believed to be increasing in size. Extension of the growth over the pupillary margin may interfere with vision, as may intraocular pressure if the tumor grows sufficiently. Analysis of the pathologic reports in my cases would seem to indicate that the glaucoma was secondary to the infiltration of pigment and tumor cells into the filtration angle.

The position on the iris is a consideration of some importance in diagnosis. In the order of frequency, the lower half, the upper half, the inner segments, and the outer segments are affected.

In differential diagnosis, inflammatory granulomas, especially tubercle and syphilis, are to be considered, as are secondary tumors and cysts. The flat diffuse lesion is sometimes mistaken for iridocyclitis. When the secondary glaucoma manifests itself, it is difficult to be sure that this condition is not primary.

Prognosis

Despite the relatively slower progress of malignant melanoma in the iris, the prognosis is uncertain at best. There appears to be no time limit of safety. Even enucleation at an early stage does not preclude metastases, and, after extraocular extension, fatalities rapidly increase. Infiltrating growths are more dangerous than the discrete variety.

Considering this tumor in the uveal tract as a whole, Martin-Jones[6] concluded that the case is quickly and invariably fatal if melanogen is present in the urine. It was not present in either of my cases. This author further observed that 27 percent of patients die within 3 years after operation, 36 percent within 5 years, and 56 percent within 10 years; that the mixed-cell type of growth is the most malignant; that the presence of malignant cells in the emissaria of the globe is not necessarily of bad prognostic import (in 58 percent of such cases survival reached 5 years); that the prognosis in cases of extraocular extension is comparatively bad (70 percent of patients died from the disease within 5 years); and that in younger patients the prospect of survival from the disease is better than in those more advanced in years.

The spindle-cell type of lesion with a delicate nuclear structure gives the best and the round-cell epithelioid and the mixed-cell

types the poorest prognosis. Also, the less dense the intercellular reticulum the graver the prognosis, according to Duke-Elder.[1] Their work on the prognostic significance of reticulin, or argyrophil, fibers led Callendar and Wilder[21, 22] to conclude that there is an apparent connection between the reticulin content of the growth and the prognosis. Callender, Wilder, and Ash[15] mentioned an apparent increased lethality with increased pigment content, but withheld a definite conclusion.

Treatment

Once the diagnosis of diffuse malignant melanoma of the iris is established, enucleation without delay is the treatment of choice. This extreme measure is the only procedure that offers relative safety. It would appear that exenteration does not increase the chance of survival in cases of extraocular extension.

There is apparently no evidence to justify radiation as a primary method of treatment. Some authors think it may have value as a postoperative measure.

Case reports

Case 1

History. Dr. A. J. O., a dentist aged 40 years, was examined on June 9, 1945. He complained of photophobia of 6 months' duration and a slight blurring of vision of the left eye of 7 days' duration. He stated that he had had no previous ocular trouble other than an astigmatism, for which glasses were worn, but he thought the left eye had been discolored for several months.

Examination. The vision in the right eye was 20/15, and in the left eye it was 20/20. The right eye was normal in all respects; the iris was light brown in color and without freckles (fig. 1R).

In the left eye, mild ciliary injection, sensitivity to light, and mild edema of the corneal epithelium were present. The aqueous contained a few cellular elements and, with biomicroscopy, the aqueous beam was hazy. The pupil was slightly dilated ovally, but reacted to light in its upper half. The iris was densely pigmented, its color being dark brown, but in its upper segment a few islands showed no pigmentary changes (fig. 1L). Below, there were 3 pigmented nodules rising slightly above the surface of the iris. Biomicroscopy showed dense pigmentation of the iris extending into the filtration angle. On the posterior surface of the cornea there were deposits of pigment. No new blood vessels were noted.

Intraocular pressure was: R.E., 19 mm. Hg (Schiøtz); L.E., 50 mm.

A 2½-percent solution of neosynephrine was instilled twice. The pupil dilated slightly above, but in the lower segment of the iris where pigmentation was heaviest, there was no dilation. The use of neosynephrine for dilation of the pupil was deemed necessary in order to examine the posterior chamber. The ocular fundus was normal; there was no cupping of the optic disc. The fields of vision were within normal limits.

Consultation. The patient was told that in my opinion a malignant melanoma of the iris was present and that enucleation was imperative. Consultation was advised, and he was referred to Dr. A. B. Reese, who, in confirming the diagnosis, wrote me on July 27 as follows:

"I agree most assuredly with you that Dr. O. has a malignant melanoma of the iris of the left eye. I do not feel there is any doubt at all about this. This melanoma is a flat, diffuse type which gives early glaucoma and is sometimes mistaken, particularly in the early stages, for iridocyclitis. I have seen 2 such instances, in which the eyes were operated on for secondary glaucoma. With the gonioscope, I noted the angle over the lower 180 degrees occluded by the tumor tissue."

The patient then returned to me. On August 2nd, the eye was enucleated, and a vitallium sphere was implanted in Tenon's capsule.

Pathologic report. The pathologic report made by Dr. J. A. C. Wadsworth of the College of Physicians and Surgeons, Columbia University, follows.

Microscopic. The sections are from an adult globe in which there is a heavily pigmented tumor of the iris and ciliary body which in its growth has involved the filtration angle (fig. 2).

Near the base of the iris below is a loosely packed, heavily pigmented tumor mass which has spread diffusely throughout the iris and into the ciliary body. The tumor cells with their heavy pigment content can be seen clogging the meshwork of the angle and Schlemm's canal.

On the posterior surface of the cornea near the angle below, a thin layer of tumor cells can be seen extending axialward. Many of these cells contain pigment. Also, scattered irregularly over the entire posterior surface of the cornea are numerous individual implants of tumor cells. Below, the iris is almost completely infiltrated with tumor cells, and those in the stroma of the iris contain no pigment or are very scanty in pigment. The contraction of this infiltrative growth has created a well-marked ectropion uveae.

The tumor extends back from the base of the iris to the base of the ciliary body. In the region of the main mass of the tumor, pigmented cells can be seen coursing along the perivascular spaces into the sclera, but no tumor can be seen outside the confines of the globe in the sections examined.

The majority of the tumor cells are large, oval, and epithelioid in type, and filled with round pig-

ment granules (fig. 3). Occasionally one sees the branching typical of the chromatoblastic type of cell. The numerous implants along the cornea and throughout the iris and into the meshwork of the angle indicate the extreme friability of the tumor, and a marked tendency of the tumor cells to desquamate and disseminate which is typical of the chromatogenic type.

Sections stained with the Wilder method show a moderate amount of reticulum. Sufficient reticulum is present in the tumor to be placed in 2-c according to the Wilder classifications.

In the ciliary body opposite the site of the tumor there are areas of proliferation of the pigment epithelium with an associated proliferation of nonpigmented epithelium.

The retina shows peripheral cystic degeneration, and scattered throughout the retina are numerous small cystic areas. These areas are seen in the ganglion cell layer and external plexiform layer. There is also wrinkling of the internal limiting membrane of the retina.

The choroid is normal except for occasional drusen of the lamina vitrea.

There is moderate cupping of the optic nerve.

Diagnoses. Tumor of iris: melanoma—malignant (disseminating type). Tumor of ciliary body: melanoma—malignant (disseminating type). Glaucoma: secondary to tumor. Ciliary body: hyperplasia of ciliary epithelium.

Course. Recovery was uneventful. When the patient was examined on May 1, 1947, 22 months after enucleation of the eye, there was no evidence of recurrence or metastasis.

CASE 2

History. Mrs. W. L. P., a housewife aged 39 years, was referred to me in consultation by Dr. R. L. McDaniel on May 5, 1944, with the tentative diagnosis of malignant melanoma of the iris of the left eye. She stated that this eye had been red and had ached for 3 days, but there was no history of previous trouble with the eyes. Over an indefinite period of years she had observed the iris of the left eye become dark brown and she had also noticed a dark brown spot on it for many years. The iris of the right eye was blue, with no deposits of pigment.

Examination. On examination, the conjunctiva of the left eye was mildly hyperemic, and there was congestion of the ciliary vessels. Intraocular pressure was: R.E., 19 mm. Hg (Schiøtz); L.E., 40 mm.

The iris of the left eye was uniformly colored a chocolate brown and had the appearance of having had brown pigment spread on its surface. Its normal markings were effaced by the deposits of pigment, and it seemed thicker than usual. The pupil did not react to light; it was slightly dilated and, in the pupillary circle, ectropion uveae was observed. Biomicroscopy showed a slight edema of the corneal epithelium. The aqueous beam was hazy, and within the aqueous fine pigment granules were noted. The filtration angle was covered with pigment over its entire circumference. Fine deposits of pigment were observed on the posterior surface of the cornea and on the anterior capsule of the lens.

A 2½-percent solution of neosynephrine was instilled, but the pupil did not dilate. The ocular fundus was normal except for a pathologic cupping of the nerve head.

The right eye was normal in all respects. The vision in this eye was 20/15, and in the left eye it was 20/20. The field of vision of the left eye was contracted concentrically to 20 degrees for form.

Diagnosis. It was difficult to identify this condition positively as a melanoma of the iris. Uveitis could not be ruled out clinically, nor could glaucoma. A diagnostic iridectomy was therefore performed on May 5th. The pathologic diagnosis was malignant melanoma, and the eye was immediately enucleated (fig. 4).

Pathologic report. The following pathologic report of the enucleated eye was made by Col. J. E. Ash, director of the Army Medical Museum.

Gross. The specimen consists of a firm, rather large eye measuring 26 by 24 by 25.5 mm. There is a scar at the limbus over a coloboma of the iris. The pupil is widely dilated, revealing only a narrow margin of the iris. The eye is opened in the vertical plane. There is a fold at the macula. The optic disc is cupped.

Microscopic. The iris is absent beneath a partially closed scar of a perforating wound of the cornea near the limbus (fig. 5). On the opposite side generally round or polygonal cells, although occasional spindle forms are seen, infiltrate the iris and vascular layer of the ciliary body (fig. 6). On both sides they line the filtration angle, clog the spaces of Fontana, and appear around the canal of Schlemm (fig. 7).

The tumor cells are, on the whole, rather heavily pigmented, but the round, very deeply pigmented cells which cling to the filtration angle and the anterior surface of the iris are probably chromatophores. In the iris the tumor cells are concentrated anteriorly although, in some areas, they penetrate to the dilator muscle. A Wilder reticulum stain demonstrates an argyrophil fiber content of about 50 percent. Subuveal hemorrhage detaches the ciliary body and all but the posterior choroid. The lamina cribrosa appears somewhat depressed.

Diagnosis. Diffuse malignant melanoma of the iris, mixed-cell type, with invasion of the ciliary body; secondary glaucoma; iridectomy; subchoroidal hemorrhage.

The patient was recently examined 3 years after removal of the eye. There was no indication of recurrence or metastasis.

DISCUSSION

In both cases the filtration angle was blocked with pigment and tumor cells, there

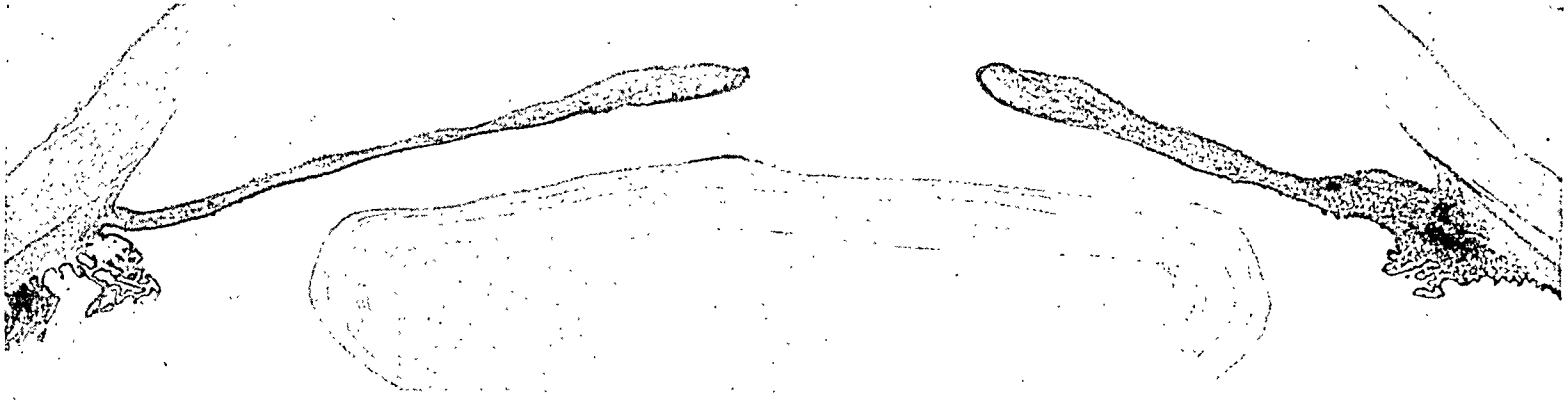


Fig. 2 (Richardson). *Case 1.* Photomicrograph showing diffuse infiltration of the iris with tumor cells, extension to the ciliary body, and involvement of the filtration angle.

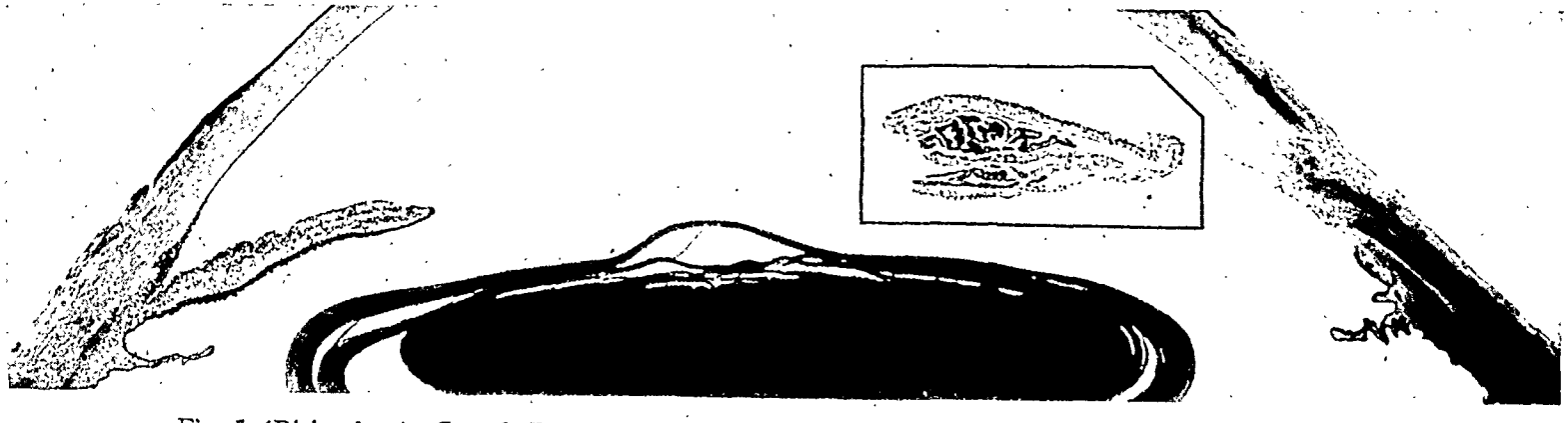


Fig. 5 (Richardson). *Case 2.* Photomicrograph showing diffuse infiltration of the iris with tumor cells. Insert shows section of the iris removed for diagnostic purposes prior to enucleation of the eye.

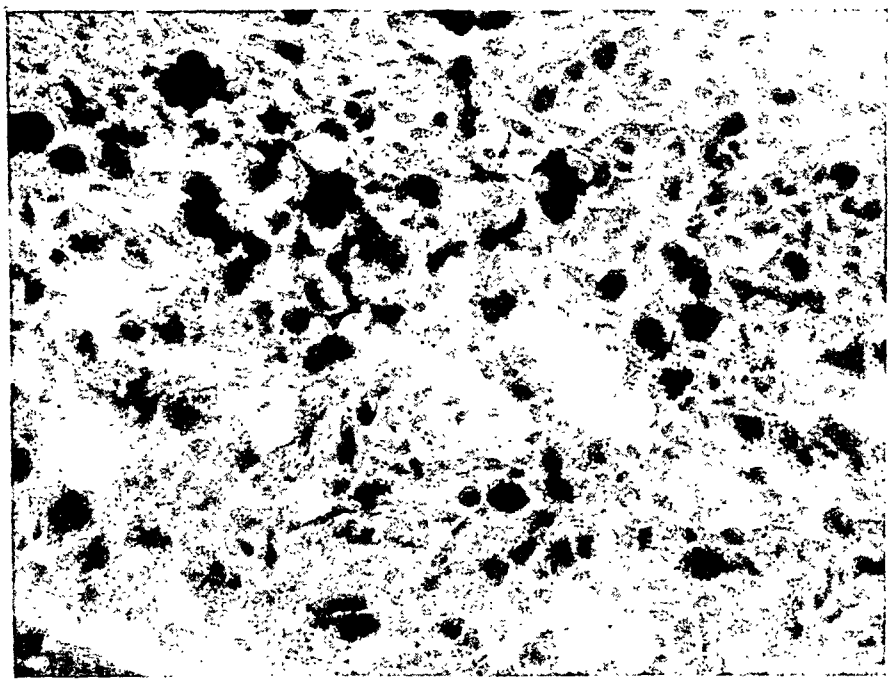


Fig. 3 (Richardson). *Case 1.* Photomicrograph showing infiltration of the iris with heavily pigmented tumor cells (×800).

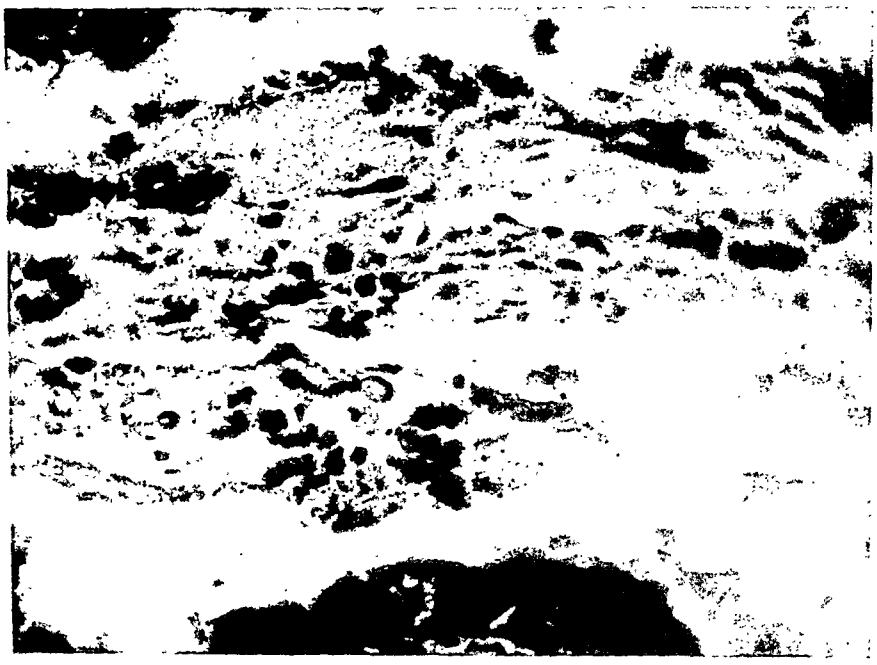


Fig. 4 (Richardson). *Case 2.* Photomicrograph showing section of the iris removed by iridectomy for diagnostic purposes (×800).

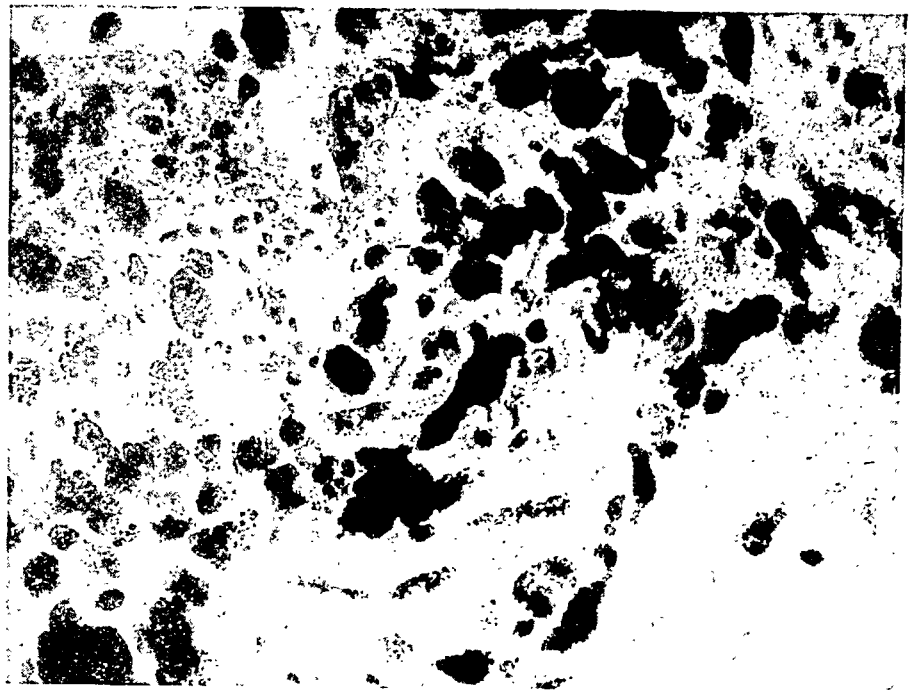


Fig. 6 (Richardson). *Case 2.* Photomicrograph showing infiltration of the iris with tumor cells (×800).

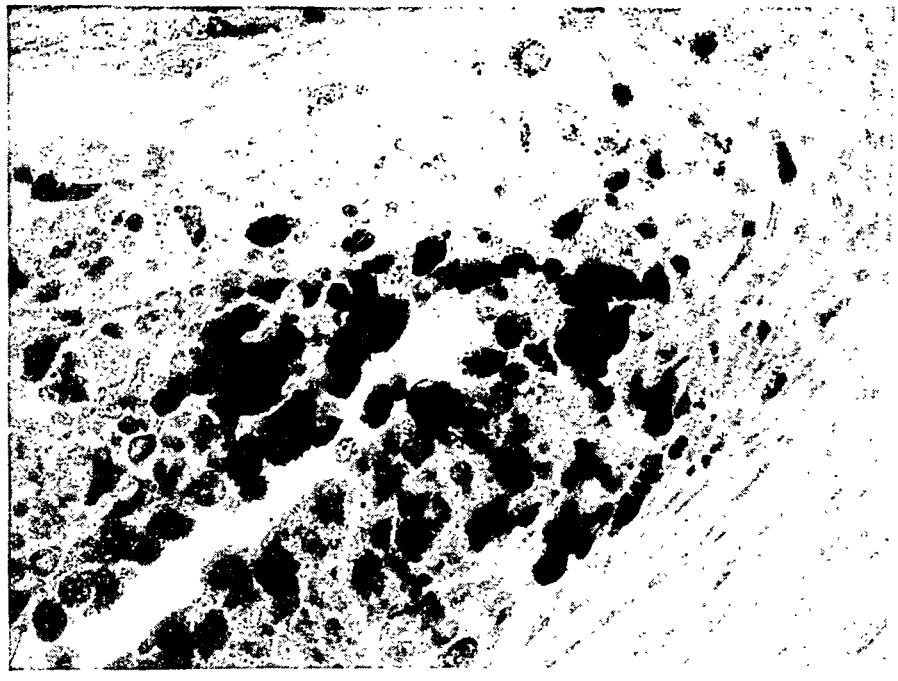


Fig. 7 (Richardson). *Case 2.* Photomicrograph showing section of the iris at the filtration angle.

was secondary glaucoma, deposits of pigment were present on the posterior surface of the cornea, and the anterior chamber was normal in depth. Also, vision was within normal limits in both cases. In Case 1 the pupil dilated only partially and in Case 2 not at all.

Reticulum stain by the Wilder method demonstrated reticulum content of more than 50 percent in Case 1 and about 50 percent in

Case 2. The lesion was of the epithelioid type in Case 1 and of the mixed-cell type in Case 2.

It is noteworthy that in Case 2 a pigmented spot or freckle on the iris of the affected eye was observed by the patient for some years prior to the development of the tumor.

SUMMARY

Diffuse malignant melanoma of the iris occurs rarely. The salient features of this unusual lesion are presented.

Two cases of malignant melanoma of the diffuse type primary in the iris are reported.

111 West Adams Street.

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HISTORICAL MINIATURE

Eduard Jaeger, who published the first comprehensive atlas of observations of the eyeground, described a retinopathy similar to albuminuric retinitis which he ascribed to diabetes.

Hirschberg, *Graefe-Saemisch Handbuch.*

THE ELLIOT TREPHINING OPERATION FOR GLAUCOMA*

A PROCEDURE TO MAKE THIS OPERATION LESS DIFFICULT AND MORE EFFECTIVE

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New York

Medical treatment of glaucoma has its limitations and in many cases it fails, at which time surgery becomes necessary. Some eye surgeons even go as far as to advise operation in all cases of early glaucoma.

INTRODUCTION

There are various operations used to reduce increased intraocular pressure, among which are the paracentesis and posterior sclerotomy operations. These procedures afford temporary reductions in tension. Paracentesis of the cornea may be done to lower the tension in the more severe degrees of glaucoma until such time as a more permanent procedure may be safely carried out.

It is dangerous to lower the pressure suddenly in an eye with a tension above 40 mm. Hg (Schiøtz). Therefore, it is recommended that in the morning of a contemplated operation—as for instance a trephining operation—a paracentesis be performed to lower the tension. This is done obliquely through the cornea so that on withdrawal of the keratome the wound immediately seals itself. Pressure on the posterior lip of the wound to permit the aqueous to escape a little at a time gradually lowers the tension. A dressing is applied and by midafternoon the tension will again be up to about 30 mm. Hg or more. The operation can then be carried out with less chance of complications, such as a hemorrhage or a sudden exodus of aqueous carrying a ciliary process into the opening. In a case with a shallow anterior chamber no paracentesis is attempted. A small posterior sclerotomy may be made, or preferably an iridectomia ab externo.

ELLIOT'S OPERATION

The Elliot trephining operation, of late, has seemed to fall more and more into disuse. It has been criticized on the ground of being followed too frequently by secondary infection. In this respect Fuchs[1] remarks, "Statements with regard to secondary infection vary greatly. On the whole it does not seem to occur often if the operation is properly performed."

The incidence of late infections has been variously reported[2] as from none to 13.6 percent. Wilmer[3] came to prefer trephination to all other procedures in glaucoma, and reported 88-percent successes and only one late infection in a series of 107 cases. Of these cases, most were observed for 5 to 15 years. If a tension of less than 18 mm. Hg (Schiøtz) was maintained without the use of miotics and the field and visual acuity remained as good or better than before operation, he considered the operation a success.

If such results can be obtained, the operation deserves more popularity than it enjoys at present. Difficulties in the technical aspects of the procedure seem to explain much of its decline in popularity. Surgeons employing this method complain of buttonholing the conjunctiva, of getting a shelf due to failure to get a clean-cut opening, of difficulty in grasping the iris due to its failure to prolapse, of losing the plug in the anterior chamber, of failure to maintain a reduced tension because of dense scar formation, and of the occurrence of secondary cataract.

MODIFICATIONS IN OPERATION

The object of this paper is to present a simple technique in performing the Elliot corneoscleral trephining operation and to restore this operation to its proper place as a means of relieving tension in glaucoma.

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*Read before the Section of Ophthalmology, New York Academy of Medicine, October 20, 1947.

Benedict's conjunctival flap

Benedict's[4] able paper brought out a proper approach to the limbus. The conjunctiva and Tenon's capsule are cut through, baring the sclera 8 mm. above the limbus. These tissues are undermined right down to the insertion of Tenon's capsule, 3 mm. from the limbus. Here Tenon's capsule is separated from the sclera and the undermining is continued to the attachment of the conjunctiva at the corneoscleral margin. This approach minimizes the trauma to the subconjunctival tissues through which drainage must occur, and makes the wall of the filtering bleb thicker.

Incisions

Attempting to split the cornea is a step where most operators run into difficulty. They make an effort to cut the outer scleral fibers of the corneoscleral margin obliquely with pointed scissors or a sharp dissector and then attempt to split the outer layer of the cornea with a blunt dissector.

The outer layers are not severed and the attempt made to force a spatula into the corneal stroma therefore fails. One small slip and the conjunctiva is buttonholed. The surgeon must then stop and suture this conjunctival tear, or he may enlarge the tear to do a peritomy. When a peritomy has been done the conjunctiva is retracted toward the fornix and away from the limbus exposing the corneoscleral margin.

The trephine is then applied. The cornea about the trephine opening must then be scarified and the conjunctival flap pulled down and sutured to it so as completely to cover the opening. The conjunctiva readily adheres to the scarified cornea around the trephine wound. When simple suturing of the buttonhole is done, the trephine opening may be done to one side of it.

Trephine openings

Trephine openings have been purposely made in the sclera above the limbus. This I do not advocate for two reasons: (1) because this opening is a sclerectomy which may fill with fibrous tissue in about two weeks, and (2) because it places the wound in the apex of the angle of the anterior chamber where the ciliary processes can readily prolapse into it.



Fig. 1' (Meek). Ciliary process from the iris.



Fig. 2 (Meek). Ciliary process from the iris.



Fig. 3 (Meek). Ciliary process from the iris.

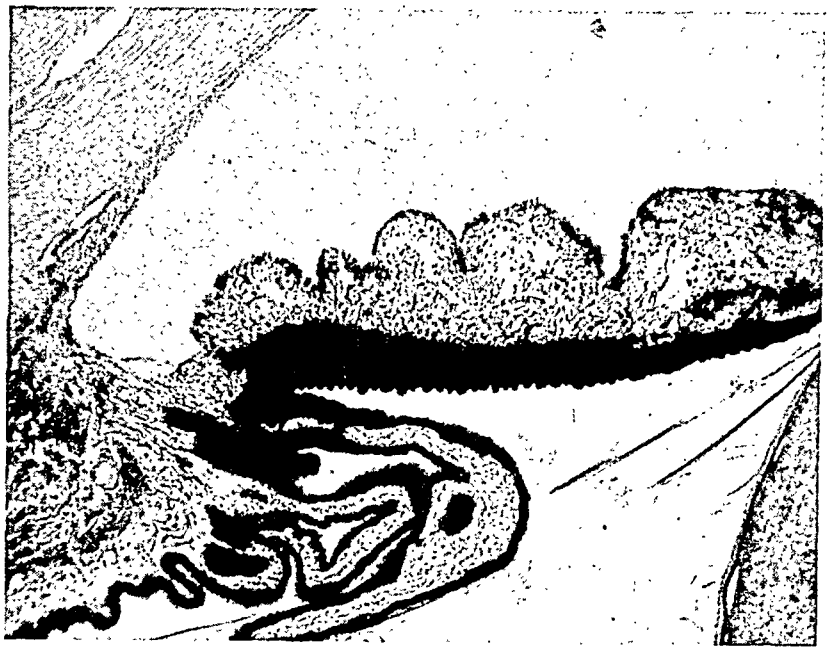


Fig. 4 (Meek). Ciliary process from the posterior surface of the iris root.

Reese[5] has found ciliary processes extending as far forward as the equator of the lens and in some instances has even found them arising from the posterior surface of the iris. This can account for failures with the trephine opening because a ciliary process may block the trephine opening.[6] Placing the trephine opening to the extent of 0.75 mm. in the cornea will reduce the likelihood of such blockage.

In a study of histologic sections of human eyeballs in the Eno Laboratory of the New York Eye and Ear Infirmary, my findings substantiate those of Reese (figs. 1-6).

Technique of new procedure

The method of approach here advocated is to make the conjunctival-Tenon's flap by Benedict's method until the corneoscleral junction is reached. The flap is drawn down over the cornea with a toothpick point covered with wet cotton laying bare the corneoscleral margin.

A Wheeler or Lundsgaard knife is now held lightly between the fingers and thumb. With the blade perpendicular to the surface, the corneoscleral junction is gently sliced until the tissues are half cut through. By so cutting the tissues, the splitting of the cornea is no problem at all. An ordinary iris repositor easily separates the fibers of the cornea. In fact, with very little pressure, the iris repositor may be pushed down between the lamellae as far as one third of the vertical diameter of the cornea.

A 1.5-mm. trephine is used. With about 1 mm. of the cornea now denuded of its outer

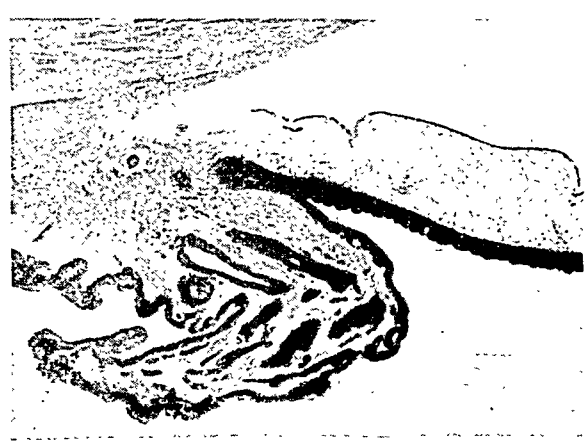


Fig. 5 (Meek). Ciliary process from the junction of the iris and the ciliary body.



Fig. 6 (Meek). Ciliary process from the posterior surface of the iris.

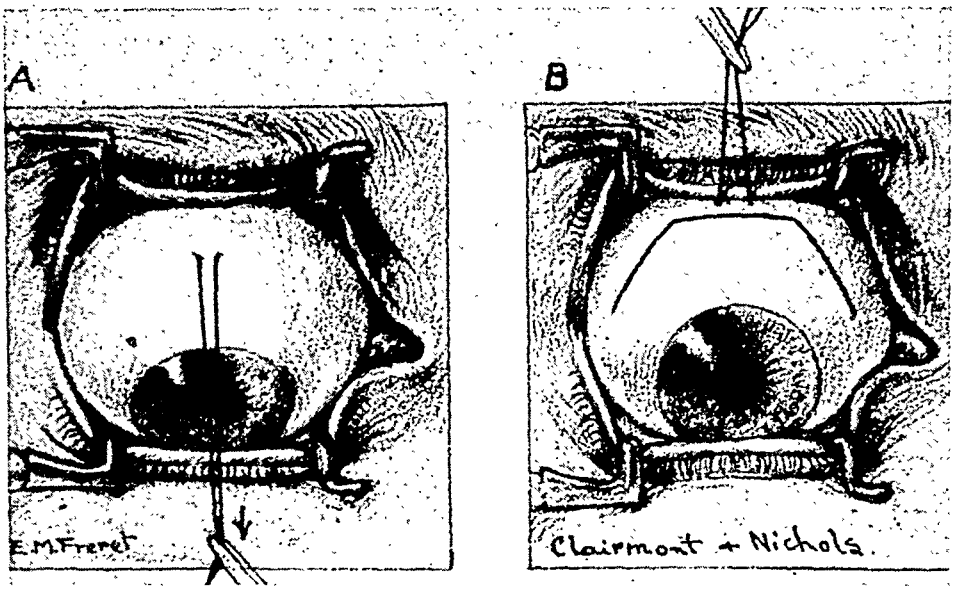


Fig. 7 (Meek). (A) A stay suture is placed in the tendon of the superior rectus muscle. (B) An incision is made with scissors through the conjunctiva and Tenon's capsule down to the sclera.

half, the trephine may be applied above and slid down over the split cornea using the lower raised anterior section of the cornea with its attached conjunctiva as a shelf to hold the trephine in position. In Negroes or highly pigmented persons the cornea is split for a distance of 1.5 mm. from its limbus and, a 2-mm. trephine is used (figs. 7-13).

Gentle rotation of the trephine is now started. The trephine is removed from time to time to be sure that it has not penetrated into the anterior chamber.

Elliot[7] recommended tilting the trephine forward to get a hinge on the corneoscleral disc on its scleral side. Others suggested tilting the trephine back to get an anterior hinge, or to the right or the left side. Such hinges are undesirable because often they form so large a shelf or obstruction that the iris can not prolapse.

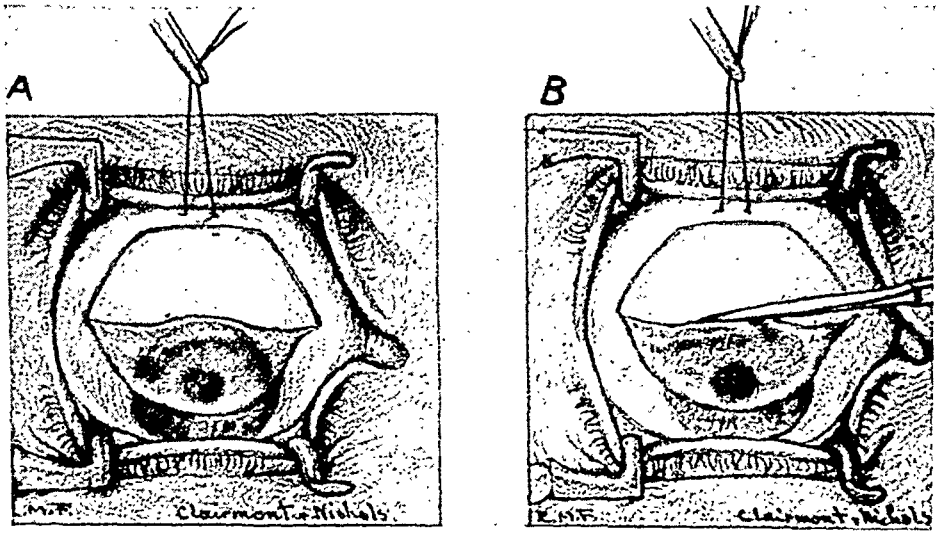


Fig. 8 (Meek). (A) The conjunctiva and Tenon's capsule are undermined down to the limbus. (B) The blade of a Wheeler knife is held perpendicular to the corneoscleral margin.

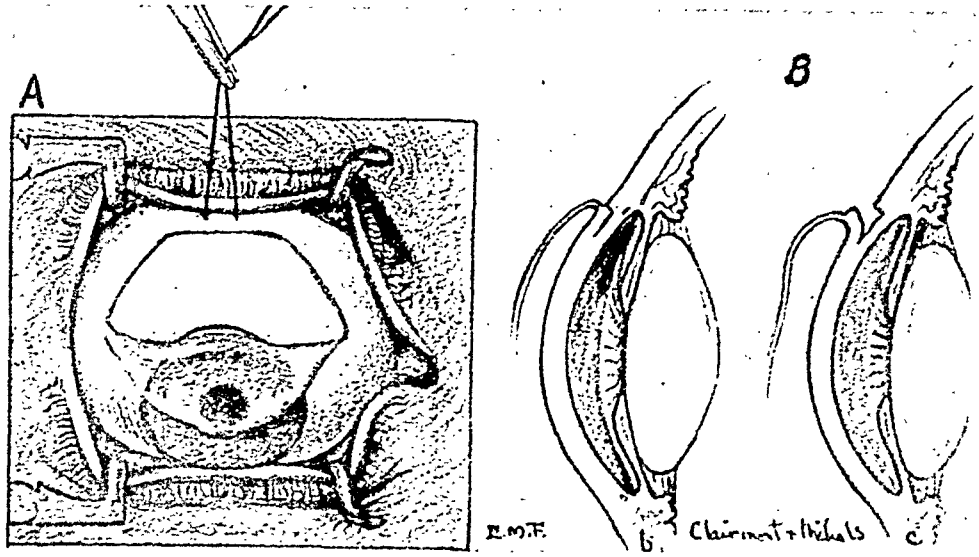


Fig. 9 (Meek). (A) The corneoscleral margin is sliced half-way through. (B) Diagram to show where the tissues are separated by a spatula.

It is best to hold the trephine perpendicular to the corneoscleral margin. With care, a distinct sensation is felt when the trephine penetrates into the anterior chamber. The trephine should then be removed immediately. A trephine with a collar may be used advantageously to avoid penetrating too deeply.

Usually, when the trephine is withdrawn, the iris prolapses at once from the opening, pushing the plug ahead of it. The plug may be removed first if free, and the iris then picked up and incised. If the plug is still adherent, plug and iris are cut together.

In any case, the iris, after being grasped with forceps, must be pushed down toward the center of the cornea so that a broad peripheral iridectomy is performed at the base of the iris. Too often, pulling up on the iris results in an iridectomy down toward or even into the pupil. By pulling the iris axially the ciliary portion of iris is excised to-

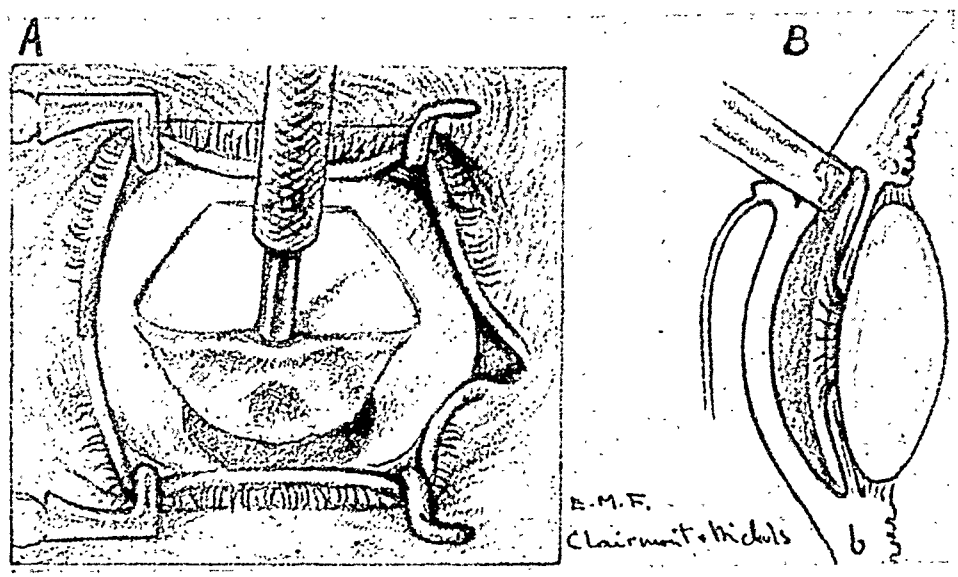


Fig. 10 (Meek). (A) A 1.5-mm. trephine is placed astride the corneoscleral margin. (B) The outer split half of the cornea acts as a shelf to hold the perpendicularly placed trephine.

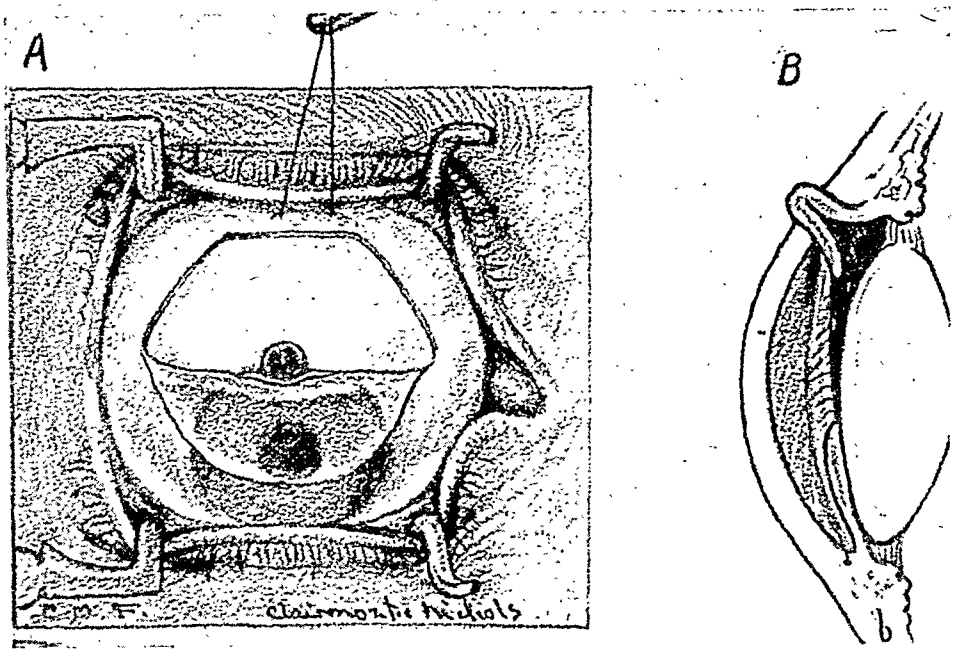


Fig. 11 (Meek). (A) and (B) The iris prolapses through the trephine opening.

gether with any ciliary processes which may be present on the iris. The iridectomy should be wide and deep because it may be surrounded on three sides by ciliary processes. The iridectomy should be sufficiently large to prevent its edges from touching the edge of the trephine opening when the pupil is dilated.

The corneoscleral plug is occasionally lost in the anterior chamber. This is of no consequence and the plug must be severely let alone. In at least two cases I have observed this plug lying on the iris without complications for several years.

If the iris tissue should remain in the opening after the iridectomy, it is easily dislodged by directing a stream of half-normal saline solution into the opening. This must

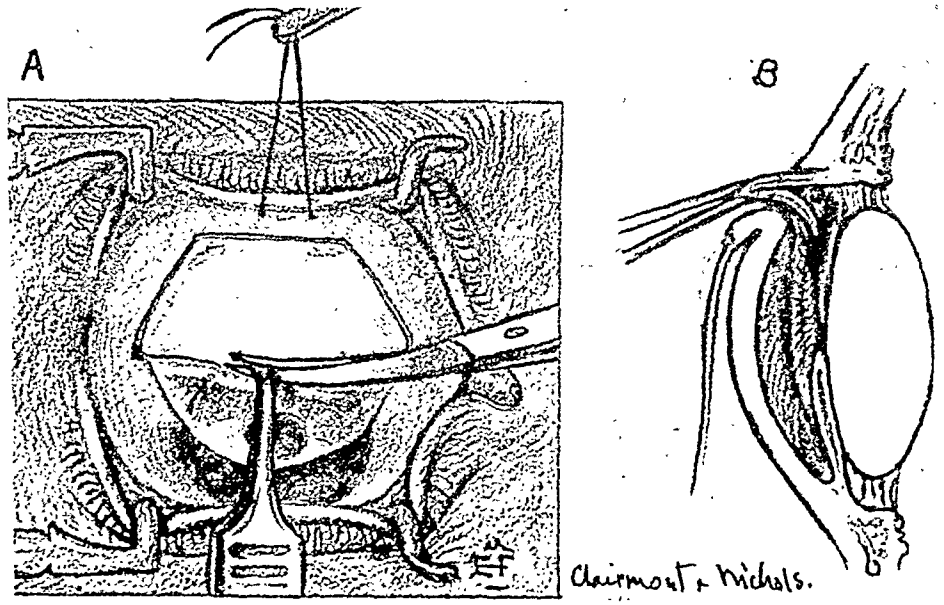


Fig. 12 (Meek). (A) The prolapsed portion of the iris is excised. (B) The iris prolapse is drawn down toward the pupil to get at the base of the iris.

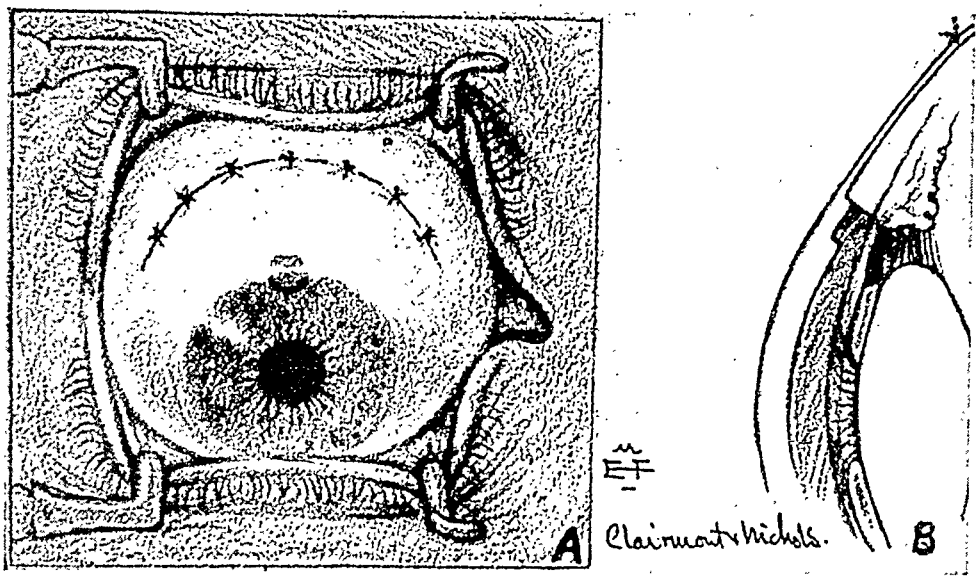


Fig. 13 (Meek). (A) The conjunctival flap with Tenon's capsule is drawn up and sutured. (B) Diagram to show the flap in relation to the trephine opening and why massage is necessary to keep the tissues separated.

be done at once and, if there is bleeding, before the blood clots. The trephine opening must be considered inviolable and no forceps or spatula should enter the anterior chamber.

If the iris does not prolapse, suction may be used, either a Dimitry suction with a lacrimal irrigator or a medicine dropper with a small tip. Disregard of this restriction may lead to damage to the lens, zonule, ciliary body, or anterior hyaloid membrane by misdirected instruments.

Payne[8] in examining enucleated globes in which trephining operations had been unsuccessful found the operative wound closed by dense connective tissue containing fragments of pigment, lymphocytes, and new blood vessels. Verhoeff[9] has described the perfect trephine wound as being filled with

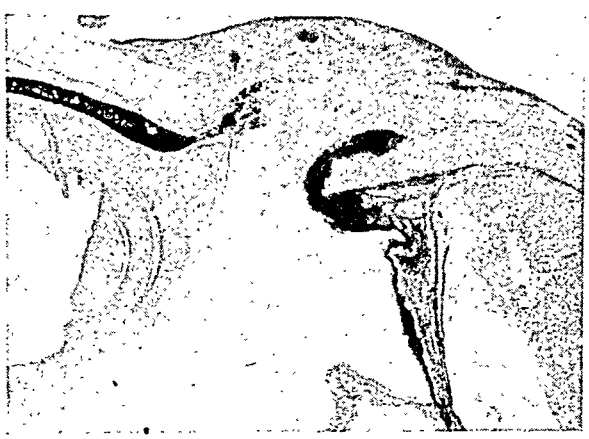


Fig. 14 (Meek). Ciliary process prolapsed into the posterior part of the trephine wound and iris tissue into the anterior part.



Fig. 15 (Meek). Ciliary process prolapsed into the trephine wound.

delicate connective tissue, full of empty spaces intercommunicating and traversing its extent and free of endothelium. Such a scar can be achieved only by keeping instruments and uveal tissue out of the trephine wound.

The toilet of the trephine wound being completed, the conjunctival flap is drawn up, smoothed back into its former position and the cut edges joined with a continuous plain catgut suture or a number 5-0 black silk suture.

In cases of chronic simple glaucoma with

no congestion or inflammation, a drop of ¼-percent eserine to draw the iris from the trephine wound is instilled. In an eye that shows congestion without definite iritis or

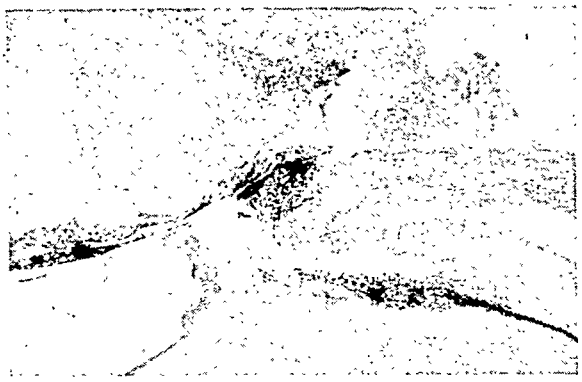


Fig. 16 (Meek). Iris in the trephine wound.

uveitis a drop of 2-percent pilocarpine is instilled. In glaucoma secondary to a uveitis, 1-percent atropine solution may be instilled at the time of operation or, better, at the first dressing especially when eserine or pilocar-

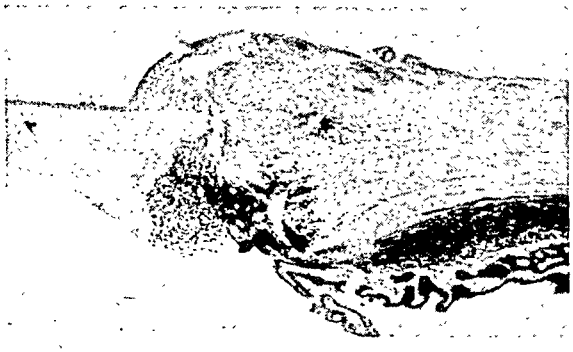


Fig. 17 (Meek). Iris in the trephine wound.

pine have been used. An ointment is applied to the closed eyelids to keep the lashes from sticking to the dressing. In my opinion it is a mistake to fill the conjunctival sac with ointment after any intraocular operation because of the danger of the ointment being drawn or forced into the anterior chamber. The eye is bandaged and may be observed in 24 hours.

A most important step of the operation comes on the third day when gentle massage is begun. This massage is done below the cornea to avoid additional trauma to the flap. The massage helps maintain the filtering

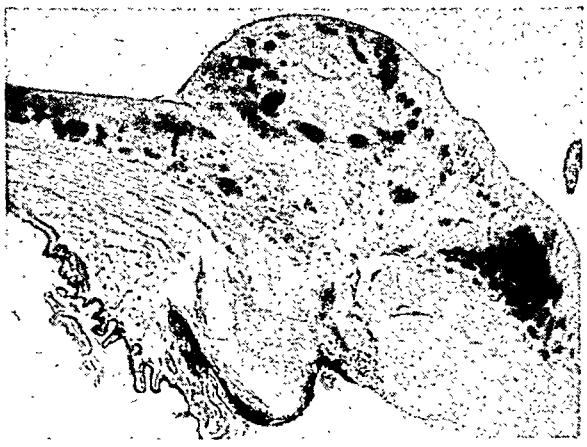


Fig. 18 (Meek). Iris lining the posterior portion of the trephine wound.

bleb and prevents the tissues covering and immediately surrounding the bleb from becoming firmly adherent to the sclera. This

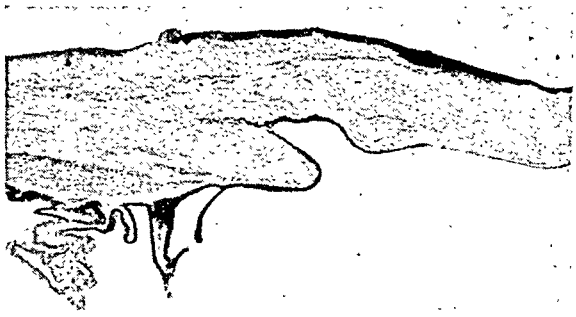


Fig. 19 (Meek). Iris in the wound.

massage should be instituted by the operator himself, for, if care is not used, an intraocular hemorrhage may occur. The massage is continued daily until the wound is healed and the circulation of aqueous established.

Although a filtering bleb is desirable and will usually be achieved by scrupulous technique, the bleb occasionally fails to form or disappears. Sometimes the bleb can be re-

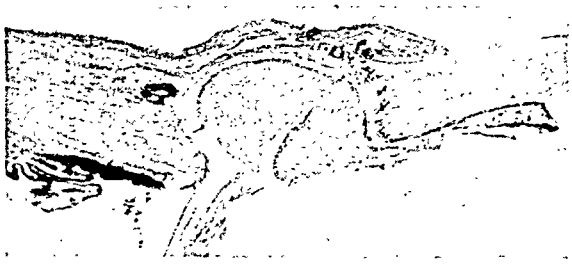


Fig. 20 (Meek). Iris and lens in the trephine wound.

stored by the injection of saline or air into the subconjunctival tissue. Absence of the bleb does not constitute a failure, for even in the absence of an apparent fistula the tension is reduced. Meller[10] states that he has found the tension reduced in 60 percent of such cases. This may be due to the peripheral basal iridectomy. A dressing is kept on the eye for a week.

Comments

From a study of pathologic slides I have found that the causes of failure of the Elliot trephining operation are:

1. The iris is found in the wound in most failures (figs. 14, 16-20).
2. Rupture of the lens with lens fibers in the wound (fig. 20).
3. Ciliary processes in the trephine opening (figs. 14 and 15).
4. Subluxated lens blocking the wound.
5. Hemorrhage.
6. Intraocular infection.
7. Episcleritis.

I have found more failures where iris tissue is caught in the wound than all the other causes put together. In all instances, the wound becomes filled with vascularized fibrous tissue. In every failure one of the above complications was found. The procedure suggested should go far to eliminate these complications.

Summary

A simple method of performing the Elliot corneoscleral trephining operation is hereby presented in the treatment of glaucoma.

Benedict's method of making the conjunctival flap to include Tenon's capsule is used. With a Wheeler or Lunsgaard knife an incision is made at the corneoscleral junction. The knife blade must be held perpendicular to the incision. The corneoscleral margin is sliced to one half its thickness. The cornea is now easily split to a distance of one millimeter. With the trephine placed astride the corneoscleral margin, and using the lower raised portion with its attached conjunctiva as a stop or shelf, the opening is made. The trephine should be held perpendicular to get a clean-cut disc or plug.

The iris tissue, which now presents in the trephine opening, is grasped near its base with iris forceps and, with slight tension pulling the iris toward the pupil, its base is excised. If no prolapse occurs, the iris may be withdrawn by suction.

The conjunctival Tenon's flap is replaced and sutured. Gentle massage below the cornea is begun after the anterior chamber has reformed (usually on the third day) and kept up daily until the wound is healed and the circulation of aqueous established. A dressing is kept on the eye for a week.

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PSYCHOSOMATIC INTERRELATIONSHIPS IN OPHTHALMOLOGY

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With reference to psychosomatic medicine, it has been somewhat acetiously remarked that "any other brand of medicine is veterinary medicine."

Franz Alexander,[1] in a clarification of the question of psychogenesis, gives point to this statement when he says, "The distinctive feature of psychogenic factors such as emotions or ideas and fantasies is that they can be studied also psychologically through introspection or by verbal communication from those in whom these physiological processes take place. An automobile climbing a hill has no sensation of tiredness or of a goal to reach. In contrast to a man-built machine, the organism climbing a mountain has an awareness of certain of its internal physiological processes in the form of effort, tiredness, discouragement and so on. Moreover, man in contrast to the animal organism is able to convey these internal sensations to others by verbal communication. Verbal communication is therefore one of the most potent instruments of psychology and consequently of psychosomatic research. When we speak of psychogenesis we refer to physiological processes consisting of central excitations in the nervous system which can be studied by psychological methods because they are perceived subjectively in the form of emotions, ideas, or wishes."

OPHTHALMOLOGY AND PSYCHOSOMATIC MEDICINE

Ophthalmology as a medical discipline has not taken kindly to the concept of psychosomatic medicine. The past 20 years have shown revolutionary changes in the study and clinical application of psychology and psychiatry, but ophthalmologists have taken little or no advantage of these changes. They have, on the whole, either ignored this vital stream of new knowledge or have been downright hostile to its development. For example, when the late Dr. Mark Schoenberg[2,3] presented an extremely conservative paper on the therapeutic implications of psychosomatic interrelationships in glaucoma, in 1939, his work was greeted with reactionary jeers or "damned with faint praise" by most of the discussants. When I[4] published an article last year on "Ocular Manifestations of Psychosomatic Medicine," only 15 percent of the 200 requests for reprints came from ophthalmologists.

Perhaps there are several reasons for this attitude. As noted above, verbal communication is one of the most potent instruments of the psychologists. Words are to the psychiatrist what the stethoscope is to the cardiologist; and ophthalmologists are notoriously short on words. There is a precision of diagnostic and therapeutic procedure to ophthalmology which has encouraged too accurate particularization and has led to a conspicuous neglect of such evanescent qualities as psychic factors in ocular disease.

But the concept of psychosomatic medicine is in the ascendancy and its appeal will not be denied. It must be sympathetically studied and understood to be appreciated and no medical discipline can escape its imprint.

Dunbar's[5] very apt definition of psychosomatic medicine should especially appeal to ophthalmology, using as it does the idea of visual fusion. "Psychic and somatic represent merely two angles of observation. Our understanding of disease rests on pictures taken from these two angles viewed simultaneously, united stereoscopically."

In a summary of his views on psychosomatic research, Alexander[1] states that there are fundamental psychologic and physiologic differences between conversion symptoms, vegetative neuroses, and psychogenic organic disease. He suggests that we restrict

hysterical conversation phenomena to symptoms of the voluntary neuromuscular and sensory perceptive systems and differentiate them from psychogenic symptoms which occur in vegetative-organ systems, the functions of which are under the control of the autonomic nervous system.

A conversion symptom is a symbolic expression of a well-defined emotional content, an attempt at relief; although as Freud originally expressed it, these substitutive innervations never bring full relief. The symptoms express at the same time both the repressed emotion and its rejection. Because they do not fully relieve the tension, we have a pathologic condition.

A vegetative neurosis such as emotional hypertension is not an attempt to express an emotion but is the physiologic accompaniment of constant or periodically recurring emotional states. The chronicity of an emotional tension alone is what makes such a condition morbid.

Ocular disturbances of psychogenic origin

In considering ocular disturbances of psychogenic origin it would seem rational to divide them as follows:

I. Ocular conversion symptoms

1. Blepharopasm
2. Convergence spasm
3. Asthenopia
4. Photophobia
5. Hysterical amblyopia and amaurosis

II. Ocular vegetative neuroses

1. Ciliary spasm
2. Amaurosis fugax
3. Central angiospastic retinopathy
4. Migraine
5. Glaucoma

These are the more common ocular disturbances of psychogenic origin which will be discussed here. That there are others, I am aware, especially in the vegetative neurosis group. These will require further psychosomatic research for their proof.

Ocular phenomena of conversion hysteria

There is hardly a sign or symptom of organic disease which hysteria cannot simulate. While there have been many published articles on the subject of ocular hysteria, the majority of cases are diagnosed per exclusionem. After a thorough ocular examination has failed to reveal an organic cause for the visual loss, the condition is labeled "hysterical" by virtue of the purely negative result. Seldom is any attempt made to determine in a positive sense the existence of hysteria, an absolute necessity for both adequate diagnosis and rational therapy.

Blepharospasm

This symptom may vary from the transient "blinking" of a nervous child to the most severe and constant spastic closure of the lids. One of the most common of all ocular complaints in children, especially in the early school years, is a frequent, nervous "blinking" tic, which starts as a hardly noticeable increase in frequency of the normal wink reflex and becomes rapidly worse until it is noticed as an actual grimace by the parents or the school nurse. Many of these children are brought to the ophthalmologist for examination with this as their only symptom. In the majority of instances they are refracted and a pair of glasses prescribed in the hope that relief from a minor eyestrain will relieve the symptom.

It is true that an occasional case of this type will be found to have a considerable degree of uncorrected refractive error with secondary chronic conjunctivitis and consequent lacrimation and irritation leading to the development of the symptom, but in most instances the disturbance is purely psychogenic in origin. A careful history from the mother, with some sympathetic questioning and coincidental observation of the child, will reveal a background for conver-

sion hysteria of a mild character that can hardly be doubted.

The symptom may have started "after a severe scolding," "after a school-yard fight with a bigger boy," "after a severe fright by a dog." These are manifestations of a "shrinking from danger" where "squinting" or closure of the lids is a natural protective reflex. Often the symptom is first noticed when the child begins "audience reading" in school. The more difficulty the child has in learning to read, the more he stumbles and gropes for words, the more apt is he to develop obvious signs of anxiety, increased nervous tension, stuttering and stammering, and finally blepharospasm. This attempt at escape from a difficult situation is a typical example of a conversion symptom in hysteria.

From this mild form of "nervous tic," it is only the degree of severity and the duration of the hysteria which produce the elaborate muscular twitching of the orbicularis oculi and the grimacing spasm of the entire face that may finally result in the constant, spastic closure of the lids seen with relative infrequency in the adult.

To attribute these phenomena to eyestrain, refractive error, uncorrected phorias, and the like, as is frequently done, is manifestly improper. Even to make the diagnosis by exclusion of organic disease is a negative approach. One must, by proper psychiatric evaluation, establish the positive diagnosis of hysteria before treatment, if it is to be successful, can be based upon an exploration of the subconscious for an adequate explanation of the repression responsible for the symptom.

Convergence spasm

This is perhaps one of the most clearly defined ocular motor anomalies which may occur as a symptom in conversion hysteria.

Souders[6] reported a case of this type and briefly reviewed the rather meager literature. He states that the disturbance represents an excess of convergence usually associated with a comparable excess of accommodation which becomes pathologic because of its duration in a susceptible psychoneurotic patient.

In these cases, ample evidence of a psychogenic background is offered but again the diagnosis is made by exclusion of organic disease, and therapy by persuasion and counter suggestion is declared unsuccessful.

It is suggested that, in severe cases of long duration, one is not justified in pronouncing them incurable until all the possibilities of prolonged psychoanalysis have been explored. I have seen two cases of severe convergence spasm, associated with hysterical amblyopia, promptly cured by sodium-amytal narcosis followed by brief psychoanalytic therapy. Both were acute cases of short duration, and both were diagnosed by a positive psychologic approach to the hysteria rather than by negative exclusion of organic disease.

Asthenopia

This has become a waste basket of the eye symptomatology and has been used to describe everything from unclassified headache, photophobia, and eyestrain to amblyopia of psychogenic origin. Numerous articles have been written decrying the practice of prescribing glasses for eyestrain when an analysis of the patient's psychic background would have speedily revealed the real cause of his trouble.

Derby[7] believed that "ophthalmologists produce more neurosis than they cure. Too often the neurotic patient is dismissed with a minor change in his prescription, when what he really needs is a careful analysis of his condition and an explanation of how his various aches and pains should be interpreted and treated." Derby would like to see the word "eyestrain" banished from our vocabulary and states that "if the general public could learn that eyes are seldom strained, this would be a happier world to live in."

Rutherford[8] identifies asthenopia as a psychoneurosis "to distinguish it from simple eyestrain," and becomes considerably confused himself in the process. In the discussion which followed this paper, Lancaster called attention to the rule that a psychoneurosis should never be diagnosed on negative evidence alone.

Asthenopia, like all forms of conversion hysteria, is extremely susceptible to cure by suggestion but, only by being constantly alert and interested in the subject can the ophthalmologist avoid the common pitfall of temporarily curing a symptom while completely neglecting its cause. The prescription of a pair of glasses, no matter what their dioptic power, may result in immediate relief of eyestrain, headache, blurring of vision, and the like. Without a true analysis of the underlying cause and its treatment by psychotherapy, however, no more than a transient improvement, at best, can be expected.

Photophobia

In the absence of organic pathologic conditions, particularly intraocular inflammation and keratitis, the most common cause of photophobia is psychogenic.

Inman[9] states that "nearly every person who complained of glare or bright light, whether natural or artificial, had either definite fear of the dark or could remember his struggles to get rid of this fear when a child."

The complaint of photophobia was an extremely common one in the Armed Services during the war and has been reported by me.[10] It is usually a minor disturbance, frequently only a part of a more complicated conversion-hysteria symptom complex, but may reach such proportions as to be a disabling disorder in its own right. It is markedly increased by fatigue and by anxiety and emotional stress.

The exclusion of irreversible disease in severe photophobia is not difficult, but even more important in establishing the psychogenic origin of the symptom is a careful analysis of the patient's history and personality pattern. There is a frequent association of photophobia with blepharospasm, facial tic, and transient amblyopia from ciliary spasm. These associated symptoms and the photophobia itself can often be abolished by direction of the patient's attention away from his symptoms.

A typical example of severe and disabling photophobia was reported by me in the case of an aviation cadet who developed such anxiety over failure to pass his Morse code blinker-light signal test that, in an unconscious attempt to escape from an intolerable situation, he transferred his fear of failure to a fear of the light itself. When the psychogenic nature of the disturbance was understood by the patient, he was able to overcome his difficulty, qualified for advanced flight training, and the photophobia disappeared.

Hysterical amaurosis and amblyopia

There is a vast literature on the subject of hysterical blindness. The majority of articles, however, deal with individual case reports of hysterical amblyopia in which the diagnosis of the psychogenic nature of the disturbance has been made by the purely negative method of exclusion of organic disease. Many authors make reference to an "intolerable situation" as a factor in the production of the amblyopia, but almost none of them make any attempt to explore the nature of the psychic factors which alone will explain the raison d'etre of any individual case. Little attention has been paid by ophthalmologists to Freud's[11] comprehensive discussion of psychogenic visual disturbances in the light of psychoanalytic knowledge.

To quote Dunbar,[5] "To consider the numerous and peculiar ocular neuroses as disease entities is not permissible. It is not only that, in addition to the neurotic eye symptoms, there are always neurotic symptoms in other bodily spheres, but also that the neurotic symptom is always merely the ex-

pression of a psychic conflict in the total personality. It is with this total personality and its situation that we have to deal. Confronted with a neurotic amaurosis, we must deal, not with this, but with underlying disturbance in psychic equilibrium, if we are to understand the symptom and the necessary course of treatment. There is always a conflict out of which the neurotic individual finds no other way than that of flight into illness, which is itself an attempt at cure, even though unsuccessful. Persuasion and suggestion can at best eliminate a symptom. The deep sources of the neurosis are reached only by psychoanalysis."

It is not advocated that ophthalmologists should attempt to psychoanalyse their patients, but a study and appreciation of psychology is essential to intelligent coöperation with the psychotherapist.

Amblyopia is a much more common symptom of conversion hysteria than amaurosis. In the majority of cases in which the amblyopia is the dominant symptom, there are, however, other complaints and symptoms which can be readily uncovered by psychiatric evaluation and which fit into the picture of hysteria.

A recent article by Yasuna[12] reports 15 typical cases of hysterical amblyopia in men about to be discharged from the Army. All of the classical symptoms are demonstrated, including the resigned attitude of the patient to his disability; the slow, hesitant reading of the Snellen test chart, no matter what letters were chosen as minimum visual acuity by the patient; the typical tubular, sharp margined, visual fields found in almost all cases; and the marked amenability to suggestion resulting in rapid improvement in vision with only the most superficial psychotherapy.

Yasuna points out that while monosymptomatic hysteria is not uncommon, the greatest number of cases present a variety of manifestations and that the acute type in which the amblyopia develops suddenly is relatively uncommon. Most of the cases belong in the chronic groups in which no definite time of onset can be fixed; and the course is complex or of the mixed type, in which other elements of psychoneurosis are also present and frequently are the more obvious factors in the individual.

It is generally agreed that suggestion plays a most important part in the treatment of hysteria,[13,14] but it must be emphasized again that the transient "cure" of a symptom by suggestion is by no means a cure of the underlying psychogenic factors producing the symptom. Cure by suggestion, therefore, is of more value as a diagnostic procedure than as a rational form of therapy. Frequently, and especially in children, the complicated routine of a careful ocular examination carries so strong an element of suggestion that, during the procedure, the vision shows distinct improvement, and the correct diagnosis is thus established.

Lastly it must be remembered that the amblyopia of conversion hysteria may be superimposed upon a visual disturbance with an organic basis. I have recently established such a diagnosis in a patient with an extreme colloid degeneration of the choroid. The appearance of the fundus suggested the possibility of considerable loss of visual acuity, and the patient had been accepted as blind to the extent of receiving a large monthly pension and a seeing-eye dog. He had lectured before numerous groups on the opportunities and occupations open to the blind and was running his own successful dairy farm. His vision was reduced to light perception. Associated with his amblyopia, however, were other symptoms, such as severe photophobia and blepharospasm, strongly suggestive of the psychogenic nature of the disturbance. A careful psychiatric evaluation of the total personality of the individual revealed a pattern which left little doubt of the real nature of the disability. Improvement of vision to 20/20 with normal visual fields by suggestion and psychotherapy, further confirmed the diagnosis of hysterical amblyopia. The eventual cure of this pa-

tient's underlying psychoneurosis will be a most difficult problem. Cases of this sort demand the closest coöperation and understanding between the ophthalmologist and the psychiatrist.

Ocular vegetative neuroses

This is one of the most fertile of all fields for psychosomatic research. As noted above, a vegetative neurosis is not an attempt to express an emotion but is the physiologic accompaniment of a constant or periodically appearing emotional state.

There is ample anatomic and physiologic evidence of the cortical control of the vegetative nervous system through the hypothalamus.[31]

In a very comprehensive review of the experimental data on the anatomy and physiology of the hypothalamus, Ingram[15] conservatively concludes that the evidence clearly indicates that this portion of the brain contains important integrating mechanisms for the so-called vegetative functions. Many of these mechanisms produce their effects by influencing lower, subordinate complexes. In turn, the hypothalamus is undoubtedly under a certain measure of control by higher regions, including the cerebral cortex.

In a lengthy and well-documented article on hypothalamic function in psychosomatic interrelations, Grinker[16] concludes that "as a cephalic representative of the autonomic nervous system, the hypothalamus has to do with the energies of visceral origin which are the forces of the instincts."

Bard[17] was able to show conclusively that a central autonomic center resided in the hypothalamus and that there is also a direct inhibitory effect exerted on the hypothalamus by the cerebral cortex.

More recently Kennard[18] has correlated autonomic interrelations with the somatic nervous system and found that anatomic and functional interrelations between the autonomic and somatic nervous systems can be demonstrated at many levels; that emotions are known to produce responses in both autonomic and somatic nervous systems; and that these interactions take place chiefly within regions containing the extrapyramidal representation in the forebrain.

From an ophthalmic point-of-view all of this is simply evidence for the cortical or emotional control of the vasomotor system since most of the ocular vegetative neuroses are primarily vasomotor disturbances.

Ciliary spasm

This is, perhaps, the single exception to the foregoing statement. The action of the autonomic nervous system on the pupillary constrictor and dilator fibers and on the ciliary body is well known and has been reviewed by Cogan.[19] Many authors have called attention to the dilation of the pupils in both animals and human subjects under conditions of emotional stress, such as rage and fear.

Since the days of Helmholtz accommodation for far vision has been considered to be a passive process, the ciliary muscle being relaxed; while the accommodation for near vision is said to be an active process, the ciliary muscle being in a state of contraction.

Several authors have questioned the validity of this theory and Olmstead,[20] on the basis of careful animal experimentation, flatly states that "both divisions of the autonomic nervous system can act on the lens; that the influence of the sympathetic is in the direction of hypermetropia, and the parasympathetic in the direction of myopia; that there is a tonic action of both divisions of the autonomic nervous system, since removal of either leads to permanent dioptric change; that the radial fibers can act in groups; and that the same general picture resulting from sympathetic stimulation is shown in man as well as in lower mammals."

Relatively little has been written regarding the production of transient myopia by emotional disturbance such as fear or anxiety states, and yet it is a relatively common phenomenon and one which must be familiar to most ophthalmologists.[13]

The disturbance is limited to young people and manifests itself as a periodic and transitory blurring of distance vision usually associated with prolonged reading. There is often a sensation of ocular fatigue or even fairly severe pain and the visual loss may vary from slight to as low as 20/200, and may last from a few minutes to days or even weeks at a time. The change in refraction may vary from 0.50D. to as much as 2.0D. by manifest refraction and is characteristically altered by rest or by employment of the "fogging" method of refraction. The use of homatropine as a cycloplegic immediately abolishes or reduces the dioptric change, but this improvement is only temporary and the symptom becomes manifest as soon as the effect of the cycloplegic wears off. Ciliary spasm is differentiated from amaurosis fugax by the measurable change in the refractive power of the eye, but it must be remembered that both conditions may occur in the same eye.

A careful analysis of the histories of these patients will reveal a definite and sometimes severe anxiety state, and it is only by analysis of the psychogenic factor that a cure can be accomplished.

A typical example of ciliary spasm is seen in the young student who is on the verge of failure in school. Because of his poor scholastic ability he is forced to spend more than the average amount of time in study. His anxiety over his incipient failure causes him to work under more and more pressure until a vicious circle of more reading and greater anxiety results in a spastic myopia of greater or less degree.

I have found this disturbance quite frequently in medical students and it was extremely common in preflight and basic training schools in naval aviation in the last war. Here the consequences of failure, loss of the coveted wings and a commission in the Air Corps, had a correspondingly strong psychogenic factor.

Whether one adheres to the Helmholtz theory of accommodation or to the newer theories of dual autonomic innervation of the ciliary muscle does not alter the basic fact that this disturbance is a vegetative neurosis—the physiologic accompaniment of an emotional state.

Amaurosis fugax

This symptom complex differs from ciliary spasm in the absence of measurable dioptric change in refraction. It is a true vegetative neurosis which is vasomotor in origin and, as reported by me,[4, 21] differs only in the matter of degree of vasospasm from central angiospastic retinopathy, to be discussed later. It includes all those ocular disturbances, such as periodic dimness of vision and black out, which are associated with autonomic instability but leave no permanent or visible organic change. It is frequently a part of the symptom complex of neurocirculatory asthenia.

The chief complaint is of periodic visual loss which varies from transient fogging of vision to complete "black out lasting for 30 to 60 seconds and identical with the black out described by aviators at the termination or pull out of a power dive. The frequency and severity of the amaurosis may be so severe as to be actually incapacitating, but exhaustive ocular examination reveals no evidence of organic disturbance sufficient to account for the symptoms.

Even casual observation will reveal, in most cases, other evidences of vasomotor instability, notably an increased sweating of the hands, tremor of the fingers, and poor peripheral circulation with blanching of the fingers when the hands are held above the head and cyanosis when they are dependent.

Careful evaluation of psychogenic factors will always reveal marked anxiety state, frustration, fear, excitement, or homesickness, and treatment must be directed to these causative factors.

Central angiospastic retinopathy

This is the term applied by Gifford and Marquardt[22] to a type of macular retinal

lesion which they felt to be definitely of circulatory origin. They and Horniker,[23] Bailliart,[24] and I[21] have established evidence of general vasomotor instability in these cases and demonstrated the vasospastic etiology of the disease.

A large number of cases of central angiospastic retinopathy were reported in the Armed Services during the last war and I have seen a number of cases in the past year.

Visual disturbance is usually sudden in onset and may be quite severe with central vision reduced to 20/200 or less. The condition may be unilateral but is more frequently bilateral. Visual fields show a central scotoma of varying size and density. There is frequently a complaint of distortion of objects or metamorphopsia.

Examination of the fundi in the acute stage of the process shows a definite grayish edema of the macula with loss of foveal reflex and a generally smudged appearance of the macula. One of the earlier names for the condition was descriptive of this stage of the process—central serous detachment of the retina. As the edema subsides, the macula takes on a mottled, granular appearance due to redistribution of the retinal pigment. The absence of the foveal reflex persists. The vision may improve markedly but seldom comes back to its previous acuity.

A large number of cases show, in their final stage, a minute, sharply outlined, irregular hole in the fovea with a corresponding minute central scotoma and vision of 20/30 or 20/40. These macular holes are difficult to see but, with adequate illumination and especially with red-free illumination, they are usually quite visible when searched for.

In searching for the etiology of this condition, the only constant etiologic factor in nearly 100 cases seen by me[21] was autonomic instability and excessive stimulation of the vegetative nervous system. Practically all cases studied showed definite clinical evidence of vasoneurotic diathesis with hyperhidrosis, cyanosis or pallor of the finger tips, and deficient peripheral vascular systems as manifested by abnormal skin-temperature readings of fingers and toes.

Psychiatric studies have revealed almost uniform anxiety states, often of considerable severity. Even in peace time the psychosomatic aspects of the disturbance are quite evident to fairly casual study. Zeligs[25] has approached the subject psychosomatically and has pointed out the occurrence of anxiety as a common type factor in the production of central angiospastic retinopathy. It is realized that any autonomic stimulus of sufficient severity and duration can produce this condition but the most common stimulus is psychic trauma.

This is a classical example of a severe vegetative neurosis with associated physiologic disturbance of such intensity and duration as to become irreversible. The end result is an organic pathologic condition.

Migraine

While the visual disturbances associated with migraine are primarily cerebral in origin, the ocular symptoms are of so dominant a nature that a large percentage of sufferers first consult the ophthalmologist, and it is surprising how few ophthalmologists have a sympathetic understanding of the disorder or can even recognize its symptoms. A complaint of headache, if carefully analysed, will frequently reveal associated visual disturbance, slight or severe nausea, an aura which may vary from a vague sense of depression to an outstanding burst of physical energy, and a postheadache period of lassitude or mental sluggishness. These are the symptoms of migraine and they vary tremendously in intensity and duration. Further inquiry will almost always demonstrate a period of tension, anxiety, frustration, or other psychic trauma preceding each attack. The association of peptic ulcer with a migrainous history is too common to be mere coincidence.

I have observed two cases of severe migraine over a considerable period of time in which I could easily demonstrate visible

vasoconstriction in the retinal arterioles during the aura preceding the attack and continuing on into the period of preheadache hemianopia. In numerous other instances I have found overwhelming evidence of emotional disturbance and I am completely in agreement with Wolff's[26] observation that subjects with migraine show certain typical personality features and reactions. It has been my observation that most migrainous patients show strong evidence of a vasoneurotic diathesis. Most of them are overly conscientious. They accept responsibility but only at great cost to their peace of mind. They often suffer from insomnia. The incidence of migraine is greatly increased during periods of stress, notably during the last war.

It is now, I believe, generally accepted that migraine is a vasospastic disorder; that the preheadache scintillating scotoma and homonymous hemianopia occur as the result of a severe cerebral vasospasm, and that the compensatory vasodilation produces the headache.

Even the somatists, with their elimination diets, have come to feel that the allergic reaction is a vasomotor one, and those who are using the trypan-red, vital, staining-dye method of treatment concede that its action is to lower vasomotor tone.

Psychiatric treatment of migraine subjects is admittedly difficult but, if the condition is recognized as a vegetative neurosis, much progress will have been made toward its relief.

Glaucoma

This is one of the most fascinating of all subjects from the standpoint of psychosomatic interrelationships in ophthalmology.

The importance of the psychic factor in glaucoma is recognized by every ophthalmologist. Many authors[2, 3, 27, 28] have cited instances of psychic precipitation of single attacks of acute glaucoma and almost every ophthalmologist can duplicate these case histories from his own records.

If it is assumed that attacks of acute glaucoma may be precipitated by psychic shock, is it not also possible, as suggested by Sussmann,[29] that the latent disposition toward glaucoma has its causal basis in the unconscious life?

More and more evidence is being accumulated to show the close relationship between the intraocular vascular circulation, the secretion of the intraocular fluid, the level of intraocular pressure, and their control by autonomic nervous system.

As has been pointed out above, our present knowledge of the anatomic and physiologic connections of the autonomic nervous system with the higher cerebral centers through the hypothalamus makes it logical to assume a direct effect on intraocular pressure by these higher centers. Certain it is that there are many aspects of glaucoma which cannot be explained by the purely mechanical theories of aqueous drainage.

In an extremely interesting recent study of personality patterns in 27 selected cases of primary glaucoma Hibbeler[30] has demonstrated that more than two thirds of the patients showed marked deviations on one or more of the personality scales as measured by the Minnesota Multiphasic Personality Inventory. In many instances, the personality deviations were so severe as to suggest behavior bordering on the psychotic.

Schoenberg[2, 3, 31] contended that the eyes of some patients with glaucoma registered states of anxiety which acted as a precipitating factor for the development or maintenance of a high intraocular pressure. He argued from this that some of the glaucomatous crises are therefore preventable by proper attention to the patients' emotional life. He stated that ophthalmologists must familiarize themselves with the fundamentals of psychoanalysis and psychotherapy and must become interested in the personality problems of their patients, and that a somatic diagnosis without a survey of the patient's emotional life is an incomplete diagnosis.

I am in complete agreement with these statements of Dr. Schoenberg, although I believe he was somewhat conservative in limit-

ing his thesis to the precipitation of glaucomatous crises in previously glaucomatous eyes by anxiety states. It is my belief that chronic emotional disturbances may play a definite part in the progress of a primary glaucoma without reference to congestive failure or crisis.

For this view I anticipate criticism and repeat my statement from an earlier paper,[4] "It is not my purpose to advocate the thesis that glaucoma is a purely psychosomatic disorder or to prefer psychotherapy over all other forms of treatment in glaucoma. I feel, however, that psychic trauma may be an important causal factor in many cases of glaucoma and that its recognition will lead to a more rational and complete therapy of the disease."

Summary

Ophthalmologists have not appreciated or availed themselves of the recent advances in psychodiagnosis and psychotherapy as they apply to their specialty.

The fundamental differences between conversion symptoms and vegetative neurosis are discussed.

The following ocular disturbances of psychogenic origin are described and discussed.

I. Ocular conversion symptoms
1. Blepharospasm
2. Convergence spasm
3. Asthenopia
4. Photophobia
5. Hysterical amblyopia and amaurosis

II. Ocular vegetative neuroses
1. Ciliary spasm
2. Amaurosis fugax
3. Central angiospastic retinopathy
4. Migraine
5. Glaucoma

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THE INFLUENCE OF TORSIONAL MOVEMENTS ON THE AXIS OF ASTIGMATISM*

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A number of recent publications[1-3] dealing with changes of the axis of astigmatism have aroused new interest in this problem. These changes concern either those resulting from effort to maintain fusion for distance or those brought about by convergence. The present investigations were undertaken with the former changes in mind, and a simple method of examination will be suggested. However, in order to evaluate this problem in its true perspective, it seems appropriate to scrutinize the complex mechanism of torsional movements of the eyes. Only by recapitulating the physiologic principles involved is one able to draw any conclusions as to the importance of the relatively small part that the abnormalities in question play.

A number of coördinated movements of the eyes that can be performed voluntarily can be differentiated. There are two main groups, the conjugate and the disjunctive movements. To the former group belong levo- and dextroversion, elevation and depression; to the latter, convergence and divergence. A number of movements should be added that can be performed under certain conditions only, and that cannot be called voluntary per se: Abduction and adduction (or prism divergence and convergence), and supra- and infraduction (sursum- and deorsumvergence). All these movements can be performed from the primary position. Rotations around the transverse axis involve the "angle of altitude," those around the vertical axis are relative to the "angle of azimuth." Movements around these axes are referred to as "cardinal movements," and the positions reached as "secondary positions." The eyes are not restricted to cardinal movements, and can be rotated in any oblique meridian. But, in any event, they will have to rotate around an axis that is perpendicular to the line of fixation, as formulated in Listing's law: "When the line of fixation passes from its primary to any other position, the angle of torsion of the eye in this second position is the same as if the eye had ar-

*From the Department of Ophthalmology, Northwestern University Medical School. Aided by a grant from B. Spero for the Sanford R. Gifford Memorial Fund.

rived at this position by turning about a fixed axis perpendicular to the initial and final positions of the line of fixation."[4] The term "torsion," as used by Listing needs clarification: It does not indicate any actual rotation around the anteroposterior axis but rather a position of the globe. Peter[5] suggested "false torsion," a name that does not help to clarify the situation.

True torsions, that is rotations around the anteroposterior axis, are, of course, of extreme interest in connection with the problem under discussion. It is obvious that if such a rotation should take place, and the eye happens to be corrected for astigmatism, the axis of the astigmatism that coincides with that of the cylinder in the primary position will assume an angle after it has performed a wheel movement. Theoretically two types of movement are possible: A conjugate form if both globes rotate in the same direction, and a disjunctive form if they rotate in opposite directions. Neither one of these movements can be voluntarily performed from the primary position.

There are three ways to induce torsional movements:[6] The most obvious, static-dynamic procedure—that is, turning of the head—is not suitable for experimental work. Obviously tilting of the head not only causes rolling of the globes around the anteroposterior axes; it also calls for compensation of a vertical imbalance created by this type of movement. Besides, only conjugate torsion can be produced, and the disjunctive rolling that is most important in connection with our present investigation cannot be induced in this manner.

A second method is to create torsion optokinetically. This means was employed by Brecher,[6] who had the subject observe rotating wheels that were provided with alternating white and black sectors in a haploscope. Up to a certain speed, and for most observers, a rotary nystagmus was produced similar to horizontal nystagmus elicited by a drum provided with black and white vertical stripes and rotating around a vertical axis. If the speed of the wheels exceeded a certain maximum, the torsional movement of the eyes became sustained. Depending on the direction of the rotation of the two wheels, the rotary nystagmus—and torsion—was either conjugate or disjunctive.

The method most frequently used to study torsional movements, however, is through actuation by optical means. Most frequently one or the other modification of the haploscope is used.[7-11] Helmholtz[12] described a rather ingenious device to cause rotation of objects. Two right-angle isosceles prisms are held in front of one eye in such a manner that the surfaces of the hypotenuse are parallel but in opposite directions. Since objects viewed with such an arrangement undergo a double inversion (left to right by one prism, and vertical inversion by the other) they appear in an unaltered position. If the two prisms are rotated around their common axis, an apparent rotation can be effected. Helmholtz was able to compensate for a rotation of up to 7 degrees. The most recent, and at the same time the most accurate, investigations have been undertaken by Ogle and Ellerbrook[13] by means of the space eikonometer.

The idea that prompted all these investigations was to determine in the interest of binocular vision whether the eyes would follow any rotation that the objects underwent. If such vision is maintained, this may be due to fusion without any torsional movements of the eye, or the eyes may execute the same amount of torsion as the object viewed. A third possibility is a combination of the two: The torsion of the eyes lags behind the rotation of the objects, and the difference is supplied by fusion.

In the first instance the image points would have to fall on corresponding areas of both retinas. Corresponding retinal areas are a function of two lines: The horizontal line of separation (Ruete) or the horizon of the retina (Helmholtz), and Ruete's vertical line of separation (Helmholtz' apparent vertical meridian). It is only necessary

to state the longitudinal and latitudinal deviation in order to express the exact position of any point on the retina. If the two positions are identical, the retinal points are corresponding; otherwise they are disparate (Fechner). It should be recalled that the torsional movement would take place to fuse the two vertical lines in (a) the two horizontal lines in (b) should include an angle. Actually they form a continuous line as in (c).

No torsional movement is necessary for this effect but fusion of the disparate points

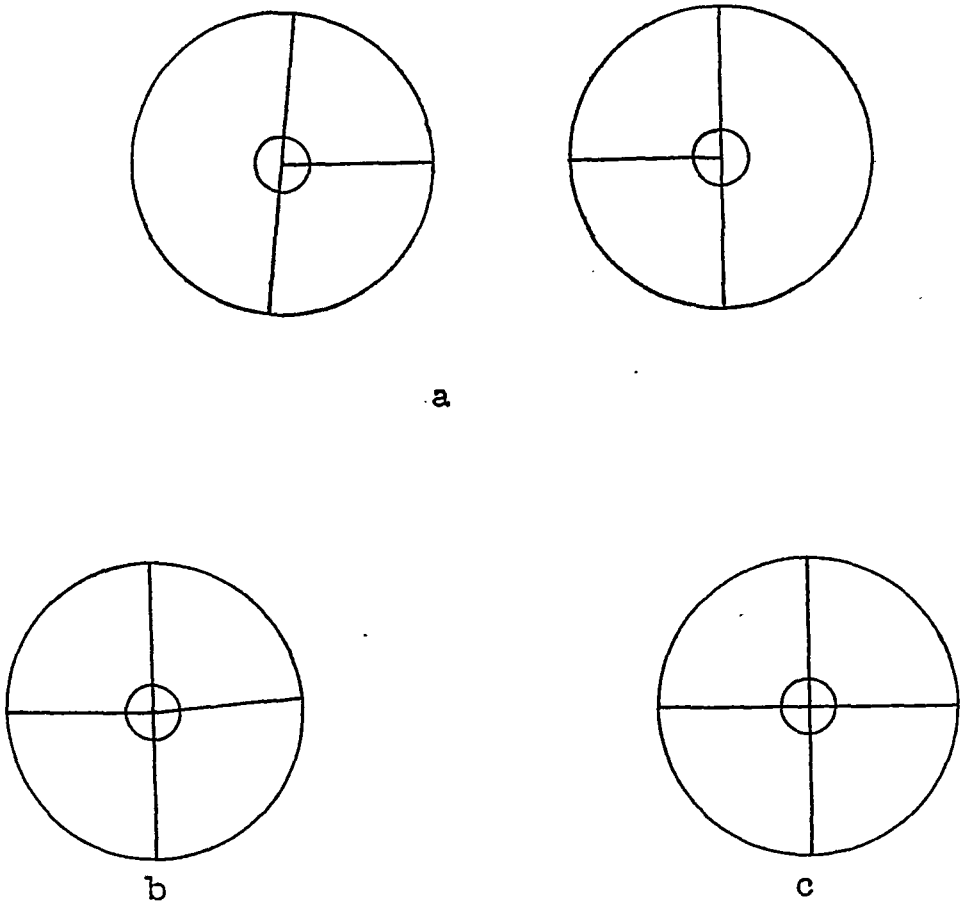


Fig. 1 (Van Wien). Fusion of the two circles in (a) will result in one vertical and one horizontal straight line (c). The vertical line declines forward. This is due to cyclofusion of the two vertical lines and not due to cyclotorsion which would result in an angulation of the horizontal line (b).

vertical lines of separation do not coincide with the geometrical vertical line: The upper ends tilt outward from 0-1° 30′.[14] The only plausible conclusion that can be drawn from this fact is that, in most instances, it is impossible for all points on a vertical line to fall upon corresponding points of the two retinas. Most investigators seem to agree that the eyes actually perform cyclotorsional movements.[7-9,11-13,15-16] Verhoeff[17] in his earlier publications doubted that cyclotorsion actually occurred. He argues that if (fig. 1), of the two vertical lines will result in one single line. It should be noted that the declination of the two vertical lines impresses stereoscopically as an inclination; that is, the upper part appears to be closer to the subject. An even stronger argument was introduced by Verhoeff when he pointed out that cyclotorsion could not possibly account for fusion in the case of the two curved lines illustrated in Figure 2.

Again, the resulting single vertical line can only be explained as being the product of

fusion of disparate points and, consequently, a stereoscopic illusion prevails.

Years later, Verhoeff[10] repeated Hofmann's and Bielschowsky's[11] experiments. There was a modification in the setup, but he employed printed texts as objects, and, this time, he reached almost complete agreement with their conclusions. He considered cycloduction a normal function of the eyes but took great pain in emphasizing that single or multiple lines accord but a feeble stimulus to cycloduction. Printed words are much more effective, and this was the reason why he could not convince himself in his earlier work of the existence of this phenomenon. His maximum range of eso-cycloduction (printed words serving as a stimulus) was 5 degrees, the maximum range of exo-cycloduction was about 4.5 degrees. This contrasts with 20 degrees mentioned by Hofmann and Bielschowsky. What seems to be most significant, Verhoeff was able to demonstrate that maximal cycloduction is always less than the angular deviation of the stimuli required to produce it. It was already noted by Nagel[7] that wheel motions do not exceed 5 degrees for each eye (a total of 10 degrees for both eyes). Ogle and Ellerbrook again report that the torsional movements of the eyes can, to a varying extent, lag behind the angular deviation of the object. According to Hofmann and Bielschowsky, vertical and torsional compensation is relatively slow as compared to the very rapid abduction and adduction. In other words, if cyclofusional movements lag behind the angular deviation at first, they may be rather complete after a certain time interval. Both eyes participate in the rolling, even if the object is rotated for one eye only (Hering).

To summarize, and in answer to our original question, it can be stated that angular displacement of objects can be compensated for by all three possible means; that is, no cyclotorsion at all, only partial cyclotorsion, or cyclotorsion to the exact extent of the angular displacement of the object. Whereas, in the first two instances fusion of the disparate retinal points will guarantee single vision, in the last instance the retinal images will fall on corresponding points. Fusion of disparate retinal points will give rise to stereoscopic vision. It should be remembered, as Ames[9] has pointed out, that only vertical diameters go into perspective. While the human brain has the capacity to interpret noncorresponding retinal areas along the vertical diameter as fused, if they can be interpreted as a single object in perspective, the fusion of rotated horizontal diameters is based on what he calls "corresponding fusional sectors."

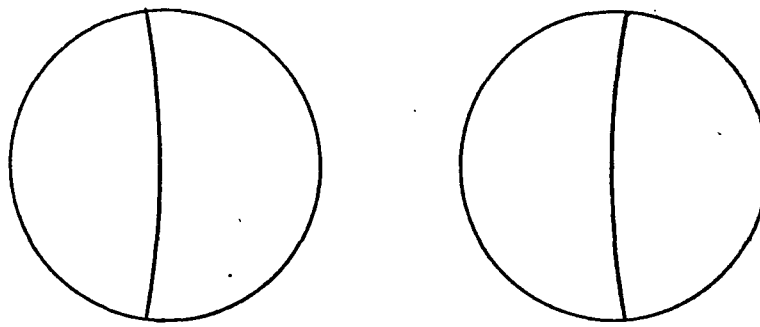


Fig. 2 (Van Wien). Fusion of the two curved lines to produce an image of a single vertical line convex to the observer is entirely possible but cannot be explained by torsional movements of the eyes.

The torsional movements discussed so far are forced and unnatural. They can be produced by special arrangements only. It has been necessary to discuss them in order to understand more clearly those that do actually occur under physiologic conditions:

Compensatory movements in instances of cyclophoria and torsions encountered in deviations from the primary position of the globes.

Savage,[18] in his original report in 1890 on what Price later called "cyclophoria," spoke of "insufficiency of the obliques." Although he deserves full credit to recognize this syndrome first, his explanation is based on false premises: A weakness of an oblique muscle would not only result in cyclo- but also hyperphoria.[19] Also, his statistics as to the occurrence of cyclophoria in 25 percent of cases during convergence as an anomaly is open to discussion,[20] and will be dealt with later.

Cylcophoria usually is not included in routine tests for muscle imbalances. This may have two reasons: Firstly, there is no satisfactory treatment for this anomaly; secondly, no treatment is indicated since cyclophoria, usually, does not cause any symptoms. There are two noticeable exceptions to this rule, namely the combination of cyclophoria with high degrees of astigmatism, and "pseudo-cyclophoria" (Savage) that is induced by oblique astigmatism. Peter[21] prefers to call the latter "accommodative" cyclophoria in order to harmonize with terms applied to other subdivisions of heterophoria. This type, accommodative cyclophoria, is considered first.

For an eye suffering from oblique astigmatism or one that has been made astigmatic by a cylindrical lens at an oblique position, the image focused on the retina will lean toward the maximal corneal meridian. In Figure 3a, a cross is formed by a vertical and horizontal line. Let this cross be viewed by a right eye through a strong minus cylinder at axis 135°. Both the vertical and horizontal lines will lean toward the axis of the cylinder, resulting in a displacement illustrated in Figure 3b.

This phenomenon was first described by Maddox.[22] Its explanation seems fairly obvious. In the cited instance the eye has been made hyperopic in the 45-degree meridian (it requires a plus cylinder to correct the minus cylinder at axis 135°). With the 45-degree meridian positive, the 135-degree meridian is relatively negative. Along the 45-degree meridian, therefore, the refractive power of the eye has the effect of a plus lens, and any object point not coincident with this 45-degree meridian is subject to prismatic displacement. The vertical as well as the horizontal line in Figure 3a increase their distance from the effective power of the meridian toward the periphery. According to Prentice's rule, both lines will undergo a continuously increasing displacement away from this 45-degree meridian. The negative principal meridian at 135-degrees, on the other hand, has the opposite effect, that of a prism with the apex along its course, and will displace the vertical and horizontal lines toward it, thus in-

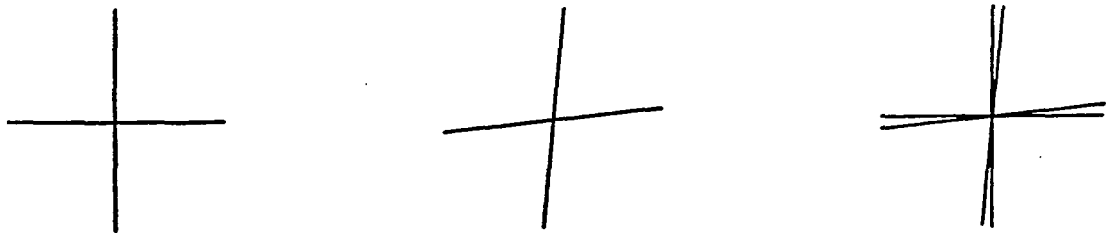


Fig. 3 (Van Wien). A true 90-degree cross as in (a) appears to an astigmatic eye as a skewed cross as in (b); if superposition without fusion could occur, the resultant image would be that of (c).

tensifying the action of the positive principal meridian. In binocular vision, and with the left eye emmetropic, the superimposed retinal pattern will appear as in figure 3c, that is, the two retinal images will not fall upon corresponding retinal points. What is more, they cannot be made to coincide simultaneously by wheel motion. According to Maddox, either intorsion will be necessary to bring the vertical lines into the same position, or extorsion to guarantee the same result for the horizontal lines. This explanation has been accepted by the majority of authors.

Only Verhoeff[10] has pointed out that coincidence could be obtained by fusion instead of wheel motion. His reasons have been given earlier in this paper. It is easy enough to determine what happens if Figures 3a and 3b are brought together by fusion: It is impossible to fuse the horizontal lines (unless they are very short, and include a very small angle). The vertical lines can be fused quite easily but the upper end of the fused line will appear tilted forward. This should prove beyond the question of a doubt that this fusion is not brought about by a cyclotorsional movement that would bring corresponding retinal points to coincide. In that case, no stereoscopic illusion would prevail. Only fusion of disparate retinal points will bring about such a result.

It is easily possible to repeat Hofmann's and Bielschowsky's experiments (they also formed the basis for Verhoeff's later investigations) without any special arrangements. With very little practice one can learn to suspend convergence, and fuse identical or nearly identical objects without the aid of a haploscope. Two squares containing the same text are brought into a position where it is possible to fuse them. If these two squares are rotated slowly in opposite directions (either toward or away from each other), single vision can readily be maintained. The motion has to be slow, and only 2 or 3 degrees at a time. If each of the squares is marked with a cross in identical position, there will be only one cross and, after fusion is maintained for a few seconds, no stereoscopic effect will be perceived. This, then, would indicate true wheel motion, that is the two crosses fall upon corresponding retinal points (fig. 4).

The same experiment is now repeated, this time with the two lines forming one cross being declined as it would appear to an astigmatic eye. If the two squares are rotated

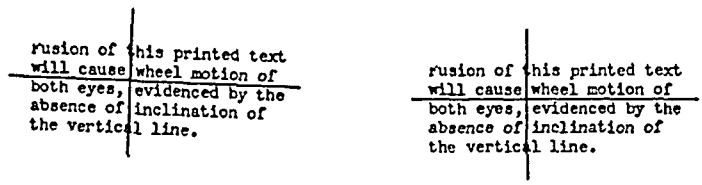


Fig. 4 (Van Wien). This would indicate true wheel motion—the two crosses fall upon corresponding retinal points.

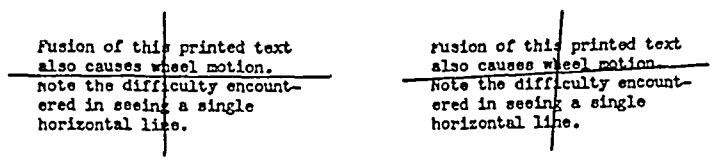


Fig. 5 (Van Wien). If the two squares are rotated toward each other, and the torsion of the two eyes lags somewhat behind that of the targets, the vertical lines will fall on corresponding, or nearly corresponding, retinal areas, and there will be no stereoscopic illusion with regard to these lines.

toward each other (fig. 5), and the torsion of the two eyes lags somewhat behind that of the targets (as is the case, according to Verhoeff), the vertical lines will fall on corresponding, or nearly corresponding, retinal areas, and there will be no stereoscopic illusion with regard to these lines. The horizontal lines are within Ames's "fusional sectors," and, consequently, will be seen singly but not in perspective. Similarly, in extorsion only the vertical lines need actual fusion. However, in that case, inclination of that line will be noted.

For practical purposes, the "induced" type of cyclophoria does not represent any therapeutic problem at all: Correction of the astigmatic error will eliminate it. The combination of astigmatism and essential cyclophoria introduces a different problem. Routinely, the axis of astigmatism is determined monocularly. However, a wheel motion will take place during the act of binocular vision causing a discrepancy between the axis of the astigmatism and that of the correcting lens. It was this problem that prompted the present investigation. A method to correct this form of "induced" cyclophoria will be suggested later.

In dealing with positions other than the primary, it is necessary to consider conditions prevailing during convergence. Hering,[23] prompted by studies of Meissner, v. Recklinghausen, Volkmann, Helmholtz, and Donders, demonstrated that Listing's law does not apply to positions reached in either symmetrical or asymmetrical convergence. Rather are the vertical meridians declined further outward, or, respectively, less inward in symmetrical positions of convergence than is required according to Listing's law. This deviation increases not only with the increase of the angle of convergence but also with an increase in the depression of the visual plane and in extreme instances reaches almost 5 degrees. In asymmetrical convergence that amount of torsion is very similar to that resulting from equally strong symmetrical convergence. Rarely is there a divergence of the lower ends of the vertical meridians.[24] A striking way to demonstrate this phenomenon is by the following three experiments:

1. With a pencil held vertically but below the level of the eyes, and with this pencil viewed by depression of the eyes without corresponding movement of the head, diplopia can be produced by relaxing convergence. If the two images are then allowed to fuse slowly, it will be noted in most instances that the lower ends touch first, forming a V. Only as fusion is completed will the upper ends touch, resulting in one single pencil in exactly vertical position.

2. If the pencil is held as described, but the depressed vision obtained by head movement, the phenomenon just described is likely to occur but with a decrease in the angle between the two images.

3. If the pencil is, however, held in the vertical plane whether at eye level, or below eye level with depressed vision obtained by head movement, then the declination cannot be observed, and the two images will appear parallel and approach each other in that manner.

This form of cyclotorsion should be considered physiologic (perhaps in the same light as exophoria for near). While undoubtedly cases may exist that are of pathologic origin, as some of those reported by Hughes,[2] it would seem that most of the cases included in Sugar's[3] series are of the physiologic variety. This type of cyclotorsion should hardly ever give cause to visual discomfort because, as mentioned before, it depends not only on the angle of depression of the visual plane but also on the angle that the visual lines form with the plane of the object, and will be minimized if they form a right angle. It is reasonable to assume that the subject, in the process of reading, will instinctively hold the reading material in the most favorable position.

Conjugate torsion of the eyes, as a compensatory movement to the tilting of the head, was denied by Helmholtz,[25] provided

the position of the line of fixation relative to the head remained unchanged. In commenting on this statement by Helmholtz, v. Kries[26] in his notes cites Javal, A. Nagel, Mulder, Skrebitzky, Woinow, Donders, and W. Nagel, all of whom proved the actual existence of such a compensatory mechanism. However, it "amounts to only a small fraction of the inclination of the head. This fraction which is compensated by the opposite rolling of the eye is about one-fifth when the rotations are slight, and gets as low as one-tenth when the rotations are considerable.*"

Depending on the amount of astigmatism, even such a slight discrepancy between the axis of astigmatism and that of the correcting lens must lead to considerable blurring of vision. Glasses, of course, will exactly follow the tilting of the head. For all practical purposes, however, this condition will hardly ever give rise to any discomfort because, under ordinary conditions, the head is not inclined but held in an erect position.

From the discussion thus far it should have become evident that the only instance where a shift of the axis of astigmatism is of importance is when it occurs in connection with essential cyclophoria. These cases are met with not too frequently; nevertheless, ever so often, a patient with strong cylinders will obtain excellent vision monocularly but complain of blurring or tilting of objects after he receives the new correction. It is this type of case that should benefit from an examination under binocular conditions.

Method

A sheet of polaroid filter is used to cover half of the smallest line that can be read with ease on the visual-acuity chart. Another polaroid film is mounted between two thin glass plates in the frame of a trial lens. It is easy to determine that position of the trial lens that blacks out the portion of the visual acuity chart that is covered. The vertical or horizontal axis of that position is marked on the trial lens. It can be inserted in the trial frame with the patient's correction. To insure proper alignment it is preferable to use a phorometer or phoropter. With the polaroid lens in front of the eye not under investigation, binocular vision is guaranteed. At the same time, this eye cannot see the small area that the eye to be examined observes. Copeland[27] has suggested to use a strong plus lens to obtain the same result. However, with Copeland's method, if the lens blurs the vision sufficiently, there is no stimulus for binocular vision and, therefore, the method outlined here may prove superior. The eye not examined, and with the polaroid lens in place, is screened by an opaque cover, and the axis of astigmatism determined carefully with the cross cylinder. Next, the screen is removed and the axis determined again, this time under binocular conditions. Any shift in the axis of astigmatism thus will become evident. This procedure is repeated for the other eye.

Since a combination of cyclophoria and high astigmatism causing clinical symptoms is not too frequent, a series of patients that showed astigmatism of 1.5 diopters or more was chosen at random. In addition to determination of the axis of astigmatism under binocular conditions, a test for cyclophoria for distance only was performed with two Maddox rods in vertical position. The two horizontal streaks of light were separated by 8 prism diopters of vertical prism evenly distributed between the two eyes.

Results

A total of 46 patients were examined. It was felt that, if the cylinders were below a certain strength, slight changes of the axis would be too insignificant to be appreciated; 1.5 diopters was, therefore, chosen as the smallest cylinder. Most cases were considerably higher, the average being 3.61D. Twelve

* It is a daily experience of every refractionist that patients try to correct a wrong axis by tilting the head. Only a compensatory rolling of the eyes can succeed in altering the relation between the axis of astigmatism and that of the cylinder.

patients had astigmatism of 1.5D. or more in one eye only. In these cases, only the eye with the high cylinder was examined. The other eye was neglected, and was not included in determining the average strength of astigmatism.

In 39 cases no variation in the axis of either eye was shown; neither was there evidence of cyclophoria. Among three cases, cyclophoria of 2, 2.5, and 4 degrees could be demonstrated. In these, the axes remained unchanged during binocular examination. Two cases showed a shift in the axis of one eye of 5 degrees and 15 degrees respectively. The strength of astigmatism in the first instance was 1.5D. in the second 2.0D. In one case, the right cylinder of 3.75D. shifted from 15 degrees monocularly to 8 degrees binocularly. The left cylinder of 3.0D. changed from 165 to 170 degrees. This was a disjunctive rolling as could be expected in compensation for cyclophoria. No such anomaly could be demonstrated. Only one patient had a cyclophoria of 2.5 degrees in the left eye (there definitely was no tilting of the right eye when tested with the Maddox rod), and a shift of 5 degrees of the left axis during binocular test. The strength of astigmatism of that case was 4.0D.*

Summary and Conclusions

In evaluating the importance of torsional movements of the eyes it is necessary to examine first those that are forced by experimental methods. They can be produced optokinetically, or by optical means—that is, by prisms—a method suggested by Helmholtz, by various modifications of the haploscope, or by the space eikonometer. It can be stated at present that rolling movements of the eyes do result under such arrangements. However, the amount of rolling does not necessarily have to equal that of the targets employed, and, at its maximum, does not exceed 5 to 10 degrees. If no strong stimulus for fusion is present—that is, a printed text—cyclofusion may take the place of cyclomotion. Unless the torsion of the globes equals that of the targets, a stereoscopic effect in the form of inclination will be observed.

From the clinical point of view this type of wheel motion is of no importance as it does not occur under physiologic conditions. However, a number of problems are met with by the refractionist in his daily routine that should be clearly understood. All these problems have in common the correction of astigmatism since, obviously, a cylindrical correction cannot follow torsional movements of the eyes. Fortunately, the one anomaly that has to be dealt with most frequently, namely cyclophoria induced by astigmatism "off axis," does not present any problem at all: The correction of the astigmatic error simultaneously eliminates the necessity for overcoming the induced cyclophoria. If uncorrected, this anomaly is all the more annoying because the vertical and horizontal axes are not displaced in the same direction but toward each other thus making virtually impossible compensation by actual torsion; this is responsible for the headaches caused by the continuous effort of cyclofusion.

Torsional movements of the eyes with an accompanying shifting of the axes of astigmatism have been observed to occur as a result of changing fixation of distant objects to those at reading distance. This fact is not so much due to convergence as to the depression of the visual axes that occurs simultaneously. If the line of fixation and the plane of the reading matter form a right angle, the amount of torsion is minimized or eliminated. This optimum position will be—more or less unconsciously—assumed during the process of reading. For wearers of a bifocal correction, the plane of the glasses does not form a right angle with the line of fixation. In the case of a high cylindrical correction, a certain amount of "accommodative" cyclophoria is introduced. This accounts for

* A change in the axis of astigmatism amounting to less than 5 degrees was neglected because it was considered to be within limits of error.

the large number of individuals with astigmatic eyes that are unable to wear bifocal glasses comfortably for near work and have to be provided with two pairs of glasses.

The number of patients with actual cyclophoria is small. They are the ones that need special consideration if at the same time they need astigmatic correction. Routine refraction is performed monocularly and, during the act of fusion, discrepancy between the axis of astigmatism and that of the correcting lens results. Most ophthalmologists perform tests for muscle balance routinely with every refraction. It is suggested to include a test for cyclophoria in all cases of high astigmatism. Should there be such an anomaly present, the determination of the axes of astigmatism binocularly can be performed without elaborate equipment by means of polaroid filters and in minimum time. This small extra effort on the part of the refractionist may cut down materially the number of patients that complain of tilting or distortion after they get their glasses.

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TREATMENT OF DELAYED POSTOPERATIVE FORMATION OF THE ANTERIOR CHAMBER*

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Delayed formation of the anterior chamber following cataract surgery is by no means a rare complication. There is, however, a surprising lack of information regarding it in the medical literature. This article was prepared in an attempt to organize some of the available information on the subject and to present methods of treatment of the condition, one of which is original with the author. This original procedure has only been used in two cases, but was so effective that it is reported in the hope that it will be tried by others so that final evaluation can be made.

SURVEY OF LITERATURE

Textbooks on eye surgery are of little assistance in the care of the patient with delayed formation of the anterior chamber. Berens[1] and Wiener and Alvis[2] do not mention the condition. Stallard[3] mentions it but does not discuss its treatment. Spaeth[4] states that delayed closure of the wound and nonformation of the anterior chamber are rather commonly seen, but he gives the impression that it is a complication of rather minor importance and provides no statistics as to its incidence.

Bracken[5] found, in a series of intracapsular extractions using corneoscleral sutures, that only 0.28 percent showed shallowness or absence of the anterior chamber at the first dressing the morning after operation. This figure may be a bit misleading because the patient may have a reformed anterior chamber at the first dressing and lose it later.

McCool and Dickey,[6] in reporting the results of 100 cases of intracapsular cataract extractions, reported four cases (4 percent) having delayed wound union of over one week's duration.

Kronfeld and Grossman[7] made a study of 120 unselected cataract extractions and found that in 20 instances (16.7 percent) there was a delay of more than three days in the formation of the anterior chamber and in 11 instances (9.2 percent) there was a delay of more than five days.

Castroviejo[8] stated that in a series of 150 cataract operations, using corneoscleral sutures, only two cases of late restoration of the anterior chamber occurred. Townes[9] in his review of 500 cases of cataract extraction, reports one case of delayed wound healing of eight days' duration, but states his records are incomplete in so far as delayed formation of the anterior chamber is concerned.

Due to a peculiar series of circumstances, which will be detailed below, there were five cases of delayed formation of the anterior chamber in a series of 60 cataract operations (8.33 percent) performed between January and June, 1947.

SEQUELAE OF DELAYED FORMATION

Management of the condition is important because of the unfavorable effects of the absence of the anterior chamber with its threat to future vision. The most important complications are iritis, iridocyclitis, secondary glaucoma, epithelial cyst of the anterior chamber, and choroidal detachment. Infection entering through the opening in the wound may also occur.

In discussing Heath's[10] paper, Dunnington[11] states that the usual course of events when the anterior chamber fails to reform is:

1. Hypotony
2. Detachment of choroid and retina
3. Corneal opacification
4. Secondary glaucoma

* Presented before the III Pan-American Congress of Ophthalmology, Havana, Cuba, January 6, 1948.

Iridocyclitis

No figures are available on the incidence of iridocyclitis due to delayed formation of the anterior chamber alone. The relationship of iridocyclitis to postoperative glaucoma and of delayed formation of the anterior chamber to postoperative glaucoma make the following figures of interest.

In Townes's[9] series of 500 cataract operations there was an incidence of iridocyclitis of 5 percent following intracapsular cataract extraction and 10.7 percent following extracapsular extraction.

Hughes and Owens[12] in an analysis of 2,086 cataract operations found a similar decrease in iridocyclitis with the intracapsular operation and stated that iridocyclitis is the main factor in the production of secondary glaucoma. Klein[13] in his analysis of 650 operations showed a similar relationship between extracapsular extraction, iridocyclitis, and secondary glaucoma. The incidence of secondary glaucoma following intracapsular extraction in his series was 0.45 percent and following extracapsular extraction, 2.5 percent.

These authors all stress the relationship between iridocyclitis and postoperative glaucoma. However, Kronfeld and Grossman[7] studied a series in which iridocyclitis was not the cause of the glaucoma. In these selected cases the inflammatory postoperative reaction was slight and had either completely subsided or was definitely diminishing in intensity within 14 days after operation. They have shown that the glaucoma which developed was due to the formation of peripheral anterior synechias and that the extent of these synechias was proportional to the length of time the anterior chamber had been flat. Delay in formation of the anterior chamber of over five days resulted in more extensive and denser synechias than those in which the chamber was flat less than five days. If less than five days, the eye was usually able to compensate for the less extensive synechias and maintain normal tension.

Kronfeld and Haas,[14] in a further study confirmed the previous findings that glaucoma was due to the formation of the peripheral synechias caused by contact between the iris and cornea during the period in which the anterior chamber was flat.

Post[15] reported 20 cases of glaucoma following cataract extraction in which 11 cases (55 percent) had shown delayed formation of the anterior chamber for longer than three days.

On the basis of these studies it would appear that anterior chambers which are flat longer than five days are particularly liable to be followed by persistent secondary glaucoma.

Epithelial cyst

Epithelial cyst of the anterior chamber is a serious condition usually leading to loss of the eye regardless of radiation or other therapy used.

Theobald[16] has shown that epithelial downgrowth occurs through poorly healed wounds. In 9 of 14 eyes enucleated for this reason, there was a poorly healed wound. In 5 of these cases the epithelium could be readily traced into the anterior chamber. She reported that 9 of the enucleations resulted from a series of 8,062 cataracts, an incidence of 0.11 percent. There were several eyes in this same series with epithelial cyst of the anterior chamber which were treated by radiation and not enucleated. These were not included in her statistical study.

Townes[9] reports one case of epithelial cyst of the anterior chamber in 500 operations (0.2 percent). Inasmuch as epithelial cyst of the anterior chamber follows poorly healed wounds, delayed formation of the anterior chamber obviously favors its development.

Choroidal detachment

Choroidal detachment is frequently associated with delayed formation of the anterior chamber and was very severe in one of the cases here reported. Spaeth[4] mentions this troublesome complication. As stated by

Heath[10] and Dunnington,[11] it is probable that it is a result of the hypotony produced by the leaking wound, rather than the cause of the flat anterior chamber as has been stated in some of the older literature.

No figures could be found showing the incidence of infection due to delayed formation, but the increased danger with an opening leading into the anterior chamber is obvious.

Causes of delayed formation

Causes of delayed formation of the anterior chamber may be considered under two headings:

1. Decreased production of aqueous by the ciliary body. This was not a factor in any of the cases in this small series. It is believed that, even though an opening cannot be demonstrated in the classical test, practically all cases of delayed formation of the anterior chamber have a leaking wound.

2. Delay in healing of the corneal wound. This may be due to:
   a. Inaccurate apposition of the wound edges when the wound is closed. (Improperly placed sutures may be a factor.)
   b. Interposition of tissue between the margins of the wound—iris tissue, vitreous, lens capsule, and so forth.
   c. External pressure on the eyeball forcing aqueous out through the partially healed wound. This may be due to eyelid spasm, digital pressure, dressings which press on the eye, and straining or coughing.
   d. Decreased tendency of the cornea to heal due to nutritional disturbances.

Causes of delayed formation in this series

1. External pressure:
   a. One case due to premature removal of a corneoscleral suture resulting in slight opening of the wound.
   b. One case due to digital expression of aqueous from the anterior chamber by the patient rubbing his eye with fingers introduced under his dressing.
   c. One case due to a paroxysm of coughing in a case of chronic bronchitis when prophylactic codeine administration was inadvertently omitted.
2. Decreased tendency of the cornea to heal:
   a. One case of impaired corneal nutrition.
3. Undetermined cause:
   a. One case with formation of conjunctival filtering bleb and almost complete choroidal detachment.

Prophylaxis

It has been pointed out that failure of the anterior chamber to reform was due to external causes in three of the above cases. These were premature removal of a corneoscleral suture, rubbing of the eye with a finger, and a paroxysm of coughing. These are preventable causes and obviously every effort must be made to prevent the occurrence of these and similar incidents.

Alvis[17] and Klein[13] have stressed that for rapid and undisturbed healing of the wound, the lips of the incision should be as smooth and close together as possible and that great care should be taken to free the wound of all debris of capsule, iris, cortex, and clots.

In this connection Chandler,[18] Bracken,[5] Hughes and Owens,[12] and Klein[13] have all stressed the reduction in frequency of delayed formation when adequate corneoscleral sutures have been used.

Prevention of this complication is much more effective than its cure and the importance of well-performed operations and good postoperative care of cataract patients should continue to be emphasized.

Symptoms and Diagnoses

All cases in this series complained of some discomfort in the eye and especially of "watering." There was a subjective decrease in visual acuity noticed by the patients if they had had the anterior chamber formed postoperatively and then lost it.

The classical test consists in placing a

drop of fluorescein in the eye with the patient reclining. Very gentle pressure is applied to the cornea with a strabismus hook. If a leak is present, it will be demonstrated by a washing away of the fluorescein solution from the leaking area.

Dunnington[11] states that this procedure will demonstrate a leak in most instances. Chandler,[18] on the other hand, has found that a leaking area cannot be demonstrated in the majority of cases. In this series, the slitlamp, showing the iris against the cornea throughout most of its area, was the best diagnostic aid and the one most useful in formulating the operative procedure to be used.

Technique of the original cataract operation

The original cataract extractions were done by two operators using the same technique. The routine consisted of the usual van Lint akinesia, retrobulbar anesthesia, and subconjunctival blebs of cocaine and adrenalin.

The conjunctiva was incised from the 3- to 9-o'clock positions with a Graefe knife and elevated with Stevens scissors to form a Kuhnt flap. Incisions were made half way through the cornea at the limbus at the 1:30- and 10:30-o'clock positions and two corneoscleral sutures (6-0 black silk) were put in place, looped, and left untied.

The anterior chamber was entered with a Graefe knife and the incision enlarged to include almost the upper one-half of the cornea at the limbus. Iris forceps were inserted and a peripheral iridotomy made with a de Wecker scissors.

In two of the cases the incision was extended through the pupillary sphincter to form a keyhole pupil. In the other three cases the cataract was extracted through a round pupil. The lens was extracted intracapsularly in four cases with the Arruga forceps using a strabismus hook below for counter pressure. In the other case an intentional extracapsular extraction of a traumatic cataract was done.

After removal of the lens, the anterior chamber was irrigated and the iris reposited. Corneoscleral sutures were tied and air was injected into the anterior chamber. The Kuhnt flap was pulled down over the corneal wound and sutured, using two 6-0 black silk sutures.

TABLE 1

Length of time until the anterior chamber was lost: until surgical correction: and until formation of the chamber

Case No.	Original Operation Until Anterior Chamber Was Lost	Anterior Chamber Flat Until Corrected	Anterior Chamber Formed After Surgical Procedure
1	3 days	8 days	next day
2	3 days	9 days	next day
3	6 days	10 days	next day
4	11 days	11 days	next day
5	0 days	12 days	next day
		6 days	next day
		14 days	next day

Eserine and penicillin ointment were instilled and the eyelids splinted with a thin sheet of wet cotton. Eye dressings and a double protective eye mask were applied. The patient was then placed in a crib bed. He was required to remain flat on his back for four hours, after which he was permitted to turn on the unoperated side. He was not permitted out of bed until the eye had been dressed on the second postoperative day.

Careful perusal of the operative techniques did not reveal any demonstrable cause for the delayed formation of the anterior chamber in these cases.

Treatment

No article on treatment of this condition could be found in the literature. In discussing MacMillan's[19] paper, McLean[20] first mentioned using air injection for the treatment of delayed formation of the anterior chamber and it is now being used by a number of other prominent ophthalmologists, including Chandler[18] and Guyton.[21]

Chandler tests the wound for leakage and, if found, cauterizes it with trichloracetic acid or actual cautery. If no leak is found and the chamber has not formed by the seventh postoperative day, air is injected into the anterior chamber.

A small knife is used to make a slanting incision in the lower cornea away from the original cataract incision. It should be 3 to 4 mm. from the point of engagement on the surface of the cornea to the entrance into the anterior chamber over the iris.

A small hypodermic needle on a syringe can be put part way into the tract of the incision but not into the anterior chamber. With the needle in the tract, sharp pressure on the plunger of the syringe will force air into the anterior chamber. The slanting incision acts as a trap door and retains all the air which enters. If the needle is placed all the way into the anterior chamber, much of the bubble will escape alongside the needle.

The air injection restores the anterior chamber and separates the iris from the cornea at the angle. When the air is absorbed, it is usually replaced by aqueous and the chamber remains formed. Inasmuch as all the cases reported in this series had leaking wounds, this method was not used. No statistics on its efficacy could be located.

In those cases in which a leak can be demonstrated in the anterior chamber, Dunnington[11] feels that, as a rule, chemical cauterization is insufficient. He, therefore, places a suture through the leaking area and covers it with a conjunctival flap.

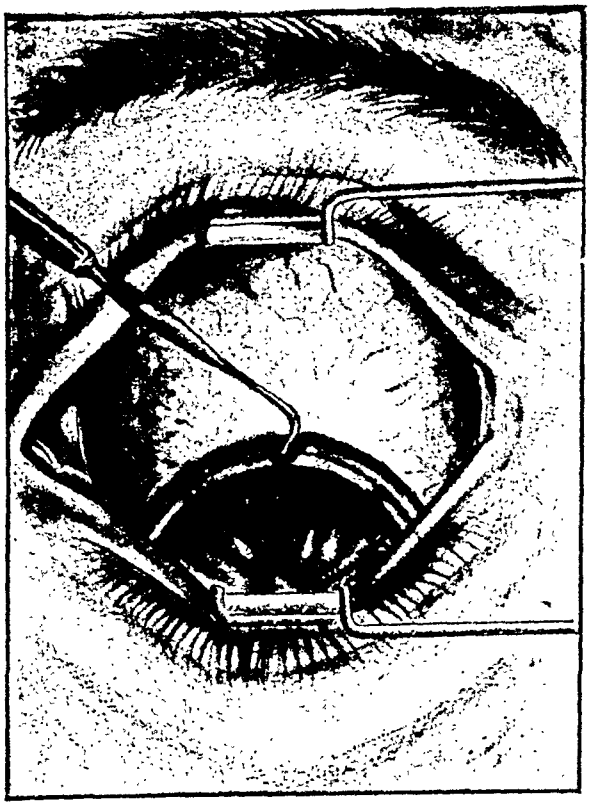


Fig. 1 (Byrnes). In leaking wounds where separation of the surface is minimal, cauterization with a heated strabismus hook will usually produce adequate closure. The conjunctival flap is resutured over the wound.

Surgical procedure followed in this series

This varied somewhat with the case. In all cases the Kuhnt flap was reëlevated. No difficulty was experienced in doing so and in no case was there any resistance or increased friability of the tissues. The wound was exposed throughout its length and in each case inspection alone was all that was required to identify the leaking area.

In three cases the procedure used was to heat a strabismus hook in the flame of an alcohol lamp and lightly cauterize the leaking area of the wound to seal it and stimulate healing. The flap was then replaced in these three cases and sutured in position over the wound. In three cases, the anterior chamber had formed by the following morning and the postoperative course was entirely uneventful.

In Case 4 there was a slightly larger opening in the cornea. The lips of the wound were separated 0.5 mm. for a distance of approximately 1.5 mm. where the corneoscleral suture had been removed at the 10:30-o'clock position on the cornea. It was closed with a single silk suture.

It was felt that a simple cauterization



Fig. 2 (Byrnes). When separation of the lips of the wound has been more extensive or there is a decreased tendency of the cornea to heal, very shallow electrodiathermy punctures along the wound margins and extending beyond both extremities are effective.

would be ineffective. For this reason the 0.5-mm. electrodiathermy needle, ordinarily used for retinal detachment operations, was used. With it, tiny, very shallow punctures were made in the cornea and sclera 1 mm. from the wound edges and extending 0.5 mm. beyond either end.

Thrombin was applied to the wound and the cauterized area and to the under surface of the conjunctival flap. The flap was then reapplied to the wound surface and sutured in position. The anterior chamber was formed the next morning and remained so. It had been flat for the previous 11 days.

Case 5 was one in which it is believed the procedure may be credited with saving an eye. This 84-year-old woman had a nutritional disturbance of her cornea and her anterior chamber failed to form after operation. After waiting 12 days, her corneal wound was exposed and an opening found from the 12- to 2-o'clock positions. The corneoscleral suture had cut through the corneal substance which was grayish in color and soft in consistency.

Two corneoscleral sutures were put in place, and the wound was lightly cauterized with a hot strabismus hook. The original suture at the 10:30-o'clock position was still holding. The conjunctival flap was replaced. On the following morning she had an anterior chamber, which she lost by the next day.

She was reoperated at the end of six days. The suture placed at the original operation at the 10:30-o'clock position had cut through, as had one of the sutures placed at the second operation. The wound was resutured with two 6-0 silk sutures and again cauterized and the conjunctival flap pulled down. Again she had an anterior chamber the following morning which she lost in two days.

Ten days later, she had her final operation in which shallow, tiny electrodiathermy punctures were made in the cornea and sclera, thrombin applied, and the conjunctiva pulled down and resutured. Her anterior chamber was formed the next day and has remained so since.

This eye obviously had a decreased tendency to heal and would probably have been lost if it had not been possible to restore wound continuity and improve corneal nutrition. Waiting periods of 12, 6, and 14 days between operations should have been adequate to allow spontaneous healing to occur.

The use of thrombin under the conjunctival flap was prompted by the experience of Tidrick and Warner[22] in the use of hemostatic agents for the attachment of skin grafts. Perhaps the application of thrombin

to the incision area and fibrinogen to the under side of the conjunctival flap would have been effective in the formation of a firm coagulum and it is planned to use this procedure if another occasion arises. The firm fibrin clot so formed should be effective in sealing the anterior chamber.

Postoperative course

The reaction to operation was in all cases slight and, as a rule, the eyes looked better one day postoperatively than they had immediately prior to operation.

The patients stated their eyes felt much better and they were grateful for the decreased "watering." They also noted improved visual acuity which made them feel more optimistic about their future vision.

It is believed that the improved patient comfort and his earlier recovery alone would compensate for the additional surgical procedure, even without the possible improvement in final visual results and the decreased danger of complications.

Recommended procedure

On the basis of the data presented above it is believed that no anterior chamber should be allowed to remain flat more than five days postoperatively. It is considered that the following is the method of choice in treatment.

1. In cases in which no leak can be demonstrated in the anterior chamber, air should be injected through a slanting incision in the lower cornea as mentioned above.

2. In cases with a demonstrable leak in the wound or when air injection has been ineffective:

   a. Elevation of the conjunctival flap.

   b. Use of electrodiathermy to cauterize the edges of the leaking wound lightly, if these edges are in close approximation. In wider wounds or those in which the cornea has shown decreased tendency to heal because of nutritional disturbances, corneoscleral sutures should be inserted, and the application of very shallow punctures, 1 mm. from the wound edge and about 2 mm. apart, extending beyond the ends of the wound opening is indicated.

   c. Application of thrombin and perhaps fibrinogen to the wound area.

   d. Suture of the conjunctival flap over the wound.

   e. Application of the eye dressing.

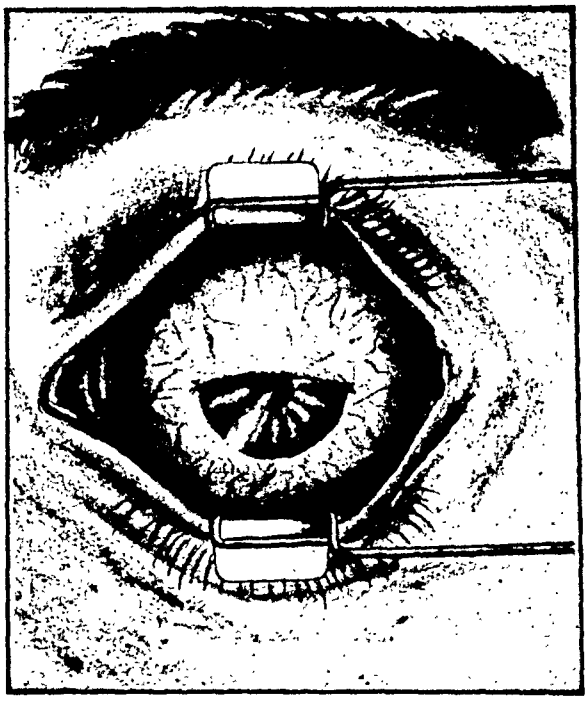


Fig. 3 (Byrnes). The conjunctival flap is resutured over the corneal wound following repair of the leaking area.

Case reports

The following cases are reported in abstract form in an attempt to present only the data which are pertinent to the present discussion. In all cases, laboratory work, unless otherwise mentioned, was negative. Complete eye examinations were done on each patient, but only positive findings are listed.

Case 1.

D. B., a white man aged 63 years.

February 9, 1947. Admitted to the Eye Service from General Surgery for cataract operation O.D. He had a chronic bronchitis with cough which had been improved as much as possible by medical management. He was given codeine (0.032 gm. every 4 hours) to control cough.

February 10, 1947. Combined intracapsular cataract extraction through a round pupil.

February 12, 1947. Eye dressed. Anterior chamber formed.

February 13, 1947. Anterior chamber flat. Patient had a paroxysm of coughing last night when codeine was inadvertently omitted. The patient also admits having inserted a finger under his protective shield to rub his operated eye.

February 17, 1947. Anterior chamber still flat. Choroidal detachment slightly increased. No iris prolapse.

February 21, 1947. Taken to operating room. Kuhnt conjunctival flap reëlevated. There was a small leaking area at the temporal end of the wound. A strabismus hook was heated in the flame of an alcohol lamp and the leaking portion of the wound cauterized lightly. The conjunctival flap was then resutured in position.

February 22, 1947. Anterior chamber reformed. The eye condition good.

March 31, 1947. Eye quiescent. Patient refracted. He has a large central area of chorioretinitis adjacent to the macula. Vision: O.D., 6/12.

This patient's failure to form his anterior chamber was apparently due to a paroxysm of coughing or pressure of his finger under his dressing, or both.

CASE 2.

R. E. S. was a white man aged 82 years.

November 7, 1946. Presented at Eye Clinic complaining of poor vision. Examination showed infiltration of the left cornea with considerable vascularization and slight left exotropia. Some slight corneal infiltration O.D. also. Kahn and Wassermann tests negative. He was given dionin and capsules of riboflavin (3 mg.), ascorbic acid (50 mg.), and nicotinic acid (5 mg.) twice daily.

December 17, 1946. Cornea O.D. now clear. Subjective improvement in vision.

December 31, 1946. Vision 10/200. Eyes quiescent. Lacrimal-sac irrigation and culture negative.

March 3, 1947. Arteriosclerotic vessels and mild central macular degeneration visible. Not well seen because of lens opacity. Admitted to hospital for operation.

March 4, 1947. Operation delayed because of cough and slight fever.

March 21, 1947. Recovered from upper respiratory infection. Intracapsular cataract extraction O.D. through round pupil.

March 23, 1947. Eye dressed, anterior chamber formed; condition good.

March 24, 1947. Choroidal detachment in superior and inferior temporal quadrants. Anterior chamber very shallow.

March 28, 1947. Choroid markedly detached. Tension 3 mm. Hg (Schiøtz); anterior chamber very shallow.

April 1, 1947. Eye still soft with choroid almost completely detached. The conjunctiva appears to be very slightly elevated at the 12-o'clock position; somewhat like the filtering cicatrix seen after a trephining operation. Patient taken to the operating room and the Kuhnt conjunctival flap reëlevated. There was a small leaking area near the 12-o'clock position on the cornea with the lips of the wound in good approximation. There was no prolapse of any kind. The leaking area was cauterized lightly with a heated strabismus hook and the conjunctival flap resutured over the wound.

April 2, 1947. Eye dressed. Anterior chamber formed; condition good.

April 8, 1947. Much improved. Anterior chamber of normal depth. The choroid almost completely reattached.

July 7, 1947. Fundus clear and readily seen. Choroid reattached entirely; eye quiet. Refracted vision 6/12, with macular degeneration present.

This patient apparently had a filtering cicatrix under his conjunctival flap producing the hypotony which he showed. This in turn was probably responsible for the almost daily increase in the extent of his choroidal detachment. The choroid did not reattach until the opening in his anterior chamber was sealed and intraocular pressure was returned to a normal level.

CASE 3

H. V. was a white man, aged 45 years.

March 29, 1947. While hammering on a metal bedstead this patient was struck in the right eye by a fragment. Examination showed a piece of steel (3 by 1.5 by 0.25 mm.) buried deep in the cornea and projecting into the anterior chamber. The lens capsule had been opened by the fragment. The foreign body was removed by electromagnet through the wound of entry. The anterior chamber was irrigated with penicillin solution (1,000 units per cc.), and he was given penicillin parenterally (30,000 units every 3 hours).

April 1, 1947. Eye slightly reddened. No obvious infection; lens has started to swell. No pain. Intraocular pressure 10 to 12 mm. Hg (Schiøtz).

April 4, 1947. Developed pain in the right eye. Tension 35 mm. Hg (Schiøtz). Extracapsular cataract extraction using full cataract incision. This was necessitated by the firm lens material. Incision, sutures, and closure were as described for the other operations.

April 6, 1947. Anterior chamber has reformed.

April 10, 1947. Anterior chamber shallow. Patient states he managed to work his finger under his protective dressing and rub his eye.

April 15, 1947. Iridocyclitis O.D. mild. Keratic precipitates and a 2+ flare present. Iris markings obscured. Started on atropine, salicylates, heat, and foreign-protein therapy. Anterior chamber still flat.

April 18, 1947. Anterior chamber still flat. Operated. The conjunctival flap was reëlevated. There was a leaking area at about the 1-o'clock position. The lips of the wound were cauterized lightly with a heated strabismus hook and the conjunctival flap resutured.

April 19, 1947. Anterior chamber formed. The

eye appears less irritated. Treatment of iridocyclitis continued.

April 21, 1947. Has corneal bedewing, plus-minus flare, no cells, iris markings slightly obscured. He has a pupillary membrane which is chiefly due to the iritis. Discharged to out-patient status to return in three days.

May 6, 1947. Patient finally returned for out-patient observation of his iritis. He has not been using the treatment ordered. Started on iridocyclitis treatment again.

June 17, 1947. The eye is quiescent; not painful or tender; pupillary membrane not touched because of possibility of exacerbation of iridocyclitis. No refraction done.

This patient was one with a traumatic eye with foreign body. His anterior chamber was flat five days before he had a manifest iridocyclitis. Whether earlier repair of his leaking wound would have prevented the onset of the condition is unknown. Certainly the mild surgical interference did not aggravate the iridocyclitis and was apparently beneficial. It was effective in restoring the anterior chamber.

CASE 4

A. P. was a white woman, aged 83 years.

March 18, 1947. Admitted to hospital with severe burns of hands.

April 14, 1947. Transferred to the Eye Service for cataract extraction. Fundus not visualized because of cataract, 2-point discrimination poor.

April 18, 1947. Operation postponed because of fever, cough, and diagnosis of mild pneumonia. Given penicillin by the Medical Service.

April 25, 1947. Cleared by Medical Service for operation. Intracapsular cataract done through a round pupil.

May 5, 1947. Patient, in order to leave the hospital, desired early removal of corneoscleral sutures. One suture carefully removed. Anterior chamber slowly flattened out immediately thereafter.

May 10, 1947. Still has flat anterior chamber. Slitlamp shows only a small central area where cornea and iris are not in apposition.

May 16, 1947. Condition unchanged; taken to the operating room; conjunctival Kuhnt flap reëlevated. There was a leaking area at the 10:30-o'clock position on the cornea where the conjunctival suture had been removed. The wound edges were superficially cauterized, using a 0.5-mm. electrodiathermy needle, and small, very superficial electrodiathermy punctures were placed 1 mm. from the wound margin in cornea and in sclera. These were about 2-mm. apart and extended beyond both ends of the leaking portion of the wound. Thrombin was applied to the wound and cauterized areas and the conjunctival flap was sutured in position over the wound.

May 17, 1947. The anterior chamber has formed.

June 18, 1947. The eye is quiescent. Normal anterior chamber and tension. The media are clear and the fundus readily visualized. There are marked arteriosclerotic degenerative changes present. Vision cannot be corrected to better than 6/120 due to the central lesion.

CASE 5

L. N. was a white woman, aged 84 years.

April 10, 1947. Admitted to the Eye Service because of defective vision. Except for cataracts, her examination was essentially negative. Tension was 19 to 20 mm. Hg (Schiøtz).

April 11, 1947. Combined intracapsular cataract extraction.

April 13, 1947. Eye dressed; anterior chamber shallow, but appears to be formed.

April 16, 1947. Anterior chamber very shallow.

April 23, 1947. There is a mild obscuration of the iris markings and a thin pupillary membrane has formed. Anterior chamber flat. Taken to operating room where the conjunctival flap was reëlevated. There was an opening from the 12- to 2-o'clock position in the cornea where the corneoscleral suture had cut through the corneal substance. The corneal substance was grayish in color, somewhat opaque and soft in consistency. An iris repositor could be readily passed into the wound. Two additional 6-0 silk sutures were put in place and the wound edges lightly cauterized with a heated strabismus hook. The conjunctival flap was replaced.

April 24, 1947. Anterior chamber is formed, but still not as deep as normal.

April 25, 1947. The anterior chamber is flat again. Patient complains of her eye watering.

April 30, 1947. Patient reoperated. Technique used at previous operation was used again. The suture at the 10:30-o'clock position has now cut through the soft corneal substance as has one of the sutures placed at last operation at the 12:30-o'clock position. Resutured with two more 6-0 black silk sutures and again cauterized with a heated strabismus hook and the conjunctival flap replaced. The corneal tissue is still friable and gray in color.

May 1, 1947. Anterior chamber formed. The eye is improved.

May 2, 1947. Anterior chamber shallow.

May 3, 1947. The anterior chamber is flat and patient again complaining of "watering" of her eye.

May 12, 1947. Patient had a cardiac episode; possibly a myocardial infarction. Treatment prescribed by the Medical Service.

May 16, 1947. Patient still has a flat anterior chamber. Taken to operating room and an opening found from the 10- to 12-o'clock position in the cornea. The cornea is still gray, soft, and friable. The same operative procedure, using electrocautery and thrombin, used in Case 4 was used here.

May 17, 1947. The anterior chamber is now formed, but still shallow.

May 22, 1947. Anterior chamber is getting deeper. The eye looks better.

June 3, 1947. Ready for discharge from the hospital. Anterior chamber present. She is not yet ready

for refraction, but her cornea is clearing. After July 1, 1947, she had several attacks of glaucoma with tension, O.D., up to 45 mm. Hg (Schiøtz). This has now recovered.

This case of impaired corneal nutrition is one in which the eye would in all probability have been lost without the surgical procedures employed. If the last operation had been done first, it is quite likely this patient would have had less pupillary exudate formed and might well have escaped the temporary secondary glaucoma which followed the prolonged period of 36 days' duration in which her anterior chamber was flat most of the time.

Summary and Conclusions

1. Absence of the anterior chamber following cataract operation is considered dangerous to the future welfare of an eye because of the possibility of iritis, iridocyclitis, secondary glaucoma, epithelial cyst of the anterior chamber, choroidal detachment, and infection.

2. No anterior chamber should be allowed to remain flat more than five days postoperatively.

3. Surgical procedures have been reviewed which are believed to be effective in the treatment of the condition.

4. An original procedure has been described for use when there is reason to believe there may be a decreased tendency of the wound to heal. It is hoped that others will report their experiences with this method.

School of Aviation Medicine.

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THE USE OF IMMUNE GLOBULIN IN THE TREATMENT OF UVEITIS*

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The treatment of uveitis frequently presents a difficult problem. This disease usually is treated by injection of foreign proteins, by local therapy, and by eradication of any foci of infection. In many cases these procedures do not arrest the condition. A new approach in the treatment of uveitis is the use of the immune globulin.

Immune serum globulin, whether prepared from human plasma or placentas, contains gamma globulin as the active principle. While McKhann and Chu[1] enlarged our concepts concerning the heterogenicity of plasma, researches secondary to the war effort added a great impetus to a more precise understanding of the functions of the various components of human plasma. By electrophoretic means, the heterogeneous nature of plasma could be suspected. The studies of Cohn and his associates[2] made possible the fractionation of plasma, thereby permitting a more accurate study of its various components.

Gamma globulins comprise about 11 percent of the plasma proteins and are found primarily in Fraction II, to a much smaller extent in Fraction III. This component of plasma is thought to have a molecular weight of 156,000 in contrast to 69,000, the weight assigned to serum albumin.

CLINICAL INTEREST

Clinical interest in gamma globulin lies not in its physical constants but in the fact that many of the antibodies elaborated by the defense mechanisms of the body are concentrated in this fraction. Some of these antibodies are those corresponding to the following antigens: typhoid O, typhoid H, influenza A, mumps, diphtheria toxin, and streptococcus toxin. Undoubtedly many others are present which do not lend themselves so easily to identification by biologic methods. In fact, it might appear that the limitations of gamma globulin are determined by the degree of refinement and the multivalence of the plasma pool from which it is derived.

Two epidemic diseases, measles and infectious jaundice, have lent themselves nicely to the exposition of the efficacy of gamma globulin in the treatment and prevention of these diseases. Ordman, Jennings, and Janeway[3] studied the application of this agent to epidemic measles. They showed not only that gamma globulin may be administered without reactions but that it prevented or attenuated the disease in contacts, depending on the size of the inoculum and the duration after exposure when the globulin was administered. Subsequently other reports have justified the confidence in gamma globulin as a therapeutic agent in the treatment and/or prophylaxis of measles.

Stokes and Neefe[4] subsequently applied this principle to the prevention of infectious hepatitis in a children's camp where this disease was prevalent. The figures are more difficult to evaluate because of the greater variability in incubation period, susceptibility, and so forth. With these well-confirmed, practical demonstrations of the usefulness of gamma globulin, it became apparent that clinical exploration in many other diseases might be fruitful. Consequently the present study was undertaken.

TREATMENT OF UVEITIS

The theory upon which I instituted the injections of immune globulin is based upon the fact that the organism requires antibodies to combat infection. In the treatment of uveitis, the function of foreign proteins

* Read before the New York Society for Clinical Ophthalmology, May 5, 1947.

is to stimulate the production of antibodies within the organism itself. It seemed logical to me, therefore, that the patient would obtain greater help in combating the infection if antibodies were supplied directly by injections. For this reason, I used injections of concentrated immune globulin containing both bacterial and virus antibodies.

Results

Encouraging results have been obtained in the treatment of various forms of uveitis by injections of massive doses of immune globulin in conjunction with the use of foreign protein.

Six cases of acute uveitis were treated in this manner, with good results. A detailed report of three of these cases will indicate the method of treatment.

Case reports

Case 1. Mr. W. S., aged 34 years, consulted me first on March 24, 1947. He gave a history of acute inflammation of the right eye of 3 weeks' duration, and of the left eye of 3 days' duration. Diagnosis of acute iridocyclitis of both eyes was made. He had been treated elsewhere with foreign protein, with no result. The patient gave a history of having had an active lung lesion of tuberculous nature in 1935, for which he was treated successfully with a therapeutic pneumothorax in 1941.

This patient was treated by me with triple typhoid injections intramuscularly followed by intramuscular injections of immune globulin for 4 to 5 days. He was then given typhoid vaccine and again treated with immune globulin. This treatment was given for 4 to 5 days; in all, 4 courses of treatment were given.

At his first visit his vision was: R.E., 20/400, L.E., 20/200. By April 29, 1947, his vision had returned to: R.E., 20/25; L.E., 20/30. On reëxamination on August 15, 1947, his vision had returned to 20/20, O.U., and there was no evidence of any ocular lesion.

The severity of this iridocyclitis and its response to this method of therapy leads me to believe that immune globulin played a large role in his successful recovery.

Case 2. Mr. T. H., aged 57 years, was first seen in April, 1945, with an acute iridocyclitis of the right eye. He had recurrent attacks every 3 or 4 months which were treated each time with foreign protein. His last attack in April, 1947, was treated with typhoid vaccine and immune globulin. His vision returned to normal, and 10 months later there had been no further recurrence.

Case 3. Mrs. M. B., aged 51 years, consulted me on August 24, 1947, with a history of a scratch on the left eye with a stick 6 weeks before, which had developed into a corneal ulcer. She was treated at an eye institute for five weeks with sulfa drugs, penicillin, streptomycin, and foreign-protein therapy. A paracentesis was also performed. Examination revealed evidence of old trachoma of both eyes.

The left eye was markedly congested, and there was a dense, white infiltrate situated in the central part of the cornea, involving the stroma. This area did not stain with fluorescein. The cornea was vascularized, and a hypopyon was present in the lower third of the anterior chamber. The iris was bound down. Vision was light perception only.

The patient received 1 cc. of typhoid subcutaneously followed by 3 doses of 5 cc. of immune globulin. On September 19, 1947, the corneal infiltrate desquamated as a sharply defined disc, with healed corneal epithelium underneath. The hypopyon had completely disappeared. At the present time, the eye is completely white. Vision is fingers at two feet, and the patient is comfortable. In all, the patient received a total of 3 courses of injections.

Conclusion

A preliminary report on the use of immune globulin in acute forms of uveitis has been presented. Immune globulin seems to have helped in clearing up a number of

severe cases of uveitis, which did not respond to the usual therapy. Immune globulin should be used in conjunction with foreign proteins and other local therapy. The work is being continued on the use of immune globulin in the treatment of acute and chronic uveitis. Further reports on the results of this work will be made.

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ON NEW TYPES OF OCULAR DISEASES*

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Some of the new types of ocular diseases, which I have had the opportunity to describe, cannot be found in the different handbooks; some of them were described later on by another author, sometimes in numerous publications, and became so known; some were accepted by special textbooks and so saved from oblivion.

1. DIVIDED NEVI

In 1919[1] I described a special type of nevi of the lids, interesting because they are divided by the palpebral fissure. I called them *divided nevi*. Either such a nevus occupies the angle of the lids or one half is on the upper lid and the other on the lower lid. These very rare divided nevi are of a special scientific interest; we know that the lids are closed by epithelium during some time in the fetal life, but it is not yet known if the nevi originate from the epidermis or from the cutis. The divided nevi make it very probable that the place of origin is the epidermis as the connection of the lids is made only by epithelium in the fetal life; it is also likely that the anlage of the nevi is developing just in the time of this connection of the lids.

Since my publication I did not see any other such nevus in Europe and I read only once a paper in which such a case was operated upon and the nevus excised. In China, where nevi are exceedingly frequent and often enormous, I saw only one case

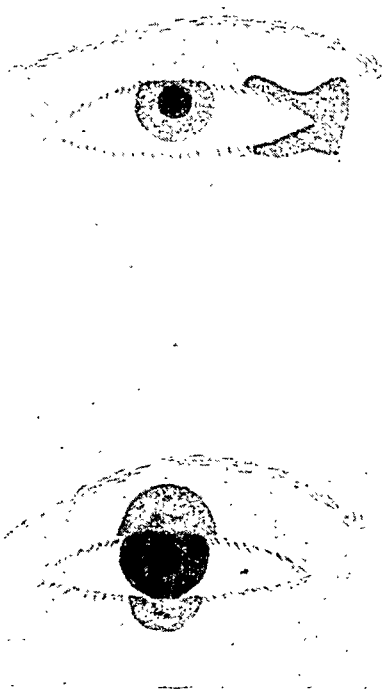


Fig. 1 (Fuchs). Divided nevi. (Above) At the inner angle of the palpebral fissure. (Below) At the middle of the upper and lower lids.

* Presented at the III Pan-American Congress of Ophthalmology, Havana, Cuba, January, 1948.

where the nevus was situated partly on the upper and partly on the lower lid and another case where the inner angle of the palpebral fissure was occupied by the nevus (fig. 1). A third case which I saw in Nanking had been operated upon but soon the lower part of the nevus, which had originally surrounded the inner angle, recurred. This case shows again how dangerous it is to operate on a nevus because, frequently, a number of these cases lead, after an operation, to sarcoma. Arcuri pleads for the removal of every nevus.[2]

2. Sjøgren's syndrome

As a special type of disease, I published the case[3] of a woman, aged 54 years, the secretion of whose tear glands and submaxillary and subligual glands had entirely stopped. She was not able to weep, her eyes had a very disagreeable sandy sensation and she had difficulty in eating anything solid like meat or bread, which she had to wash down with soup or water. The very annoying dryness of the conjunctiva was later on called conjunctivitis sicca by Sjøgren[4] and the syndrome was called later on Sjøgren's syndrome.

A real cause of this condition was not found. It may be that a hormonal disturbance or, as it seems more likely to me, a disturbance of the center of secretion in the mesencephalon is the origin.

3. Behçet's syndrome

The following interesting case was emphasized as a special new disease.[5] A Turkish dentist had frequent attacks of iridocyclitis with hypopyon for years, accompanied by very painful infiltrations in the muscles and fascies and also ulcers in the mouth and on the scrotum. He was examined very carefully but no etiologic factors could be detected. One infiltration of a muscle was excised and the biopsy showed numerous polynuclear leukocytes but no germs or parasites. This man had many posterior synechias and a membrane in each pupil and had become nearly blind. He was treated with salvarsan and showed some improvement.

I tried to get information about this very striking clinical syndrome by asking doctors who had worked as prisoners of World War I in Asia but nobody had observed such a case. Later on Behçet from Istanbul published a few cases of this disease in different medical journals and since then this disease is called Behçet's disease. Just recently such cases were described by different authors.[6] This disease apparently does not occur in China, at least many eye doctors (about 100) whom I asked about it had not observed such a case, the symptoms of which are so conspicuous.

4. Keratitis parenchymatosa linearis

In 1926 I emphasized a new type of interstitial keratitis due to hereditary syphilis and I gave it the name *keratitis parenchymatosa linearis.*[7] A very slight interstitial keratitis starts as a line which detaches itself from the limbus; this slightly undulated line-shaped opacity migrates slowly across the cornea to the other side. This opaque line shows precipitates on the posterior surface of the cornea and gives a very characteristic clinical picture. The syphilitic etiology was shown in all these cases. This type of disease I believe could be used as an argument against the idea that the interstitial keratitis is an allergic disease as it was maintained by some authors.

In recent years I have seen no more of this very rare type of disease, but it is not astonishing since keratitis parenchymatosa became very rare in Vienna.

5. Neuritis syphilitica papulosa

Another new type of syphilitic disease I called *neuritis syphilitica papulosa.*[8] This most grave papillitis (fig. 2) is characterized by a mass of exudate covering the papilla in such a degree as is not found in any other disease except a beginning case of metastatic ophthalmia. This exudate does

not permit observation of the outlines of the papilla and leads sometimes to a focus on the choroid. Besides there are very severe vitreous opacities and numerous hemorrhages of the retina. The disease occurs in the first two years after the syphilitic infection and needs a long time for recovering, usually it takes a year until the vision gets better and sometimes the vision becomes very good; the visual field may show a sector-shaped defect. As a result of the papillitis frequently a comma-shaped strand of connective tissue starts on the papilla and the point leads to an atrophic choroiditic focus (retinitis proliferans).[9]

Report of a case. A man, 33 years of age, acquired syphilis two years ago and was treated by neosalvarsan, but Wassermann tests were never negative. Two months ago

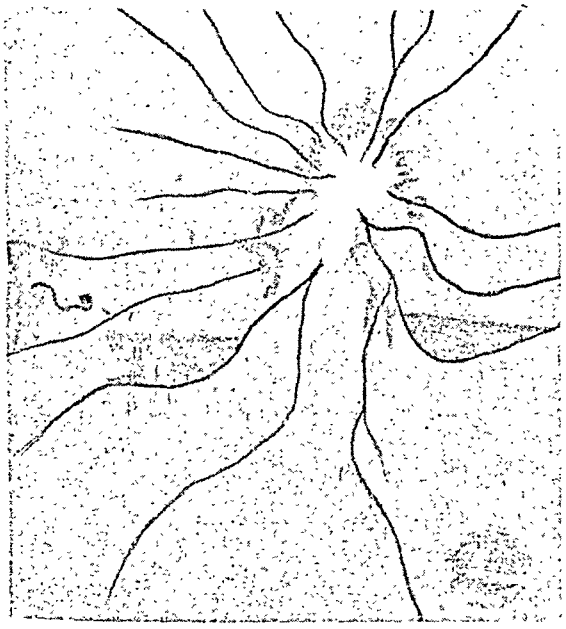


Fig. 2 (Fuchs). Neuritis syphilitica papulosa.

the left eye (fig. 2) showed a very severe impairment of vision and many dust-shaped vitreous opacities. After 1½ years the vision became 6/8. The visual field showed a sector-shaped retraction from above and temporal. The spinal fluid which was highly positive became negative five years after the picture was made.

When I was in Peiping as visiting professor on the P.U.M.C. (1923-24) I saw such a case and used it in my publication. During my stay in China with UNRRA-WHO last year I saw again such a case in

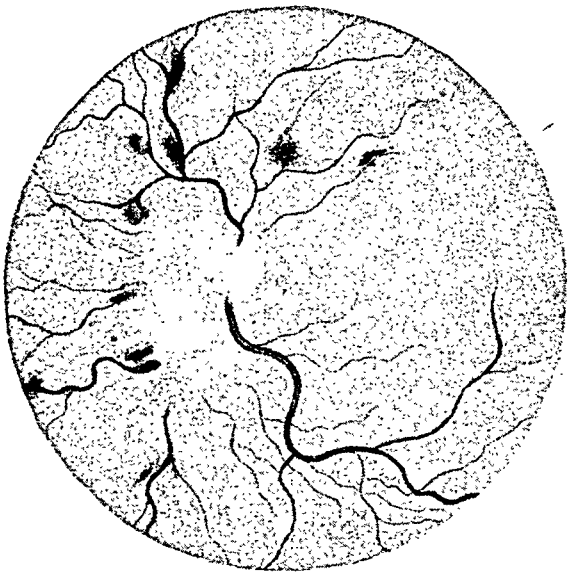


Fig. 3 (Fuchs). *Neuritis syphilitica papulosa.* This drawing is from the collection of Dr. S. K. Chang of Shanghai. The patient, a man, aged 27 years, had had visual disturbances for six weeks. Vision was 0.1. Syphilis had been acquired about 1½ years previously. The Wassermann reaction was a plus three. He was given three salvarsan injections at one-month intervals. After two months, vision was 0.5. The hemorrhages had disappeared.

Chengtu-Szechwan. It was a binocular case which differed from the published cases only by the fact that there were very few vitreous opacities. The young man was seen only once in the E.E.N.T. Hospital and did not return so I was not able to have a picture of his fundus. The vision was very poor and the syphilitic infection had been acquired a few months previously.

I found a typical picture of such a neuritis syphilitica papulosa in the collection of Dr. S. K. Chang in Shanghai which was published as a neurorezidive (fig. 3).[10] Dr. Chang had thought that this papillitis was a Herxheimer reaction and was due to the three salvarsan injections the patient had received some time ago. I do not doubt that

this papillitis has developed independently of it just as all the cases I had seen got the papillitis spontaneously.

These two syphilitic diseases, keratitis parenchymatosa linearis and neuritis syphilitica papulosa were mentioned in the third volume of Duke-Elder's textbook.

6. Myopia inversa

Myopia inversa[11] is not a very rare change of the fundus. One finds a large atrophic zone of the choroid next to the papilla but not on the temporal side as in a common high myopia but on the *nasal* side; that means on the inverse side. This atrophic area can be several disc diameters in size and can also surround the whole papilla, just as in circumpapillary atrophy of the choroid in cases of high myopia, with the exception that the broadest part is lying on the nasal side and the narrowest area on the temporal side. Such a nasal atrophic zone of the choroid can get larger during the years. Sometimes this nasal atrophy is present in both eyes; sometimes it is only in one eye, while in the other eye a temporal atrophic zone is present.

The nasal atrophy differs from the typical congenital white narrow nasal conus; the zones are much bigger and they are quite different in shape; their color is yellowish and not whitish like the nasal conus. A development of such a nasal atrophic zone out from a congenital conus is not likely because I did not see in one of these cases a differentiation of a white congenital scleral nasal conus in the yellowish atrophic zone.

The central vessels in the papilla divide as a rule in an inverse type; the temporal half of the papilla appears as a rule normal and a special supertraction of the temporal border of the papilla is present only in some instances. The fovea centralis sometimes seems to lie nearer to the papilla than normal but also in those cases I found the blindspot on the normal place of the visual field.

The cases of myopia inversa differ from the cases of the common high myopia with temporal atrophic zone in the following point. If there is a temporal atrophic choroidal zone, we are, as a rule, able to estimate the height of the myopia by the breadth of the zone; a broader zone corresponds usually with a higher myopia. This is different in inverse myopia because very often the myopia is much smaller than we would expect, although the nasal atrophic zone is very broad.

The cause of this nasal atrophic zone is without doubt a pulling on the choroid toward the nasal side. We can find sometimes a higher myopia of the nasal part of the fundus than of the posterior pole of the eye or of the temporal side of the fundus. That shows us a special unusual ectasia of the nasal sclera. This ectasia is based on an embryologic anlage that is made clear by the so frequent inverse division of the vessels. But the fact that the nasal fundus shows often a poor pigmentation shows us that we may have here, besides a congenital poor content of pigment in the pigment epithelium, a traction of the choroid, just as we have that often in common high myopia; one can see excellent examples of this condition sometimes in a case of high myopia with staphyloma verum[12] where in front of the dark reflex of the scleral step the fundus is sometimes brownish-red while the area of the staphyloma verum appears albinotic.

To this group of myopia inversa belong also the exceedingly rare cases, where the papilla and its neighborhood are normal in spite of high myopia but where the nasal fundus is markedly poor in pigment and shows considerably higher myopia than the temporal fundus. Such a case, that of a woman, 32 years of age, had a perfect normal papilla; the temporal fundus was reddish-brown and changed suddenly in the vertical meridian to a tesselated nasal fundus.

Her corrected vision was: R.E., −11D., 5/8, on the posterior pole of the eye; but −14D. sph. ⊂ 0.75D. cyl. ax. 25° in adduction; L.E., −6D., 5/8, on the posterior

pole of the eye, but −9D. sph. ⊂ +0.5D. cyl. ax. 180° in adduction.

In China I saw two cases of inverse myopia: the first, that of a man, aged 32 years, had refractive errors of: R.E., −6D. and nearly no conus at all; L.E., the same and an atrophic zone of a 1/2 p.d. breadth on the nasal side.

The second case was a high myopic man, 42 years of age, with a cerebellar tumor. On the right eye a common circumpapillary atrophy of the choroid was present and the disc was indistinct and very little swollen; while on the left eye there was a large nasal atrophy of the choroid and a very marked choked disc (fig. 4).

The second case was especially interesting for the following reasons; I had emphasized in a previous report that, in eyes with circumpapillary atrophy of choroid due to high myopia, frequently other changes of the fundus and the papilla do not develop. So highly myopic eyes often show absolute glaucoma and perfect blindness and a simple atrophy of the optic nerve without glaucomatous excavation. Also retinitis pigmentosa and choked disc can be missed on an eye with high myopia while the fellow eye without high myopia shows the typical picture. Now in this Chinese the choked disc

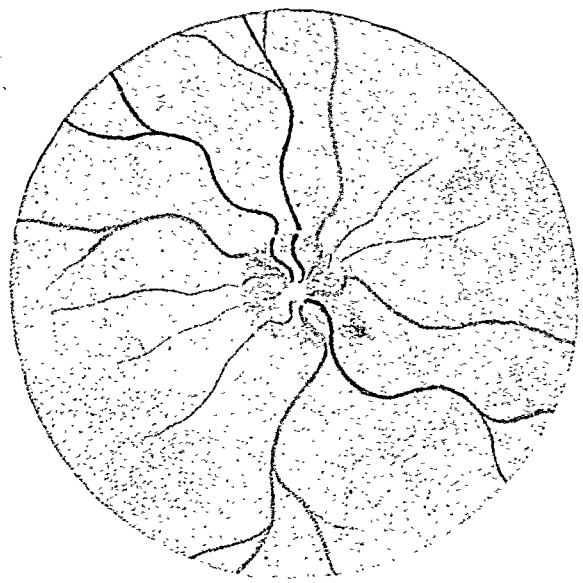


Fig. 4 (Fuchs). *Myopia inversa.* A common circumpapillary atrophy of the choroid was present in the right eye and the disc was indistinct but there was very little swelling. In the left eye, shown here, there was a large nasal atrophy of the choroid and a markedly choked disc.

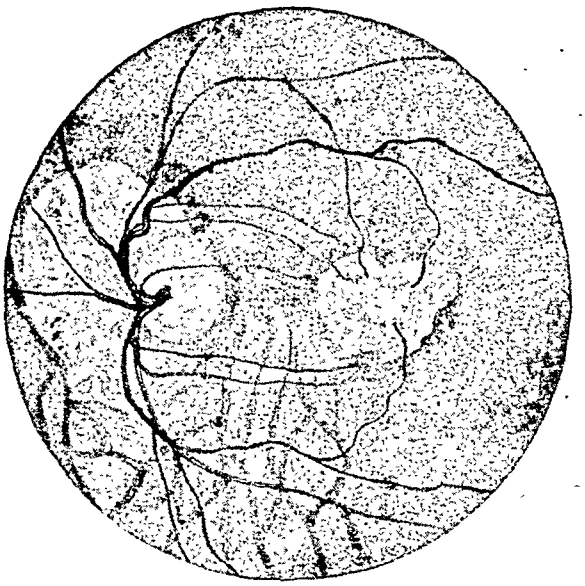


Fig. 5 (Fuchs). The case showed a big nasal atrophic zone of the choroid and a typus inversus vasorum on the left eye. In the fovea was situated a grayish focus (Fuchs's spot?).

was very much more conspicuous and easier to see on the left eye with the *nasal* atrophic zone than on the right eye with the high myopia and circumpapillary atrophy.

Pathologic changes in addition to myopia inversa I saw in two other cases many years ago in Vienna. The first case, that of a woman, 63 years of age, had a big nasal atrophic zone of the choroid and a typus inversus vasorum on the left eye (fig. 5). Below and on the nasal side, the fundus was albinotic while on the posterior pole and the temporal side the fundus was brownish. In the fovea there was a grayish focus, larger than the papilla. This focus was considered by some doctors as a coloboma of the macula while I thought it might be an old Fuchs spot because the patient had had better vision and had formerly complained of metamorphopsia. Vision was: −4D., 6/60-J5. Wassermann test was negative. We have

here a very large nasal choroidal atrophy although the myopia was not high at all.

The second case, that of an old man, was seen in the clinic of internal diseases and therefore an examination of the vision was

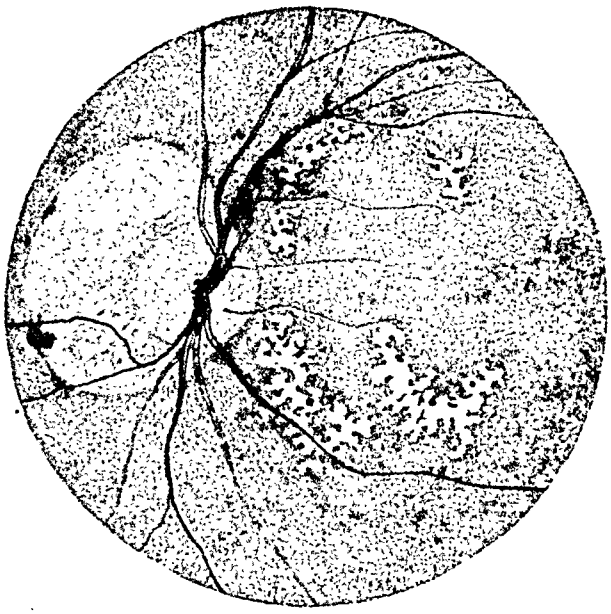


Fig. 6 (Fuchs). *Myopia inversa.* This myopic left eye showed a very broad atrophic zone of the choroid on the nasal side of the papilla and a retinitis circinata around the macula.

not made. The myopic left eye showed a very broad atrophic zone of the choroid on the nasal side of the papilla and a retinitis circinata around the macula (fig. 6).

7. Choroiditis proliferans

A very rare change of the fundus I called *choroiditis proliferans.*[13] It is characterized by a marked formation of connective tissue between retina and choroid. Narrow or broad strands (fig. 7) of whitish color and fine radiation are visible beneath the retinal vessels. Apparently the retina does not produce these strands because the vision is frequently quite good. According to my opinion, this connective tissue is a residue of a retinal detachment especially of an inflammatory detachment due to an exudative choroiditis. I imagine that in the fluid which is poured out between retina and choroid some filaments are formed by fibrin which later on become organized.

This idea was later on corroborated because there are numerous of these cases in China and I saw altogether about six cases of this type. The cause of the formation of the connective tissue in China is mostly Harada's disease which is by no means rare in that country. I saw a number of fresh cases of Harada's disease; some were very severe cases where retinal detachment was combined with deposits, severe iritis with infiltration, shrinkage of the vitreous, perfect blindness, and general symptoms. Some cases are very benign and show only a spontaneous detachment of the retina of short duration without other symptoms of the eye or of a general kind; one case healed in four weeks with final vision of 6/10.

The choroiditis proliferans in China, often monocular, shows the following symptoms: (1) Very long, thin, straight, white strands which are sometimes slightly bent, frequently branched, and sometimes end in a fan-shaped, fine striated connective-tissue layer. Frequently these white strands show knots like bamboo and they can also appear grayish and pigmented. (2) Frequently large areas of the choroid are covered with a thin membrane which hides the texture of the fundus and gives it a strange

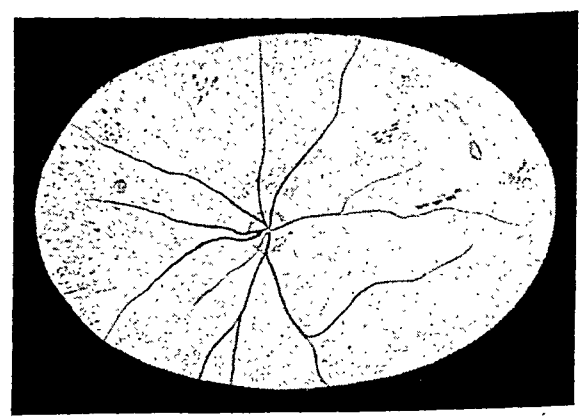


Fig. 7 (Fuchs). *Choroiditis proliferans* is characterized by a marked formation of connective tissue between the retina and the choroid. Narrow or broad strands of whitish color and fine radiation are visible beneath the retinal vessels.

silver-white color, while other parts of the fundus show the tesselated type of membrane (fig. 8).

Sometimes one can find in this whitish area a slight elevation of the retina of 1 or 2 diopters. In such a case the question arises as to whether in such an area the retina is detached or not. The visual field, especially the fact that the patient can see red and blue in this area, shows that there is no detachment and that the neuroepithelium is relatively intact. In spite of an extensive silver-white membrane, the function of the retina is not greatly impaired, and the vision can be relatively good.

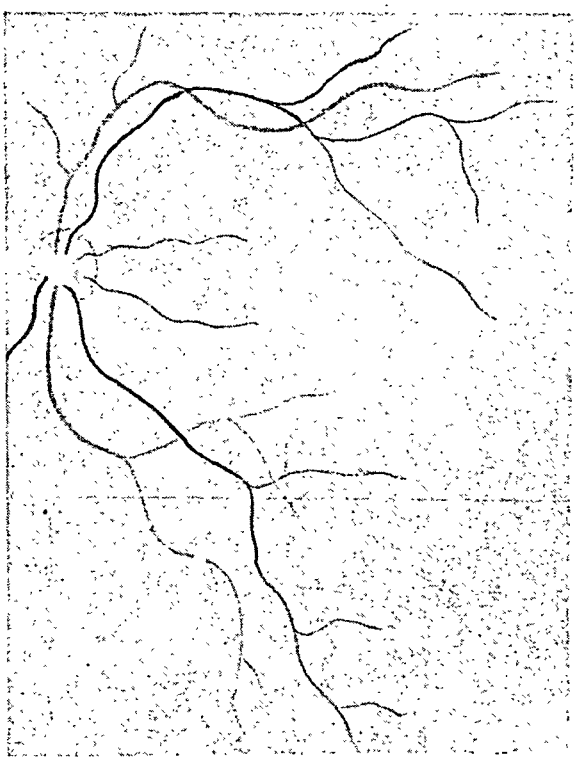


Fig. 8 (Fuchs). Frequently large areas of the choroid are covered with a thin membrane which hides the texture of the fundus and gives it a strange silver-white color, while other parts of the fundus show a tesselated type of membrane.

8. Neuritis retrobulbaris maligna

In China I found another new type of ocular disease which I could not find described in the available literature. This type I called *neuritis retrobulbaris maligna* and is characterized by a complete loss of vision in a very short time; in 2 to 3 days no light sensation or pupillary reflex on light remains. The fundus and especially the retinal vessels are normal. In Europe we have rare cases of retrobulbar neuritis with perfect loss of vision but an energetic treatment always seems to bring about a certain recovery and not so rarely the vision will become normal again. These Chinese cases differ from the European ones; in spite of energetic treatment the condition cannot be changed and the people remain blind.

The first case I saw was that of a Chinese general who had become blind in two days in both eyes and later on a genuine optic atrophy appeared. It was thought that the cause of this rather sudden blindness was intoxication with alcohol or another poison. The patient was examined in the United States by eminent doctors in a very intensive way but no diagnosis except optic atrophy could be made. I also could not imagine what was the cause, but I saw later a young man, aged 25 years, who became blind quickly in both eyes, and a woman, aged 39 years, who had the same condition in one eye. In these two cases, a genuine atrophy of the optic nerve followed and energetic fever therapy and injections of yatren-casein had not the slightest effect, and the pupillary reflex did not come back.

The important symptom which we generally find in cases of retrobulbar neuritis—slight sensibility of the globe when the eye is touched or moved—was present in all the three cases during the first days of the disease but only in a slight degree. So I learned by these two cases that the general had become blind apparently by the same disease as the two others, namely by a specially malignant retrobulbar neuritis.

This very rapidly developing inflammation of the optic nerve is without doubt combined with a very intense edema, because it seems that the edema compresses the nerve fibers in such a strong way that they are entirely paralyzed and the pressure keeps on for some time so that the

fibers lose their capacity to conduct the nervous impulse and cannot recover. I was not able to detect the etiology.

I have presented here some types of diseases which are either of clinical or of special scientific interest. In China, I was able to observe a few other new types of diseases but I have had no time, as yet, to work up my material.

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Historical Miniature

In the times of the Greeks, Romans, and Arabs, and until the end of the European Middle Ages, all patients who had had successful surgery for cataract had to be content with the very moderate improvement in vision that was possible without cataract glasses. Sixteen-hundred years elapsed between the first description of cataract surgery by Celsus and of cataract glasses by Daça de Valdes, Notary of the Inquisition in Seville, in 1623. The lenses were numbered 11 or 12 for distant vision and 20 for near work. The numbers seem to correspond roughly to our diopters. The worthy notary does not reveal whether this was a new invention or how things were before, and he does not give evidence of the slightest comprehension of the refraction of rays in the aphakic eye.

Hirschberg, *Graefe-Saemisch Handbuch.*

OSTEOMA INVOLVING THE ORBIT*

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An osteoma is a benign tumor of non-inflammatory origin having a circumscribed form, a definite periosteal covering forming a line of cleavage from adjacent structures, and showing active participation of osteoblasts. The tumor commonly originates in a nasal accessory sinus and may invade the orbit relatively early in its growth, causing ocular disability prior to localizing signs in the sinus.

INCIDENCE IN LITERATURE

The many reports indicate that the tumor, while uncommon, is not rare. However, its incidence is difficult to assess as most reports deal with a single case, frequently one presenting bizarre symptoms or complications. The incidence of ocular involvement varies with the site of origin of the osteoma, being almost universal when original growth is in the sphenoid or ethmoid sinus, uncommon with frontal tumors, and extremely rare with those originating in the maxillary sinus. Unilateral exophthalmos arising from orbital tumors was found by Reese[1] to be caused by an osteoma but one time in 174 consecutive cases of surgically verified orbital tumors.

The male is affected more commonly. In Teed's[2] review of frontal sinus osteoma, 172 males were affected to 92 females, a figure corresponding closely to that determined earlier by Eckert-Mobius,[3] who found 110 males to 70 females. The preponderance of males is attributed by Armitage[4] to their greater liability to trauma and the larger size of their sinuses, which are, therefore, the site of greater developmental activity.

Extremes of age of 13 years (Carmody[5]) and 82 years (Blake[6]) have been reported. In Childrey's[7] series of 15 patients, the average age was 46.4 years, but only one case (Case 14) was symptomatic. In Teed's[2] review, the average age was 28.8 years, with 90 percent of the cases symptomatic. The age of the patient when first seen, however, gives little indication as to the time of occurrence because an osteoma may lie quiescent for long periods or reach huge size without symptoms.

The frontal sinus is the most frequent site of development. Malan[8] collected 458 cases; in 178, the growth occurred in the frontal sinus; in 110, in the ethmoid sinus; in 41, in the maxillary; and in 7, in the sphenoid sinus. In the remainder the growth was external, of doubtful origin, or it was questionable as to the first cavity involved.

GROUPS OF OSTEOMAS

True osteomas may be divided into three main groups: the eburnated, which is ivory hard; the compact, which has a structure not unlike that of normal bone; and the spongiose, which represents the most immature type. Externally they present a hard, glistening, rounded surface with numerous facets following the outlines of the sinuses and structures impinged against during the period of growth. They may be sessile with a broad base of spongiose bone, or they may have a pedunculated base of compact bone.

Microscopically, the tumor is covered with well-defined, apparently normal periosteum, with branches extending into the substance of the growth. The eburnated type consists of solid bone without haversian canals and with the bony lamellae arranged in whorl formation. The compact type presents an exterior not unlike the eburnated type, but interiorly, small haversian canals are present, surrounded by concentric rows of

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bony lamellae with irregular arrangements of bony corpuscles in bundles. The spongiose type consists largely of connective tissue with large numbers of fibroblasts and numerous interconnected areas of new-bone formation.

It is most important that the tumor be distinguished from the most common cause of bony hyperplasia of the bones of the skull, namely, the hyperostosis occurring in the course of dural endothelioma. Dandy,[9] who states that he has never seen a localized osteoma, warns that the hyperostosis of meningioma is so common that a degree of skepticism is warranted when a diagnosis of pure osteoma is made. Microscopically, this type of hyperostosis shows the marrow spaces of the bone filled with tumor cells, the invasion of which causes the bony overgrowth.

Theories of cause

Numerous theories have been advanced as to the cause of osteoma, none of which adequately explains its occurrence in each of the nasal sinuses. Arnold[10] believed that the tumor represented ossification of the fetal cartilage at the junction of the ethmoidal and frontal sinus where bone of endochondral and membranous origin were adjacent.

Ersner and Saltzman[11] likened the formation to osteomyelitis where, according to Mosher,[12] osteoblastic and osteoclastic activity take place simultaneously. They considered a low-grade exudative infection in the sinuses might stimulate osteogenesis more than osteoclasis and result in bony tumor formation.

Cushing[13] believed the tumor might be initiated by a fissured fracture of the anterior cranial fossa with a diastasis of the suture between the orbital plate of the frontal bone and the adjacent edge of the ethmoid bones roofing the ethmoidal cells, causing quiescent cartilage to be stimulated to bone production.

Fetissof,[14] who supported his contention with histologic studies, advanced the theory that the tumor initiated from a nest of periosteum split of bone at an early age, which developed a tumor under the influence of irritation and trauma.

Symptoms and signs

Symptoms and signs of osteoma may be conveniently divided into cerebral, nasal, and ocular groups with the predominant type dependent upon the site of origin and with many growths asymptomatic. Cerebral disturbances are uncommon and include mental deficiency, vertigo, various sensorimotor disturbances, convulsions, cerebral pneumatocele, and signs of increased intracranial pressure.

Sphenoidal growths almost universally give rise to intracranial difficulties because of their location, which makes their removal an extremely formidable procedure. Meningitis and brain abscess have occurred following surgery, particularly in cases reported in the preantiseptic days. Cerebrospinal rhinorrhea may complicate surgery of an ethmoidal tumor and is observed rarely preoperatively.

Occlusion of a sinus with resultant infection occurs most commonly in tumors of the frontal sinus because of their predilection for growth at the inferior nasal angle of the sinus. Obstruction of breathing on the side of the tumor is uncommon and occurs most commonly in osteoma of the ethmoid. Anosmia usually indicates cerebral extension with involvement of the olfactory nerve at the christa galli. Fenton[15] reported one case of well-defined nasociliary neuralgia being relieved by removal of a small osteoma of the frontal sinus which was impinging on the anterior ethmoidal nerve.

Ocular signs occur most commonly with ethmoidal and sphenoidal tumors. The ethmoidal type are so likely to extend into the orbit that Cushing[13] labeled them "orbito-ethmoidal" osteomas. Orbital extension usually results in a slowly progressive exophthalmos which, if untreated, may cause loss of the globe.

Fridenberg[16] reported a case in which growth of the tumor from the central portion of the frontal sinus caused an enophthalmos. Rarely, orbital extension from the frontal or ethmoidal sinus causes displacement of the trochlea with signs of superior oblique paresis, a complication which may follow removal of the tumor.

Sphenoidal osteomas tend to involve the optic nerve early, with visual disturbance and optic atrophy, and, rarely, papillitis or papilledema. Occasionally an ethmoidal tumor will cause papillitis, presumably due to involvement of the optic-nerve blood supply.

Diagnosis

The diagnosis is based upon roentgenographic evidence of a well-circumscribed, bony tumor originating in a sinus and the absence of increased thickness of other bones of the skull. Usually there is no question of the diagnosis of the frontal or maxillary-sinus osteoma as the appearance of a localized, isolated bony sphere resting on the floor of the sinus is quite characteristic.

Diagnosis of the sphenoidal tumor can be made with certainty only by microscopic study of the tumor, as dural endothelioma may give rise to a similar picture. This is true, but to a lesser extent, of tumors originating in the ethmoid sinus, although a localized, well-circumscribed bony tumor occurring here without evidence of hyperostosis of the roof of the orbit or sphenoid ridge is most likely an osteoma.

Dandy[17] points out that the age of the patient is an important differential point as dural endotheliomas occur after the age of 30 years and the benign osteoma frequently occurs before. He warns that the burden of proof must rest on the diagnosis of osteoma when made after the age of 30 years.

Treatment

The treatment is surgical but the opportune time and surgical approach have been much debated. Those occurring in the frontal and maxillary sinus frequently remain asymptomatic for long periods and, in the absence of symptoms or rapid growth, surgery is not indicated.

Sphenoidal tumors should be removed immediately, if possible, for the slow but gradual growth will ultimately result in blindness and death. The likelihood of bony tumors in this location being part of the hyperostosis of meningioma is indication enough for the surgery other than their bad prognosis even though histologically benign.

Ethmoidal tumors, because of their early encroachment into the orbit, frequently require early surgery but, in the absence of symptoms or rapid growth and with the patient less than 30 years of age, some procrastination is permissible. Operative intervention will, however, likely be necessary.

The ethmoidal tumors may be removed by an anterior orbital route or by Cushing's osteoplastic transtemporal approach. The anterior route is preferred in cases of well-circumscribed tumors lying far forward in the orbit and in the absence of signs of cranial extension. The transtemporal approach must be used in sphenoidal tumors, those with intracranial extension, and questionable growths possibly secondary to meningiomas. The frontal and maxillary sinus osteomas are probably best removed through an external approach over the involved sinus. Radium and X-ray therapy was successfully used in two cases of spongiose osteoma of the maxillary sinus by Priest and Boies,[18] but was of no value in Case 3 of this series.

Case reports

Case 1

History. The patient, a 24-year-old, white, unmarried farmer, was first seen January 15, 1942. He complained of progressive protrusion of the left eye, of three years' duration. There was no history of trauma and the patient was in good general health except for frequent left frontal headaches relieved with aspirin. He had had the usual childhood dis-

eases and the past history was essentially irrelevant.

Examination. Vision was 20/20 in the right eye and 20/25 in the left eye, improved to 20/20 with a −0.5D. sph. ⊂ +1.5D. cyl. ax. 75° correction. There were 4 prism diopters of exophoria for near and far (Maddox rod) and no hyperphoria. The extraocular movements were normal and the convergence near point, 50 mm. The exophthalmometer (Hertel) reading was: R.E., 18 mm.; L.E., 28 mm. The pupils were equal and reacted normally to light and accommodation. The closed lids did not entirely cover the left eye. At the left inner canthus a hard, fixed, smooth nodule, firmly adherent to the bony orbit, was palpable. Ophthalmoscopic examination showed normal fundi and the peripheral and central fields were normal. Roentgenologic studies showed a dense, bony mass encroaching upon the left orbit, apparently arising from the floor of the left frontal sinus adjacent to the ethmoid plate.



Fig. 1 (Newell). *Case 1.* X-ray study of ethmoidal osteoma involving left orbit.

Operation. On January 16, 1942, under ether anesthesia, an incision was made from the inferior medial angle of the orbit, upward to a point 10 mm. above the insertion of the medial canthal ligament. The ligament was severed, the bony tumor exposed and chiseled free of its insertion in the ethmoid and floor of the frontal sinus. The tumor was then grasped with a rongeur, rocked free, and extracted from the wound.

A large defect in the left frontal sinus was created and a large amount of white, glistening, tenacious mucous removed. There was no evidence of cerebrospinal fluid, and no defect was found in the anterior cranial fossa.

The wound was packed with sulfathiazole powder, the medial canthal ligament was sutured to its original insertion, the wound closed with interrupted black silk sutures, and a compression dressing applied. The first seven days postoperatively, the patient received 4 gm. of sulfadiazine daily. His temperature did not exceed 100°F., the convalescence was uneventful, and the patient was discharged the 12th postoperative day.

The osteoma was a characteristic eburnated type and measured 36 by 32 by 25 mm. It weighed 21.5 gm., and arose from the ethmoidal sinus and invaded the frontal sinus secondarily.

Result. The patient was last seen on March 9, 1942, at which time the eyeball had receded to normal position. There was orthophoria for near and far. Vision was 20/20 in each eye without correction. There was a paresis of the left superior oblique muscle and a diplopia with the red glass on looking down and to the right. The patient was not troubled with this diplopia, and in a recent communication he stated that it is no longer present.

CASE 2

History. The patient, a 22-year-old, white, unmarried farmer, was first seen August 12, 1921, complaining of marked tearing of the right eye the previous four weeks. There had been no improvement of the condition with lacrimal-sac irrigation by his family physician. Past history revealed smallpox in February, 1921, and no history of trauma or nasal infection.

Examination. Vision was 20/20 in each eye, uncorrected. The ocular movements and pupillary reactions were normal. The patient was unable to converge, and there were 12 prism diopters of exophoria for far and near. The lacrimal sacs were irrigated with ease.

One month later the patient noted a small nodule at the inner canthus of the right orbit and X-ray study showed a dense tumor arising from the lateral wall of the ethmoidal labyrinth, invading the orbit and the frontal sinus on that side. In October, 1921, the patient noted divergence and diminution of vision of the right eye.

When the patient was seen on November 18, 1921, there was a right divergent squint of 10 degrees, a palpable tumor at the inner canthus, and a papillitis with elevation of the disc, 2 diopters. Vision was 20/70 and could not be improved. There was no exophthalmos and neurologic examination was negative.

Operation. The tumor was removed by Dr. Frank E. Burch. The postoperative course was uneventful, and the patient was discharged the 11th postoperative day. The osteoma was of the eburnated type with a broad base of cancellous bone attached, apparently, to the lateral wall of the ethmoidal labyrinth. It measured 25 by 29 by 31 mm.

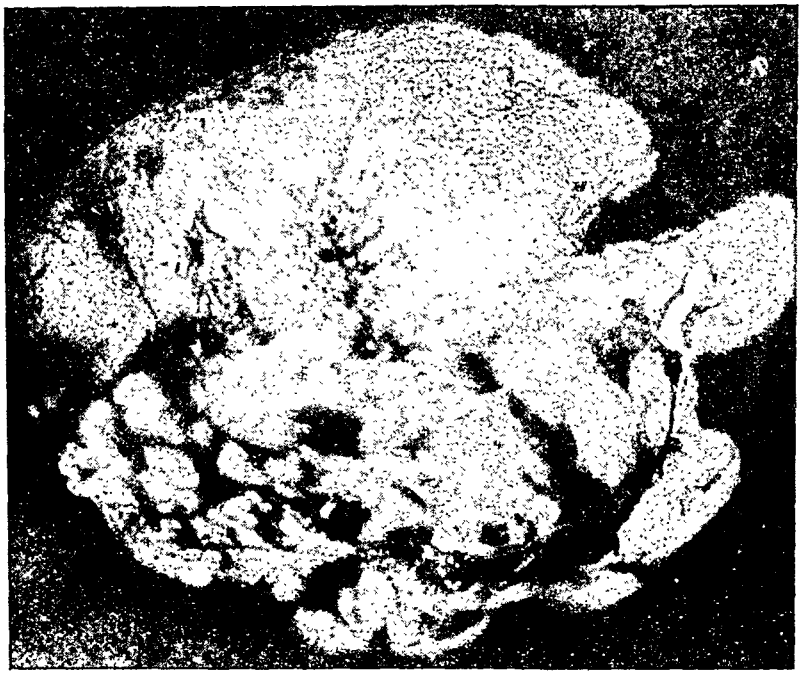


Fig. 2 (Newell). *Case 2.* Appearance of tumor; the rough, irregular surface is the pedicle which was attached to the ethmoidal sinus and the smooth area represents the orbital extension.

Course. When seen in August, 1942, there had been no recurrence. The eyes were parallel and the patient was able to converge slightly. Vision was 20/20 in each eye without correction, and there was an exophoria

of 4 prism diopters for far and near.

Comment. Case 1 presents a typical history and symptom complex, as has been reported in most cases of ethmoidal osteoma. Slowly progressive exophthalmos was the only sign with no signs of involvement of the nose or central nervous system. The almost directly lateral growth of the tumor in Case 2 caused a divergent squint rather than a proptosis.

The exophthalmos in Case 1 and papillitis with diminution of central vision in Case 2 necessitated immediate surgical intervention. In each case the anterior orbital approach yielded a gratifying result; with antibiotics and sulfonamides now available, the danger associated with the exposure of the dura to infection is much minimized.

CASE 3

History. The patient, a 10-year-old, white school-girl, was first seen July 10, 1928,



Fig. 3 (Newell). *Case 3.* Appearance of exophthalmos when patient was first seen in July, 1928.

complaining of a proptosis of the right eye, which had first been noted in March, 1926. There was no other complaint, no pain, and the exophthalmos did not appear to be progressive. Past history revealed the usual childhood diseases, including scarlet fever.

Examination. Physical and laboratory examinations were essentially negative. Vision was 20/40 in the right eye and 20/20 in the left, without correction. She was orthophoric for near and far, and extraocular movements were normal. A hard mass was palpable at the external canthus of the right orbit. Exophthalometer (Hertel) reading was: R E., 24 mm.; L.E., 15 mm. Ophthalmoscopic examination was normal.

Roentgenographic studies of the skull showed a dense, round mass which nearly filled the right orbit. The roentgenologist believed that it originated in the inferior, posterior portion of the orbit and stated it had the appearance of an osteoma.

X-ray studies four months later demonstrated an increase in size of the tumor, with likely origin in the sphenoid sinus. When examined on November 20, 1928, vision was 20/70 in the right eye and could not be improved. A definite papillitis was present.

Course. From November 28, 1928, until September 16, 1930, she was followed at the Mayo Clinic and received deep X-ray and radium therapy to the right orbit. She was seen again on May 6, 1931, at which time the right optic nerve showed complete atrophy, the proptosis had progressed, and she had been having convulsions once or twice a week the previous seven months. During the following year the patient again received deep X-ray treatments to the right orbit and radon needles were implanted in the orbit.

The tumor continued to increase in size, and the proptosis became so marked that an exposure keratitis necessitated removal of the eye in June, 1933. During this procedure the anterior portion of the bony mass was removed and studied microscpically. The bone chips had the structure of a compact

osteoma, and there was no evidence of malignant cells in the marrow.

In July, 1933, vision in the remaining eye was reduced to 5/200 and a definite papilledema was present. Convulsive seizures were more frequent and there was mental deterioration. It was assumed that an internal hydrocephalus was present. The patient died at home in October, 1933; unfortunately, an autopsy was not obtained.

Comment. The signs and symptoms of this little girl were characteristic only of an orbital and cranial space-occupying lesion, and diagnosis was dependent largely upon roentgenographic evidence. The age of the patient, slow growth of the mass, and absence of other signs served to differentiate the tumor from a meningioma, as did the study of the anterior face of the growth. The patient was, incidentally, younger than any other previously reported with osteoma. The extensive involvement of the sphenoid bone when the tumor was first discovered made surgery almost impossible, although her tragic end makes operative intervention, however apparently hopeless, seem worthwhile.

CASE 4

History. The patient, a 26-year-old, white, married salesman was first seen on February 12, 1932, complaining of diplopia since February 7th, when he acquired a mild upper respiratory infection.

Examination. He had been examined by an oculist in August, 1931, and a 3-diopter prism base up had been incorporated in his right lens. Vision was 20/70 corrected to 20/20 in each eye. There was 17 prism diopters of left hyperphoria and one prism diopter of exophoria with a vertical diplopia in all directions of gaze. No limitation of extraocular movements could be demonstrated. Peripheral and central visual fields and the fundi were normal. X-ray studies of the sinuses showed an osteoma of the inferior medial angle of the left frontal sinus measuring 5 by 10 mm.

The patient was examined two weeks later, at which time there were 2 prism diopters of left hyperphoria and no diplopia. He has been seen intermittently since that time and, when last examined, on February 24, 1942, he had a left hyperphoria of 11 prism diopters. Corrected vision has remained 20/20 and there has been no change in the fields or fundi. X-ray studies during this period have demonstrated no increase in size of the tumor, and there have been no nasal or cerebral symptoms.



Fig. 4 (Newell). *Case 4.* X-ray study of involvement of the right orbit with a sphenoidal osteoma.

CASE 5

History. The patient, a 20-year-old, white, unmarried woman, was first seen on July 17, 1934, complaining of severe, right frontal headaches following close work.

Examination. Vision was 20/30 and 20/50, right and left, respectively, corrected to 20/20. There were 4 prism diopters of exophoria for far and 8 for near, with no hyperphoria. A slight right ptosis was present. Visual fields were of bizarre conformation and were considered unreliable. Ophthalmoscopic examination showed no abnormalities.

Roentgenographic studies showed the complete absence of the left, frontal sinus and, arising from the inner angle and floor of the right frontal sinus, was a dense, bony mass extending downward along the medial wall of the orbit. Neurologic examination revealed a marked hyperesthesia of the right frontal region, which followed no definite nerve distribution.

Course. When subsequently seen, a marked spasm of accommodation was present, which was not relieved until after daily use of atropine for three weeks. Following this, the headaches disappeared but the hyperesthesia of the forehead persisted. The patient refused surgery and has not been seen since August, 1936, at which time her condition was unchanged.

Case 6

History. The patient, an 18-year-old, white, unmarried, young man, was first seen on August 2, 1934, complaining of severe arthritis involving the shoulders, hips, back, and knees. In routine X-ray examination of the sinuses for possible foci of infection, an osteoma of the lateral portion of the left frontal sinus was demonstrated and ocular examination advised.

Examination showed no abnormality of vision, fields, fundi, or ocular movements. The tumor has not increased in size since the patient was first seen, and he has no complaints referable to the nose, eyes, or nervous system.

Case 7

History. The patient, a 23-year-old, white, unmarried soldier, was first seen on February 14, 1946, complaining of a right convergent strabismus, which had been present since childhood. Previous history revealed no abnormalities, and physical examination was negative.

Examination. A routine sinus X-ray examination prior to ocular surgery revealed an osteoma of the right frontal sinus measuring 2½ by 1 cm. Neurologic examination and complete ocular examination revealed no abnormality other than an alternating convergent strabismus, which was corrected with surgery.

Comment. Case 4 and Case 5 are difficult to analyze because of the bizarre and variable symptoms which cannot be attributed to the osteoma. Case 6 and Case 7 are typical of most frontal sinus osteomas which are discovered on routine examination and seldom, if ever, give rise to symptoms.

Summary

Seven cases of osteomas are presented; in 2 cases the tumors arose in the ethmoidal sinus, in one in the sphenoid body, and in 4 in the frontal sinus. The tumors arising in the ethmoidal sinus were removed successfully, while the sphenoidal osteoma which was considered inoperable resulted in death of the patient from an internal hydrocephalus.

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THE ANTITRACHOMA CAMPAIGN IN JEWISH SCHOOLS OF JERUSALEM

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About 30 years ago, Jewish physicians of Palestine, realizing the danger that, owing to the wide spread of trachoma, threatened both the Jewish population that had already settled in the country and the new immigrants, constituted the first antitrachoma committee. As a result of its activities, trachoma is at present but a minor issue among the many medical problems facing the Jewish authorities.

Trachoma means no longer a danger to the health of the Jewish people of Palestine —a fact that is all the more important in view of the high incidence of trachoma in all countries of the Near and Middle East, in spite of the greatest efforts being made everywhere to tackle the problem.

For example in Egypt an antitrachoma campaign was launched by the government 40 years ago and has ever since been continued with the assistance of other institutions which realized the urgency of the task. However, according to the yearly report issued by the health bureau in Cairo, almost 99 percent of pupils in schools were found affected in 1939. Since that time (according to a personal communication received by the Hadassah Medical Organization from Dr. Wilson, head of the Antitrachoma Service in Egypt, in 1944) no progress has been made and even now practically every single pupil has the disease with the exception of a very small percentage (0.5 to 1.5 percent) belonging to the well-to-do classes.

In Palestine, too, besides the Jewish Antitrachoma Service, several institutions (missions, and others) have assisted the government in its endeavors to meet the danger of trachoma in the country. But, according to a report of the Government Health Office in Jerusalem, in 1939, more than 39 percent of pupils in government schools in Jerusalem were infected at that time, and there is no reason to believe that during the war years, conditions were improved.

In Jewish schools, however, owing to the unrelenting efforts of the physicians engaged in this strenuous work, and the energetic war against trachoma waged by the Hadassah Medical Organization, the systematic and intensive treatment given to every single case has yielded remarkable results. In 1918, at the time when antitrachoma work was started by this organization, the per-

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centage of active trachoma in Jerusalem among all pupils supervised, was 21.6 percent. This percentage had dropped to 1.8 percent by the winter of 1942-1943, and is now 1.4 percent.*

During the early stages of its activities the antitrachoma committee confined its services to Jerusalem schools, gradually widening its scope and including Jewish schools of other towns, eventually extending to the rural settlements, too.

The aim of this campaign was twofold and consisted, first, of prevention of a further spread of the disease among the population and, second, of the treatment of affected persons. Once or twice a year every single child is examined by an experienced ophthalmologist and, when a high rate of infection is found, the school is immediately placed under supervision, the pupils being from then on examined at monthly or bimonthly intervals. The treatment of infected children lies in the hands of specially trained nurses who visit the schools every day. If corneal complications are detected, the child is immediately presented to the school doctor or sent to the ophthalmologic clinic for treatment.

The routine therapy of trachoma in our schools consists of instillation of a 5-percent copper-sulphate solution (we prefer a solution that has been standing for some time) in combination with zinc-resorcin and frequent expressions for cases of active trachoma; while in inactive cases, a 2-percent copper-sulphate solution is used with zinc resorcin.

In the course of time it was realized that in order to eradicate the disease it is not sufficient to treat a child in whom the infection is accidentally found, for it occurred all too often that a child, after having once been successfully treated, was reinfected at home. Treatment had, therefore, to be extended to the families, too, and, in 1926, clinics were opened by the Hadassah Medical Organization to deal with that part of the population. How successful this procedure was appears from the fact that, for example, in the clinic of the Old City of Jerusalem which opened with 757 cases among a total of 2,237 Jewish inhabitants, the number of infected cases is now no more than 12 among a population that has meanwhile grown to 3,000.

The antitrachoma service is being effectively assisted by the health welfare nurses attached to the schools under supervision by the Hadassah Medical Organization and to the health welfare centers established all over the city. The ophthalmic and welfare nurses do not confine themselves to the treatment of the sick child but also visit the child's family and take care of sanitary conditions in his home.

An important factor greatly contributing to the satisfactory results of the antitrachoma campaign is the systematic care children are now receiving from the day they are born, and during their entire childhood by the health welfare centers. As soon as trachoma is detected there, the child is immediately given the necessary treatment. When he begins to attend kindergarten, he is either completely healthy or at least greatly improved. Thus statistics compiled for kindergarten children in Jerusalem for the years 1942-1943 show a percentage of no more than 1.3 for active trachoma (21 cases among 1,725 children).

The physicians engaged in antitrachoma work know that they are social workers and that their success depends in the same measure on the treatment of the individual case as on the degree to which they are able to reach the population by instruction. Of course, much depends on the social standard and adaptability of the various population groups and it is not surprising that results are not uniform in all communities. The majority of trachoma cases, as regards the Jews, is now concentrated in the oriental communities which, generally, have a lower social, cultural, and hygienic standard. Un-

* These figures refer to schools as a whole comprising all Jewish communities.

fortunately, no data are obtainable on the distribution of the various Oriental-Jewish groups in Jerusalem schools. We are, however, in possession of data concerning the distribution of children aged 5 to 14 years by community in the Jerusalem population at large (census of the Jewish Agency of 1939). In the attached table a calculation has been made—on the basis of these data and the occurrence of trachoma in schools—of trachoma incidence per 1,000 children in each community at the ages mentioned above.

From Table 1 it appears that the highest percentage of cases is found in Persian Jews and the lowest in Ashkenazic Jews. As to the sexes, there is practically no difference. As regards age, the incidence of trachoma in the oriental communities rises up to the age of 10 years, and drops after that age.

TABLE 1

TRACHOMA INCIDENCE PER 1,000 CHILDREN

Community*	Per Mille Trachoma	No. Cases
Persians	50.8	90
Kurdians	48.4	66
Babylonians	48.1	87
Georgians	22.1	8
Bokharians	20.1	11
Syrians	12.2	7
Yemenites	11.1	11
Maroccanians	8.6	6
Sephardic Jews	5.0	14
Ashkenazic Jews	1.0	6

* All these are Jewish communities.

This is in accordance with the view held by the majority of investigators who consider trachoma a disease of childhood, especially where it is endemic.

As a result of the steady drop in trachoma cases, the number of children under treatment for active trachoma was no more than 307 in winter 1942 to 1943; and for inactive trachoma it was 331 of 17,533 children for the corresponding periods. The cases are, moreover, usually mild and pannus or trichiasis have altogether disappeared from among our children.

TABLE 2

DISTRIBUTION OF TRACHOMA IN JEWISH SCHOOLS OF JERUSALEM BY AGE

Age (Years)	Trachoma Cases per 1,000 Children in Jerusalem Schools
4–6	23.0
6–8	28.8
8–10	36.8
10–12	29.4
12–14	9.5
14–16	4.3

From the tabulation in Table 4, it appears that the highest percentage (6.6 percent) is found in the evening classes; that is, among children that may not have had any schooling at all during their younger years. The figures should, therefore, be accepted with certain reservations, since they may also refer to children who have attended schools outside the supervision scheme during their earlier years.

TABLE 3

DECREASE OF ACTIVE TRACHOMA IN JEWISH SCHOOLS OF JERUSALEM FROM 1918 TO 1946

Year (Winter)	Cases of Active Trachoma per 1,000 Pupils Under Supervision
1918/19	21.6
1920/21	21.4
1921/22	18.3
1922/23	13.9
1923/24	13.1
1924/25	11.5
1925/26	9.5
1926/27	14.2
1927/28	13.0
1928/29	11.2
1929/30	11.9
1930/31	9.4
1931/32	8.5
1932/33	7.4
1933/34	3.9
1934/35	3.2
1935/36	2.9
1936/37	2.1
1937/38	4.9
1938/39	4.1
1939/40	3.0
1940/41	1.8
1941/42	1.9
1942/43	1.8
1943/44	2.1
1944/45	1.6
1945/46	1.4

During the past few years it has been tried, therefore, to extend ophthalmic supervision to children of postschool age (evening classes of several youth organizations), and three of Hadassah's ophthalmic nurses have been placed at the disposal of this new service. Moreover, in summer during the school vacations, centers are opened all over the town, where trachoma and acute eye inflammation are treated and to which almost 90 percent of the children come every day.

TABLE 4

DISTRIBUTION OF 307 CASES BY TYPE OF SCHOOL ATTENDED

Type of School	Trachoma Cases per 100 Pupils
Evening classes, etc.	6.6
Talmudei Torah (religious schools)	3.1
Elementary Schools Affiliated with the Education Department of the Jewish National Council	1.2
Elementary Schools Not Affiliated with the Education Department	0.6
Secondary Schools and Teachers' College	—
Kindergartens and Day Nurseries	1.3

Special problems are facing the antitrachoma services in connection with the expected immigration. The arrival of the so-called "Teheran children"* and groups of immigrants from oriental countries (Algiers, the Yemen, and so forth) have taught us a lesson. We must be prepared to wage a renewed war to free this country from the disease, as far as this is possible, and our success depends entirely on the degree to which it will be possible to extend this struggle to the country as a whole and to all parts of the population, Jews and Arabs alike.

Thanks are due to Prof. R. Bachi, head of the Central Bureau of Medical Statistics, and Dr. G. Kallner for their kindness in preparing the statistics.

Gan-Rehavia.

* Jewish refugee children from Europe, usually without parents, who had drifted about for many years before they reached Palestine, their last station being Teheran.

HISTORICAL MINIATURE

Fabricius ab Aquapendente, in 1600, was the first to publish an illustration that correctly shows the position of the lens. Leonardo da Vinci (1452-1519) approached the truth very closely, but his drawings were not published until late in the nineteenth century.

Hirschberg, *Graefe-Saemisch Handbuch.*

FRIEDLÄNDER'S BACILLUS INFECTION FOLLOWING PERFORATING WOUND OF ORBIT*

Report of a case treated with streptomycin

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Friedländer's bacillus infections are unusual. Extensive search of the literature has revealed no previous reports of perforating injury of the orbit, maxillary sinus, and nasopharynx complicated by infection with this bacillus. The case to be reported here developed an orbital cellulitis. Although in reviewing the literature, there were several cases of suppurative sinusitis caused by this bacillus,[1,2] there was only one earlier report of an orbital cellulitis.[3,4]

Dr. Carl Friedländer[5] isolated this bacillus, in 1882, from the lungs of a fatal case of pneumonia and called it Pneumoniecoccus. It was later called Klebsiella friedländeri, Klebsiella pneumoniae, Bacillus mucosus capsulatus, or Bacillus friedländeri.[6]

Recent writers, among them Baehr and his associates[1] and Jaffee,[7] have mentioned this confused terminology and suggest that this organism be called either Klebsiella friedländeri or Bacillus friedländeri. Bergey[6] prefers Klebsiella pneumoniae.

Friedländer's bacillus is a gram-negative, encapsulated rod, varying in size from 0.3 to 0.5 by 5.0 microns, occurring singly and in pairs. It is nonmotile and does not form spores. It usually produces smooth, mucoid, cream-colored, raised colonies on blood agar at from room temperature to 37°C. Hemolysis does not occur but the plate is browned. In broth its growth is turbid, and a ring or film is found at the top of the tube or flask. Numerous fermentation and other differential tests have been suggested and used;[8] however, until Julianelle's classification[8,9] of the Friedländer group into serologically separate types, its recognition was often uncertain.

A recent article by Osterman and Rettger[10] states, "Valid criteria have not yet been established for the differentiation of the organisms of the Friedländer and coli-aerogenes groups." Friedländer's bacilli belonging to Type A of Julianelle's classification may be identified with considerable certainty. Organisms in Type B (which is immunologically similar to, although not identical with, Type II pneumococcus[8]) and Type C (which is identical with the Rhinoscleroma bacillus[11]) may be identified with some certainty. The rest of the group, classified in a heterogenous group X, remains ill defined.

The frequency with which the different serologic types of Friedländer's bacilli are encountered was studied by Julianelle[12] who, working with 80 strains, found 52 percent to be Type A; 15 percent, Type B; 9 percent, Type C; and the remaining 24 percent were considered to be in the heterogenous group X.

It is difficult to discuss the incidence of Friedländer's bacillus infections, since accurate identification was not always made in early cases, nor even in all the later ones. The incidence of these bacilli in the upper respiratory tract of normal persons was reported as 5.8 percent.[13] This figure has been used by numerous authors; however, more recent investigators[1] doubt this percentage of incidence and believe that, on the rare occasions when it is found and accurately identified in the upper respiratory tract, it is present as a contaminant from the intestinal tract where it is reliably found in 5.5 percent of normal persons.[1,14]

The mortality of Friedländer's bacillus in-

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Fig. 1 (Crawford). Appearance of patient when hospitalized, showing proptosis, whitish exudate, injection, chemosis, and the papilloma.

fections is difficult to estimate. Prior to chemotherapy the prognosis was poor in all cases. In a review of 232 cases of Friedländer's bacillus pneumonia, the mortality was 94 percent.[8] Of the 198 cases of Friedländer's bacillus infections reported by Baehr and his associates,[1] biliary tract infections had a mortality of 30 percent; urinary tract infections, 17 percent; Friedländer's septicemia in the same series, 75 percent. The mortality varies with the type of the organism encountered as well as with the site of the infection. Of the three distinct serologic types, Type A is the most virulent and Type C, the least virulent, for both human beings and mice.[9,10] The pathogenicity of the heterogenous group X is ill defined.[10]

Report of a case

History. The patient, S. P., was first seen at this clinic on February 11, 1947, with a history of having been jabbed two months previously (December 11, 1946) with a pencil which had penetrated the outer portion of his left upper lid. He reported that he had been intoxicated at the time but remembered that there was immediate pain as well as transitory bleeding. The patient stated that the pencil had penetrated to a maximum depth of one-half inch and was certain that it had been withdrawn immediately. He was treated by his local physician for the ensuing "red eye" with one of the sulfa drugs orally, until he was referred to this clinic. Some temporary clearing had been noted approximately the 3rd or 4th day after the injury.

From February 11 until April 3, 1947, when he was admitted to the hospital here, the patient was seen every week or every other week. He was not seen more frequently because he lived a considerable distance away and was short of funds for transportation and board.

Examination. On the patient's initial visit, examination revealed a diffusely injected, thickened, beefy-red conjunctiva; a scanty whitish exudate, a papillomatous mass in the lower fornix, moderate edema of the lids, and slight proptosis of this left eye. Since the patient was positive on repeated questionings by various staff members that the pencil had been withdrawn, laboratory investigation was resorted to.

Smears taken at this time were later reported to contain many neutrophiles, occasional gram-positive cocci, and a few gram-negative rods. The total white blood-cell count was 12,900 and the Kahn and Kolmer tests were negative. The Frei test was doubtfully positive. On initial cultures a few colonies of Streptococci viridans were found as well as numerous colonies of diphtheroids, and a moderate number of colonies of Friedländer's bacilli which gave the characteristic "quellung" reaction with Type-A serum.

Treatment. Sulfathiazole treatment, 1 gm. orally every 3 hours while awake, had been started as the organisms causing the patient's



Fig. 2 (Crawford). Closeup of left eye.

posttraumatic infection were unknown at the time.

The papilloma was excised February 14th, and streptomycin ointment was prescribed for local use because of the Friedländer's bacilli; streptomycin was not used systemically as the patient could not be hospitalized. Sulfadiazine was given instead of sulfathiazole since it was believed to be less toxic. Because of the doubtfully positive Frei test, mice brains and chorio-allantoic membranes were inoculated and 300,000 units of penicillin in beeswax were given on two successive days. The egg and mouse-brain inoculations were reported negative for viruses. Orbital X-ray films, taken on February 19th, were reported negative.

Course. When the patient was seen again, the conjunctiva showed some slight clearing but the papilloma had recurred. Otherwise, his condition was unchanged. Smears and cultures were essentially the same.

In the middle of March, stereoscopic views of both orbits, as well as sinus plates, were made. These X-ray studies were negative except for some slight clouding of the frontal and maxillary sinuses. At this time, also, the papilloma was reëxcised. The report of the first biopsy had been: "Nonspecific infectious granulation tissue."

Since cultures had become negative for any organisms other than Friedländer's bacillus—Type A, it was decided to admit the patient to the hospital for systemic treatment with streptomycin, which is reported



Fig. 3 (Crawford). Pencil fragments removed via the posterior nares.



Fig. 4 (Crawford). Appearance of patient one week after discharge from hospital.

to be the drug of choice in Friedländer's bacillus infections.[15,16]

Hospitalization began on April 3rd, at which time examination of his left eye revealed moderate proptosis (4 mm. more than the right eye). There was considerably more injection and chemosis, and motion was more restricted. The papilloma had again recurred (figs. 1 and 2). Vision was 20/20, right eye; and 20/30, left. The patient's temperature was normal and his total white-cell count, 9,800.

Since laboratory investigation revealed that the infecting Friedländer organism was extremely sensitive to streptomycin, in spite of the local use of streptomycin ointment, the patient was given 1 gm. of streptomycin intramuscularly daily, divided into 4 doses.

Streptomycin therapy for seven days resulted in considerable, but not complete, clearing. Cultures from the conjunctiva were still positive for Friedländer's bacillus, although the number of colonies was reduced. The nasal cultures were also positive. Blood cultures showed no growth. A rhinolith in the left nares, diagnosed at this time, was thought to be the cause of the persistent infection.

Operation to remove the rhinolith was performed on April 12th. This was found to be the pencil which had been driven through the orbit into the left superoposterior portion of the nasal cavity. Approximately 3½ inches (9 cm.) of pencil fragments were removed through the nose (fig. 3).

Postoperatively, the conjunctiva showed some further clearing and the papilloma was nearly absorbed. Conjunctival cultures be-

came negative for the first time; however, posterior nasal cultures still showed the Friedländer's bacillus, although in much fewer numbers than before.

Penicillin, 40,000 units intramuscularly every 3 hours, was given prophylactically after the operation, in addition to the streptomycin.

Reëxamination of the original X-ray plates showed the pencil, and new plates indicated that about one inch of the pencil remained. It had, apparently, been pulled down into the region of the posterior nares. It was decided that further surgery should not be done at this time, and the patient was discharged to be observed in the clinic. Chemotherapy was discontinued. The patient's total white blood count at this time was 8,560.

The patient returned after one week showing some slight persistent conjunctival injection but the papilloma had been absorbed (fig. 4). During examination he blew out through his nose about a one-inch length of pencil lead. Some wood may still be present. Conjunctival cultures showed no growth; however, nasal cultures showed Friedländer's bacillus, Type A, and coagulase positive Staphylococci albus and aureus.

Two months later the patient had failed to return, although a postcard indicated that he was well.

Conclusion

A case of Friedländer's bacillus infection of the orbit and maxillary sinus following a perforating injury has been reported. The patient was improved after removal of the foreign body and treatment with streptomycin, which is considered to be the drug of choice in Friedländer's bacillus infections.

It is realized that infections with this bacillus may wall off and form abscesses which later may erode through or break down. So far no such tendency has been noticed in this patient.

Also, in conclusion, it must be emphasized that, in a patient with a history of injury, especially with a granulomatous lesion, the possibility of a foreign body should be borne in mind.

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ANALYSIS OF OCULAR MOTOR ANOMALIES*

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One of the most difficult subjects confronting the average house doctor in ophthalmology is the study of ocular motor anomalies. Although he may have a good understanding of the basic anatomy and physiology of the extraocular muscles, he is often confused by the complexity of the clinical findings presented by a patient with strabismus. To find his way successfully through this confusing data, the average house doctor needs an organized method of approach. Only by using such a guide can he readily recognize the important factors in the defect and intelligently institute therapeutic measures to correct them.

THE MOTILITY CLINIC

The first step in organizing the study of motor anomalies in a large hospital is the establishment of a special clinic devoted entirely to studying, classifying, and treating the various forms of motor anomalies. The second step is the use of a simple, practical method of analyzing the complex manifestations presented by patients with ocular motor anomalies.

Two years ago a special clinic for the study and treatment of ocular motor anomalies was started at the Wilmer Institute. The personnel of this clinic includes both ophthalmologists and orthoptic technicians. A member of the teaching staff is in continuous charge of the clinic, and three members of the resident staff, two internes, and one assistant resident are assigned to the clinic in rotation.

Every patient with any type of ocular motor anomaly seen in the general eye dispensary is referred to the Motility Clinic, after a complete external and ophthalmoscopic examination and cycloplegic refraction have been made. The Motility Clinic meets weekly. There the patients are studied by the doctors and orthoptic technicians according to a standardized plan of analysis. When the studies are completed, the patient is presented to the entire group, the problems are discussed, a diagnosis is made, and a plan of therapy is outlined.

If orthoptic training is the first step in therapy, the patient is turned over to the technicians who make subsequent appointments on other days of the week. However, every six weeks the orthoptic technician sends the patient back to the Motility Clinic so that his progress can be observed by the entire group. This provides a constant check on the accuracy of diagnosis and permits any changes necessary in the plan of therapy. If operative treatment is the first therapeutic step, the Motility Clinic recommends the type of operation and follows the patients postoperatively. On discharge from the hospital, an appointment is made for a return visit to the Motility Clinic, where the patient is reëxamined and any further therapeutic measures are instituted.

In this way the Motility Clinic acts as a central clearing house for all patients with motor anomalies. The constant interchange of opinion between the ophthalmologists and the orthoptic technicians has resulted in mutual understanding and excellent coöperation.

We have found this method of joint discussion in a Motility Clinic far better than the former plan of referral of patients to a separate orthoptic clinic. Often doctors referring patients to the orthoptic clinic had little idea of the aims, methods, or problems of the orthoptic technicians. On the other hand, the technicians sometimes lost sight of the broader aspects of the strabismus and in

* From the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital and University. Presented at the sixth annual meeting of the American Association of Orthoptic Technicians, Chicago, Illinois, October 12, 1947.

their intense and persistent efforts to correct some phase of the sensory anomalies, occasionally subjected the patients to unnecessarily prolonged orthoptic treatment. In the Motility Clinic, the members of the house staff become acquainted with the principles and problems of orthoptics and acquire some skill in the use of orthoptic instruments in diagnosis and treatment. By periodic re-examination of the cases by the entire group, it is difficult to overstress any one aspect of the case, and orthoptics is viewed in proper relationship to the other problems of strabismus.

Method of analysis

The tests used in studying motor anomalies should be simple and the method of analyzing the findings should be practical and easily understood. In the Motility Clinic we have found the following plan the most useful one as it enables the house staff and the orthoptic technicians to grasp the significant factors easily. Figure 1 shows the outline of the examination. It occupies a full sheet, which is included in the patient's unit history.

The first topic is a brief history of the patient as related to his motor anomaly. This is followed by a record of his vision, without and with refractive correction. The next topic is the presence or absence of head tilt. The observations on fixation follow. The type of monocular fixation is noted and an evaluation of the angle kappa is made. Under binocular fixation, the fixating eye is determined not only in the primary position for distance and near, but also in the six cardinal directions for near. As pointed out by White[1] and others, these tests are most helpful in selecting the eye upon which to operate. The rotations of the eye are considered next. The extent of the ductions are measured, a screen comitance test is performed, and the relative or absolute near point of convergence noted.

The prism and cover test constitutes the next heading. We have found that this test is extremely useful in giving the house staff and orthoptic technicians a dynamic picture of the motor aspects of the case. However, before the new house doctor is allowed to progress to the prism and cover test he should become adept in performing the tests mentioned above under fixation and rotation. We have found that new members of the staff rapidly acquire skill with the prism and cover test after they have first learned to make careful examinations on fixation and rotation, and have trained themselves always to be conscious of the position of the light reflex on the cornea.

With the prism and cover test, measurements of the angle of squint are made in the primary position for distance and near both with and without glasses. The deviations are also determined for near with the patient fixating in each of the six cardinal directions. The measurement of the angle of deviation in the six cardinal directions has always been an awkward examination to make. Usually there was no way to stabilize the patient's head; an assistant was needed to hold the fixation light, and there was no standardization of the amount of angular rotation of the eyes from the primary position into the six cardinal directions. Because of these difficulties, the house staff and the orthoptic technicians often omitted this part of the examination.

Since the test is so important in analyzing vertical anomalies and in diagnosing incomitance, we constructed a small light to standardize and control fixation in the six cardinal directions.[2] It consists of a base with an upright bar to which is attached a rotating arm. The arm is provided with automatic stops that place it in the six cardinal directions of gaze. Two bulbs in the rotating arm are used for fixation. One bulb, placed at the center of rotation is used for fixation in the primary position at near (33 cm). The other is placed at the end of the rotating arm. When the patient's eyes fixate this peripheral light, their constant angle of rotation from the primary position of gaze is 25 degrees in

each of the six cardinal directions. The instrument is used on a table with an adjustable head and chin rest.

As the patient fixates the central light, the deviation of the eyes in the primary position for near is measured by the prism and cover test. This is followed by similar measurements as the patient fixates the peripheral light successively in each of the six cardinal directions. We have found that this instrument has greatly facilitated the measurement of the deviation by the prism and cover test in the six cardinal directions of gaze.

In performing the prism and cover test it is important to hold the screen a few inches away from the covered eye so that the examiner may look over the screen to observe the movement of the covered eye. The movement of the eye immediately after covering is sometimes easier to follow than the motion of redress on uncovering. It is important, therefore, that the screen should cover the eye only from the object of fixation and not from the observer.

The tests outlined on the chart under the headings of Fixation, Rotation, and Prism and Cover Tests provide most of the information regarding the motor aspects of the case. The remaining portion of the examination is concerned primarily, but not entirely, with the sensory abnormalities. The type of retinal correspondence is determined by the after-image test and the extent of binocular vision is measured with the Worth lights. The major amblyoscope is then used to determine the objective and subjective angle for both distance and near. The type of retinal correspondence is determined; the presence and extent of suppression are defined; the ability to fuse similar pictures is ascertained; and the presence or absence of stereopsis established.

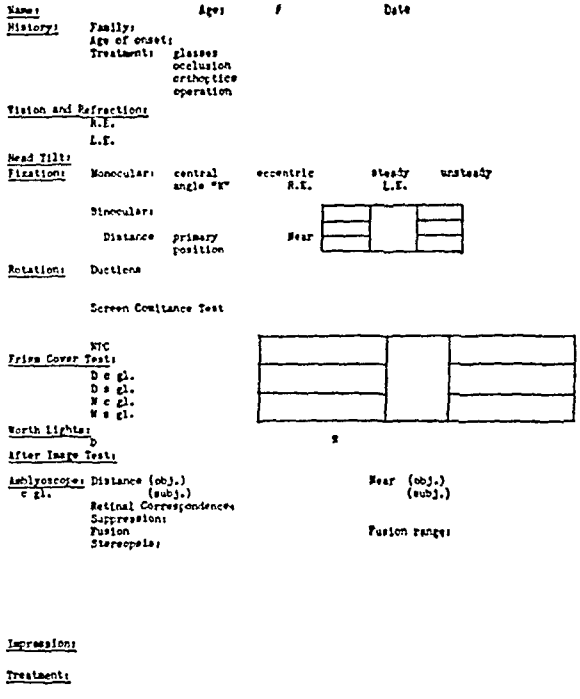


Fig. 1 (Owens). The outline of examination.

We have found that the house staff is generally confused by the classification of fusion into the so-called three grades: simultaneous macular perception, fusion, and stereopsis. They soon find some patients who have the ability to fuse "second grade targets" but lack the ability to superimpose "first grade targets," an ability which is supposed to be a prerequisite for "second grade" fusion.

Burian[3] has pointed out the difficulties in the classification of fusion into three grades. We have found it more satisfactory simply to state the findings in descriptive terms. Any tendency to shift from normal to abnormal correspondence is noted. The presence and severity of suppression are measured by various sized test objects, and the smallest sized target that is not suppressed is recorded. The term fusion is reserved for the ability to integrate similar images produced on corresponding parts of the two retinas into a single mental picture. If fusion is present, the range of convergence and divergence is measured, and finally the presence of stereopsis is determined.

This routine plan of examination is all that is necessary in most of the cases. However, occasionally special tests, such as the head-tilting test described by Bielschowsky, are necessary. The results of these tests can be recorded in the blank space at the bottom of the form.

Evaluation of data

Having obtained this data, the doctor is prepared to evaluate the findings critically and classify the case. Although the same method of analysis is used for all types of motor anomalies, the following discussion will be primarily concerned with cases of convergent strabismus. The horizontal component is considered first. Whether the strabismus is comitant or noncomitant is determined by comparing the squint angle measured in the six cardinal positions of gaze, and coördinating these findings with the results obtained by the tests on ductions and the screen comitance test. This data will separate the paralytic from the nonparalytic squints.

The second point to be considered is whether the strabismus is constant, periodic, or intermittent.

The third factor is to determine whether the squint is alternating or nonalternating. If alternating, the data will tell whether the patient is a true alternator, or whether alternation occurs when fixation is shifted from near to distance vision, or upon shifting the gaze from the left to the right fields of fixation.

From the standpoint of therapy it is important to classify the cases into the accommodative and the nonaccommodative type of strabismus. Patients with the accommodative type have large refractive errors and show a marked decrease in the amount of deviation when the refractive error is corrected. The deviation decreases when fixation is shifted from near to distant objects and often changes from one examination to the next.

Patients with the nonaccommodative type usually have small refractive errors, and exhibit little or no change in the amount of deviation whether the correction is worn or not, or whether fixation is for distant or near objects. In these cases the angle of squint is fairly constant on repeated examinations.

The nonaccommodative type of strabismus is due to two factors. One is mechanical, such as variation in the form of the orbits, the presence of abnormal check ligaments, or faulty insertion of the muscles. The other is excessive innervational tone from a nonaccommodative source.[4] Practically, we find it impossible to separate these two factors preoperatively in most cases or even at operation in some cases of comitant strabismus. Therefore we do not apply the terms mechanical strabismus or tonic strabismus to the cases of comitant nonaccommodative squint since we have no clinical evidence for the separation of the cases into these categories.

The vertical component of the strabismus is considered next. The vertical anomalies are classified as (1) cases due to paralysis of one of the vertical muscles, (2) cases of pseudoparalytic vertical anomalies with overaction of the inferior obliques, (3) cases with comitant vertical deviations, and (4) cases with dissociated innervational vertical anomalies.

The last aspect to be considered is the extent of amblyopia, the type of retinal correspondence, the amount of suppression, and the degree of fusion and stereopsis.

From such a study of the various manifestations of strabismus, the doctors and technicians can arrive at a practical plan of therapy. The cases are divided into those that have a reasonable chance to obtain single binocular vision and those in which only a cosmetic correction of the strabismus is likely to result. In the former, glasses are prescribed to relieve the convergence tone caused by hyperopia, patching is used to overcome amblyopia, and orthoptic treatments are given to overcome anomalous retinal correspondence and suppression. Finally the residual deviation is neutralized by operation. Postoperative orthoptic training is given in all the cases in this group. In general, patients with the accommodative type of strabismus are more likely to obtain single binocular vision and respond to treatment more favorably than patients with the nonaccommodative type. The cases in which only a cosmetic correction of the strabismus is likely to be obtained are sometimes given similar therapeutic measures as a trial. In a few instances we have been surprised to find that some have responded well. Usually, however, surgery is the only therapy of value in these cases.

A standardized method of analysis of ocular motor anomalies is not only of immediate use to the patient, doctor, and orthoptic technician but is also valuable in obtaining uniform records that can be analyzed statistically. One of the present problems in ophthalmology is to gather sufficient data from which to evaluate the various therapeutic measures used in the treatment of ocular motor anomalies. Routine use of a standardized method of analysis will provide information to answer these problems objectively.

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Discussion of Dr. Owens's Paper

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Dr. Owens' interesting paper has brought out one of the most vital factors necessary for the successful practice of orthoptics. That is, having an organized method of examining and treating ocular motor anomalies. For successful work a thorough routine examination is essential and should be made of each patient with these abnormalities. This examination should include the information necessary to an analysis from which a correct diagnosis and outline of treatment can be taken.

Present-day orthoptics demand this analysis in order that cases may be classified and that treatment may be directed to the factors involved. After the patient has been classified as to type of case, treatment suited to the individual can be selected. I feel certain that technicians are striving to recognize the different procedures required for each type and individual. To attempt to treat two different types of abnormality in the same manner would not only be unsuccessful but disastrous. When cases are analyzed, such unfortunate experiences do not occur. It is not true that by analysis and direct treatment

every case results in a cure, but a greater percentage of cures can be achieved in this manner. If cures have been accomplished without analyzed and specific treatment we shall certainly have to lay it to luck, or to the fact that we were treating a rare type of case in which almost any kind of treatment could affect a cure.

As Dr. Owens has stated, the method of analysis need not be complicated, but it should be as simple, thorough, and comprehensive as possible. Certainly an analysis of the findings of each case should be made, and periodic consultations between ophthalmologist and technician regarding procedures should be held. With such helpful instruments as Dr. Owens' fixation light, a major amblyoscope, the four-dot test, and like devices, examinations that have been difficult can be made quite easily. Much can be ascertained from these tests both subjectively and objectively.

In analyzing strabismus cases, we have found in our work that a detailed examination and history greatly repay the time required for them. Important indications as to the necessary procedures and the final results depend on information concerning the age at which the squint occurred, duration of the squint, and the age at which the patient is examined. It is desirable to learn if fusion is present, for this knowledge can help to determine whether surgical procedures should be radical or limited. It is well not to depend entirely on motor findings nor entirely on the sensory aspects in determining procedures, as the clinical picture may change with the development and improvement of either one. Age is of importance, especially in very young patients in whom a paresis has shown an almost constant improvement, thereby changing the amount of deviation.

There may be various opinions regarding the grading of binocular vision but the vital factor is to recognize bimacular fixation as necessary to normal retinal correspondence and to develop sufficient fusional range for maintenance of comfortable binocular vision.

In analyzing strabismus cases we divide them into three types for treatment: Accommodative, nonaccommodative, and part accommodative-part nonaccommodative.

Accommodative squints require glasses and orthoptics only for correction.

Squints of a nonaccommodative origin measure practically the same for near and distance. These do not require glasses, but do need surgery and orthoptic training. Among the nonaccommodative types are those squints in which such anatomic factors as faulty insertion of the muscles are involved. These cases seldom respond successfully to orthoptic treatment but depend almost entirely on surgery for correction.

Cases with excessive innervation are classified as part accommodative-part nonaccommodative since the deviation is usually higher for near than distance. A majority need orthoptic training for correction. Refractive errors, if present in these cases, are usually slight. Surgery may be required for the nonaccommodative part, while training similar to accommodative treatment is needed for the excessive innervation even though this factor is not refractive in origin.

Although the various classifications and terms used by different schools have brought about much confusion, a knowledge of the essential differences in each case can direct the orthoptic technician to select the treatment that will give successful results.

Being able to recognize such essential points as the effect, if any, that refraction has on the deviation, what anatomic factors are involved, whether the case belongs in the excessive-innervation group or among the cases of incomitance will contribute toward correct diagnosis and successful treatment.

Continued progress in orthoptics depends to no small extent upon our careful analysis of each individual case in order that we may gather facts with which to further our knowledge and therefore increase the percentage of cures we are able to achieve.

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NOTES, CASES, INSTRUMENTS

THE SINISCAL LID PLATE*

A NEW INSTRUMENT

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A new type of instrument for retracting the upper (or lower) eyelid during entropion and various other operations is presented herewith (fig. 1). It is hoped that this will fill a long-desired need in the ophthalmologist's armamentarium for a type of instrument that is simple to use and that will keep the eyelid well reflected and open to view for surgical procedure without tearing into the delicate lid tissues and traumatizing them needlessly.



Fig. 1 (Siniscal). The new type of lid plate.

Although particularly adaptable for use in lid surgery, especially for performing the modified Ewing operation for cicatricial entropion,† the instrument may also be used for other surgical procedures with a minimum of trauma to the lid structure and of discomfort to the patient, notably, in the operation for removal of wild hairs in districhiasis, in the surgical removal of imbedded foreign bodies of the conjunctiva (vide infra), and in some plastic operations of the eyelid that require working on the widely exposed conjunctival surfaces, particularly in ptosis operations where shortening of the levator is done (Blascovics).‡

The new instrument (fig. 1) is an outgrowth of the older trachoma lid forceps, used mainly for the removal of the tarsus, which consisted essentially of a flat, round, convex plate on one blade, and of a "biting" or toothed tip on the other end (or blade) of the forceps (fig. 2).

This older instrument was found to be unsatisfactory, since it tore into conjunctival tissue because a good deal of pressure on the closing blade was required to maintain fixation. Furthermore, it did not properly expose the eyelid for retraction because at the point of the "bite" a wrinkling or notching of the lid margin was caused, and this interfered with the path of the knife during incision and also crowded the line of incision at this point (fig. 2).

A later development on this older instrument consisted in neglecting the use of the toothed blade entirely, simply inserting a traction suture at the center of the lid margin, and winding the ends around the forceps post, meanwhile reflecting the lid over the upper toothed blade which was closed and locked.

Further modification was to cut off the toothed blade from the convex blade and simply use the latter, with the screw bind-

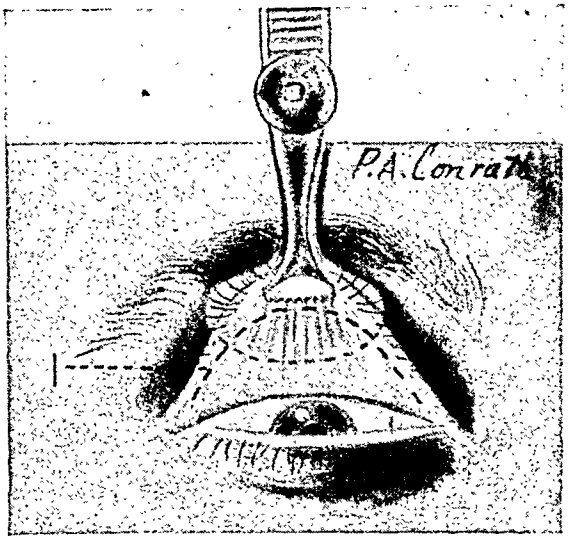


Fig. 2 (Siniscal). Showing old type of lid forceps with biting end tearing into conjunctiva at point of traction. (1) Line of incision for entropion operation. Observe that rounded, convex plate does not afford complete lid counterpressure.

* From the Missouri Trachoma Hospital.

† Smith, J. E., and Siniscal, A. A.: Am. J. Ophth., 26:382 (Apr.) 1943.

‡ Suglian, V. V.: Bulletin of Practical Ophthalmology, Green's Eye Hospital, 12:7 (Jan.) 1942.

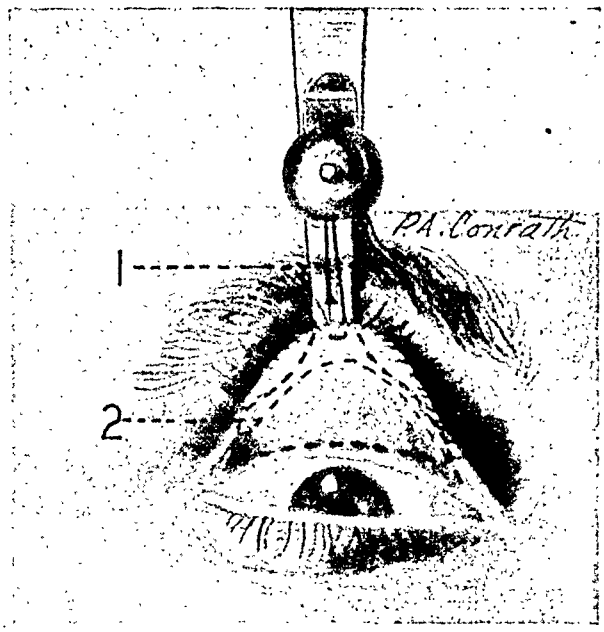


Fig. 3 (Siniscal). Showing new lid plate in use with concave blade extending into corners of reflected eyelid. (1) Traction suture. (2) Line of incision. Observe that new concave plate affords better support by counterpressure for complete line of incision. Concave edge adapts blade to convexity of eyeball.

ing post left intact. This modified instrument was used at the Missouri Trachoma Hospital for many years, with fairly satisfactory results. However, I did not find the convex edge of the lower or supporting blade, or plate, to be best suited for exposing the reflected conjunctiva properly for incision and surgical maneuver.

The new instrument has a larger and somewhat longer plate (or blade), with the presenting edge made *concave* instead of *convex* as in former instruments; the "biting" or toothed end of the forceps has been eliminated entirely so that, instead, a simple tension-spring binding post is used for winding and entwining the ends of the traction suture. As a matter of fact, this instrument is not a forceps at all, since it has only one blade which is an extension of a suitable, weighted handle (fig. 1). It is more correctly called a lid plate.

Figures 3 and 4 show illustrations of the instrument in use, with the upper eyelid reflected well back over the upper surface of the blade or plate, and with a single traction suture inserted through the middle of the lid margin, thus affording a wide exposure of the conjunctival surface when this suture is drawn upward and backward toward the handle of the instrument, and then wound securely around the binding post.

Aside from the simplicity of this new instrument, and its ease of handling, there is an important advantage gained in using a concave-shaped blade, instead of the older, convex-edged type. The latter may afford a fairly good exposure and counterpressure to incision at the broad portion of the lid proper, but it failed short in this purpose at the *corners* of the eyelid.

Here, because of its short, blunt, convex edge the older instrument did not afford sufficient support and retro-exposure for completing the line of incision medially and laterally.

In the new instrument, the elongated concave edge is thus shaped to adapt itself more readily to fit into the retrotarsal fold of the lid (on the dermal side) and because of its wider spread can reach into the corners

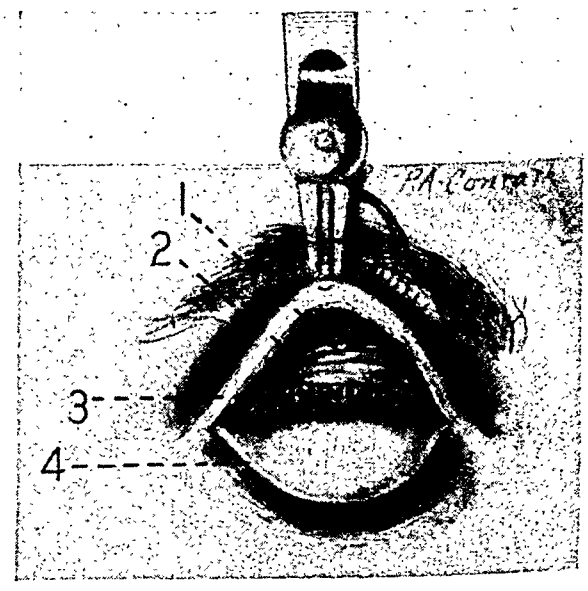


Fig. 4 (Siniscal). Showing new lid plate in use for Blascovics type of ptosis operations. (1) Exposed circular fibers of orbicularis muscle. (2) Detached lid margin. (3) Exposed vertical fibers of levator muscle. (4) Detached portion of conjunctiva and tarsus, stripped from underlying musculature and reflected downward. (Mattress sutures on edge of latter are not shown.)

(angles) of the lid and afford better support by counterpressure when incising the lid at the inner and outer canthal regions.

Furthermore, the newly shaped blade circumvents slipping or "sliding" of the instrument while in use, since its concave edge engages itself aptly into the dermal fold of the reflected eyelid. Slipping and sliding of the older instrument was a fault that frequently caused interruptions and replacement of instrument during operation.

The presence of the spring under the rounded nut on the binding post is to afford tension when the traction suture is entwined (instead of tied) around this post. The nut is turned to the desired tension on the spring, and left in the same position throughout the operation; the traction suture should be wrapped around the post tightly and snugly, and, during the course of the operation—as the need may arise—the suture may be unwound and then reapplied for securing a firmer grip, if so desired.

Although some operators prefer to use three traction sutures during lid operations in place of one, I have found that one suture is usually sufficient for cicatricial entropion operations and for most other procedures requiring repair work on either the upper or lower eyelid. When three sutures are preferred, they may all be wound around the common binding post.

When used on the lower eyelid, the instrument is applied in the same manner, from below, with the blade or plate inserted into the retrotarsal fold and a single, central, traction suture placed through the ciliary margin to retract the eyelid downward over the plate and thus keep it exposed for operative work.

Aside from its use in operations for cicatricial entropion, the new lid plate may also be used for the removal of deeply imbedded foreign bodies located in the inner recesses of the conjunctiva. A small B-B shot was thus removed from the folds of the conjunctiva of a child's lower eyelid. With pressure of the plate applied from the dermal side of the lid, and with widening of the tract of entry on the conjunctival side, the small shot was expressed without difficulty.

Again, during electrolytic epilation operations, it was found that the point of the cautery needle could be more easily directed to the base of the affected cilium when the lid was folded back over such a lid plate and held firmly in place with a traction suture. Since the cilia to be removed are those which have become incurvated or directed toward the cornea, these will appear to stand straight up when the eyelid is retracted, and thus will be more readily accessible.

In another operation, following injury to the eye from a caustic, the lower eyelid was kept well retracted over the new lid plate by a central traction suture; this afforded a wide exposure of the floor of the orbit for the removal of a subtotal symblepharon.

Restoration of the lower sulcus of the orbit was facilitated by retracting the lower eyelid and ciliary margin during the preliminary dissection of the conjunctival flap and insertion of the sutures.

In the Blascovics ptosis operation (fig. 4) the new lid plate will supplant the old type of lid clamp which tears into the ciliary margin from tension during the operation. The new instrument may also be used for tarsectomy and tarsorraphy, or for any procedure for which the older trachoma lid forceps was used. Other applications of the lid plate will suggest themselves to the ophthalmic operator with the subsequent use of this instrument.

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CHRONIC SIMPLE GLAUCOMA AND THE LABILITY TEST

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Recently, Bloomfield and Kellerman* reported their results with several tests

* Bloomfield and Kellerman: Am. J. Ophth., 30: 869, (July) 1947.

usually employed for the early detection of chronic simple glaucoma. Prior to this, Bloomfield and Lambert† described fully their method for testing the lability of ocular tension. This method consists in the application, at the same time, of the cold pressor and the jugular compression test. The former investigators reported the apparent superior value of this provocative lability test as a diagnostic procedure.

Results

The convincing soundness of the report prompted the present investigation. This consisted of the use of the lability test in early established cases of chronic simple glaucoma. Thirty-one patients were examined; all 31 gave a positive response according to the criteria described by the authors. The results conclusively corroborated those of the originators.

Comment

The lability test, as a dependable diagnostic procedure, is of unquestionable value. Speaking for it is the factual simplicity of its execution and interpretation, as well as its time-saving element—an item in a busy office.

Although the number of investigated cases was small, all, or 100 percent, showed positive results with the lability test.

The procedure is being recommended as a superior routine provocative test for the detection of early glaucoma.

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OPHTHALMIC SMALL BANDAGES*

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It is surprising how little the so-called ophthalmic small bandages are known and still less used. Even in the chapter "Bandages" of the Handbook of Graefe-Saemish, they are not mentioned. Their importance, however, cannot be disputed.

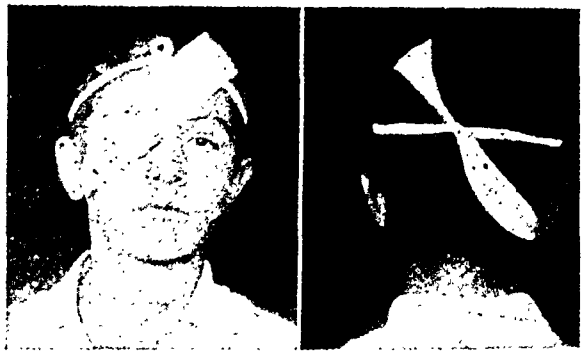


Fig. 1 (Gát). A crossed small bandage.

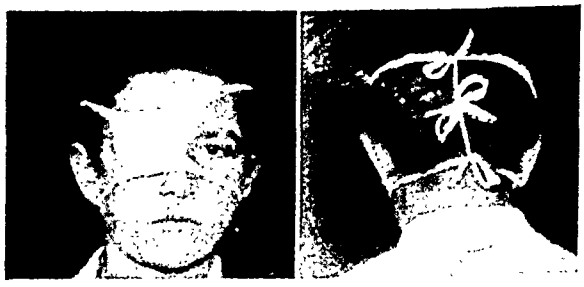


Fig. 2 (Gát). The sling bandage.

The University Eye-Clinik in Debrecen, according to the traditions of the Blaskovics school, used the different kinds of small bandages extensively. Correctly applied they are sure and immovable. A skillfully applied small bandage, with a 80 to 120 cm. swathe, holds more safely and covers better than the monocular bandage used generally.

The most simple is the bandage that we call a "crossed" small bandage because the two branches of the band are crossed over the occiput. First of all, we put gauze and cotton on the eye and then the bandage is applied, its two branches crossed on the occiput and tied on the forehead. It is simple and holds well for 24 hours, even when the patient is bedridden. In general medical practice, this bandage is to be recommended. A strip of material 8 to 10 cm. in breadth and 120 cm. length is enough for this purpose (fig. 1).

The second bandage, more complicated, is the sling bandage. For this a band of 8 to 10 cm. in breadth and 80 cm. in length is

† Bloomfield and Lambert: Arch. Ophth., 34:83, 1945.

* From the University Eye-Clinik, director, Professor Kettesy.

necessary. We split the two ends so that the middle part (8 cm.) remains intact. This middle part is placed on the eye. The split upper band parts are knotted above, the lower ones below the occiput. The two strips are tied together just in the center of occiput, thus avoiding their slipping down (fig. 2). Although, with the crossed small bandage, a displacement can happen or the gauze and cotton may slip down, with the sling bandage, this does not occur.

University Eye Clinic.

REFRACTION CLINIC*

DISCUSSION BY

ALBERT E. SLOANE, M.D.†
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These two cases deal with keeping people relatively happy with old glasses, rather than in making people unhappy with new glasses. This is a negative approach rather than a positive one. A lesson may be learned in the practical management of such cases.

CASE 1

The first patient is a woman who is 79 years of age, and she has not had her glasses checked in 25 years. Her right eye was lost at the age of four years from "scarlet fever," and other than for some early lens changes, the left eye was normal.

She was wearing: O.D., balance lens; O.S., −0.75D. sph. ⊂ −1.25D. cyl. ax. 55° = 20/100+; addition, +2.00.

She was refracted with considerable care because we noticed that she was able to get with a subjective examination: O.D., anophthalmus; O.S., 20/200; with a −1.50D. sph. ⊂ −1.25D. cyl. ax. 80° = 20/40 slowly; addition, +2.50. Pinhole does not improve further. So, these glasses were prescribed, and the doctor assured the patient that she would be happy because, with her new glasses, she should be able to see better.

One month later, the lady returned complaining that she was having bifocal trouble which she did not have before. "The segment was a little bit higher than in her own lens," and it "kept getting in her way." The glasses were checked for power, and the refraction rechecked. Both were found to be correct, and the patient was referred to the optician for adjustment of her glasses.

She was again seen with multiple complaints referable both to conjunctival irritation and her new glasses. She was given some collyrium for the conjunctivitis, and again reassured about her glasses.

And three weeks later, she again returned with many complaints attributable to her glasses. Again refraction was rechecked. The glasses were found to be correct.

DISCUSSION

In general, it may be said that if a person wears her glasses for a long period of time, she will be more resistant to any sort of a change made. One, then, has to weigh whether the added visual benefits will offset the required various new adjustments, such as judgment of distance, new frames, and new strong lenses.

If the patient's symptoms are not specifically and entirely tied up with the need for a change in glasses, it is frequently better to make no change at all. Sometimes, even three lines of vision are better sacrificed than to reintroduce the patient to the new adjustments which different glasses make necessary.

In this particular case, where the patient wore her present glasses for 25 years, we have such a situation. Another factor in this case resolves itself about the fact that she has been able to wear her glasses for this period of time. This is probably due to two factors:

First, she was wearing 0.75 diopters less myopic correction than she requires. This would serve to give her a comfortable work-

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† Director of Department of Refraction.

ing near range through her distant glasses for most of her occupations; for example, eating, washing dishes, and so forth.

Secondly, this undercorrection would tend to express itself in the form of a stronger presbyopic correction for near; thus 0.75 diopters of uncorrected myopia would tend to increase her near vision. Since the reduction of vision in such cases is very gradual, she may not have noted or missed that her distant vision was particularly failing. And also, her needs for greater distant vision is not as great as in a person who leads an active, outdoor life.

I do not mean to infer that one should never change glasses in old people. But if you are in doubt, you frequently get into less difficulty if you do not change the glasses. Since the patient could not make the necessary adjustment, her old lens was reinserted. She was told to keep her new lenses for possible future use. Sometimes, a person who resists a new glass in favor of her old glass, finds that when the old lens is again used, it doesn't equal the new glass in its suitability, and then the patient is more willing to go back to the new one. The point I might make in regard to that is "Always try to have the patient keep her old glasses if you make a change." Because, if she has difficulty with the new lenses, she will soon learn by comparison that her old lenses were not as good as she thought they were.

Case 2

The second patient in this group is a woman, aged 70 years. She has been wearing her present glasses for 15 years: O.D. +0.25D. sph.. ⊃ −1.0D. cyl. ax. 10°; O.S., +0.25D. sph. ⊃ −1.0D. cyl. ax. 165°; addition, +2.50.

We have no record of how much vision she had with her old glasses, but a subjective examination revealed the following: O.D., +0.25D. sph. ⊃ −1.25D. cyl. ax. 20° = 20/20; O.S., +0.75D. sph. ⊃ −1.5D. cyl. ax. 140° = 20/20; addition, +3.0. And, she could read the finest print. The glasses were changed.

Four months later, she came into the hospital complaining that she was unable to wear her new glasses because of the discomfort they produced, and that she finds considerable relief when she puts on her old glasses. The examination of her eyes, other than for retinal arteriosclerosis, was not remarkable. The glasses were rechecked, and it was found that with them, she had 20/20 vision.

The refraction proved correct, but a note was made that the interpupillary distance of the new frames was considerably greater than that of the old ones. So, she was referred to the optician to correct the situation.

Two months later, she again returned, insisting on having her money back. She was unhappy with her glasses, and had fixed ideas about their strength, and the note at the bottom of the record read, "Everybody would be happier if the glasses had not been changed." Here, again, we have a person who has worn her glasses too long, who is too set in her habits, and at home, even though the visual acuity was improved, found it difficult to adjust herself to the new glasses.

Discussion

It is just as well to explain that, when a person reaches the arteriosclerotic age, they do not learn new tricks easily. If no harm is done by not changing the status quo too much, no treatment may be as good a treatment as any. You prescribe a little zinc, and let the next fellow change the glasses.

Questions

House Officer: Is it not true that these people may have had difficulty with their eyes that led them to have the prescription for their eyes checked?

Dr. Sloane: I am told that, in both cases, the patients admitted that they were told that it was advisable to change their glasses after such a long period of time.

House Officer: How long a period of time does one have to wear glasses before they reach this "resistant-to-change state?"

Dr. Sloane: I would say 10 years or more would make me wary.

House Officer: In Case 1, if 20/100 vision is considered a serious blurred state, wouldn't it be better to improve her distant vision some?

Dr. Sloane: Perhaps, half way, such as giving her −1.12 instead of −1.50.

House Officer: In view of the difference in the first case of the sphere and in the axis of cylinder, would you not attempt ordinarily to correct this patient, and take your chances that the patient would be happy?

Dr. Sloane: Everybody is clever in reasoning post hoc. I probably would have tried to evaluate her symptoms in terms of "need for change of glasses," and if the symptoms were not visual, I probably would not have changed her glasses.

As far as axis of cylinder is concerned, by wearing her cylinder at the wrong axis, an artificially produced oblique astigmatism was present for which she had had an adequate number of years to make allowances, and, if you change the axis to the correct position, you may be introducing a new criterion of judgment to which she must adjust.

Frequently, you will have a person who has a strong cylinder, for example, at axis 105°, and they have never worn glasses before. They never complain without glasses that vertical lines are tipped, because they interpret this position as the normal straight position. When you give them the correct glass, one of the first symptoms they complain of is, "that everything that is straight is now tipped," and they must make an adjustment to this until it corrects itself.

There is another point on the old lady. A cylinder that is not at the correct axis in a younger person may induce an accommodative effort in order to correct the blur, and this accommodative effort will produce fatigue. The wrong axis will make for eyes blurring. In a person of this age without any accommodation, no effort is made to correct this blurring, so that she has the blur without the fatigue.

House Officer: Assume that you had prescribed the above glasses, how long would you insist that the patient try to become adjusted?

Dr. Sloane: Since some patients can adjust themselves, one should insist as long as they honestly believe that they are gaining ground. You can easily determine by talking to the patient whether they are ever going to get used to them at all. I believe it is fair to say to the patient that it is to her advantage to get used to the new glasses, because that in itself may be the incentive that will make it possible.

243 Charles Street (14).

ETIOLOGY AND THERAPY OF ACUTE RETROBULBAR NEURITIS*

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Acute retrobulbar neuritis is not a rare disease in China and we have had here about nine cases a year at this hospital. It is difficult to get a clear opinion about the frequency of acute retrobulbar neuritis; it may be that this disease alarms the patients and induces them to go earlier to the hospital than patients with other diseases, who come as a rule very late to see a doctor, often waiting for months. The frequency of retrobulbar neuritis is especially striking as in China we have apparently no multiple sclerosis, which occurs frequently in Europe. The etiology of retrobulbar neuritis in China is especially obscure. The rhinologic factor, causing an inflammation of the optic nerve is not usually found. Rhinologic therapy—such as the application of a swab

* From the Eye, Ear, Nose and Throat Hospital.

soaked in adrenalin or cocaine, scarification of the concha or opening of the ethmoid cells—does not, as a rule, bring any relief. According to Ernst Fuchs, acute retrobulbar neuritis frequently shows the same type of inflammation of the nerve as the neuritis of the nervus facialis or abducens or sciaticus. These cases were formerly called, and probably rightly so, rheumatic inflammations.

Although there is no multiple sclerosis in China, there are cases of recurring acute retrobulbar neuritis as, for instance, that of a patient, aged 25 years, who had retrobulbar neuritis in the right eye and, later, temporal pallor with normal vision. Recently, he has suffered from severe retrobulbar neuritis of the left eye. A similar case of recurrent retrobulbar neuritis was seen lately by Prof. Adalbert Fuchs in Nanking.

Report of a case

A colonel, aged 38 years, had severe acute retrobulbar neuritis 10 years ago in both eyes. The left eye had become affected a month after the right. His vision at that time was 6/60. He recovered without treatment in seven months and his vision became 6/6. In August, 1946, his vision in the right eye dropped in one day from 6/6 to hand movements. The eye was tender to touch but there was no pain on motion. A week later the left eye also became involved, and he could only count fingers.

A careful general examination did not reveal any etiology and search for evidence of multiple sclerosis was absolutely in vain. In September, he was given penicillin and he became able to read J8. In October, the tonsils were removed and the ethmoids opened. Four days after the operation the vision improved somewhat and he saw, with the right eye J5, and with the left eye, J2. Later on the vision improved a little and in May, 1947, his vision was: 6/8, J1, O.U. The right papilla was a little pale on the temporal side, the left normal.

Although this case improved somewhat after the operation on the nose, it is not certain that it was really caused by an empyema or chronic inflammation of the ethmoidal cells, especially as nothing was mentioned of any local change or of any secretion.

Therapy of retrobulbar neuritis

The therapy of retrobulbar neuritis is somewhat different in China from that used in Europe. We cannot use diaphoresis which proves so valuable in other countries. This is due to different causes: (1) The Chinese do not like to perspire. (2) It is difficult to make them perspire. (3) The facilities for inducing perspiration, such as bathrooms, steambaths, heat boxes, lightbaths, and so forth are lacking in most places in China.

Because of these mentioned contraindications, typhoid vaccine has been chiefly favored throughout this country as a form of fever therapy; an initial dose of 5,000,000 bacilli is injected intravenously with a subsequent increase of 50 percent in dosage. The fever occasionally rises to 39°C. and often reaches only 37.5°C.

Milk injections are rarely used in China, apparently because the Chinese react very little to milk, even after 10 cc. have been injected intramuscularly. The cause of this resistance is perhaps the fact that the milk is not a mixed milk as in Europe and comes mostly from one cow and is boiled immediately so that no germs can proliferate in the milk. Injections of 5 to 8 cc. of condensed milk prove very useful, however, if taken directly out of the tin without further boiling. Condensed milk is easily available even in small places in China. These injections give a strong fever reaction with considerable certainty.

Acute form of disease

We recently had a very severe case of acute retrobulbar neuritis of unusual appearance in which the therapy had a striking result.

Case report. A Chinese woman, 51 years

of age, felt slight visual disturbance in the right eye six days before examination. Her vision dropped in three days to hand movements at 30 cm. She was admitted to our hospital. At that time she had slight pain on moving or by touching the eye. The papilla showed a typical choked disc with hyperemia, blurred margin, engorged veins, small hemorrhages, and a mushroom-shaped elevation of three diopters. The left eye was normal. Vision was: O.S., with a +1.0D. sph., 6/6.

On the next day only light perception was noted. On the second day after admission she was given 5 cc. of milk intramuscularly. The day following both light perception and light reflex of the pupil had vanished. An injection of 10 cc. of milk was made on the fifth day and produced a high temperature but no improvement in vision. Two days later 5 cc. yatren-casein was injected intramuscularly. The light sensation and light reflex of the pupil had not been present for three days. The disc showed an increased amount of hemorrhages. This was perceived on the seventh day after admission. Three days later, another 5-cc. dose of yatren-casein was given.

On the 12th day after admission, light perception reappeared, after not having been present 7 days. This was 4 days after the first injection of yatren-casein. She could count fingers on the temporal side at 12 cm. On the 14th and 16th days, another yatren-casein injection (5 cc.) was given. After this she could count fingers at 20 cm.; while standing at 6 meters she could see movements of the leg in the inferior part. From the 19th to the 38th day after admission, she was given 1 cc. of yatren-casein every day. Vision improved slowly. On the 29th day, a central scotoma could be found with the perimeter. The outline of the papilla became gradually distinct and the swelling disappeared. She was discharged on the 38th day after admission. The vision of the right eye was 6/15 and the papilla appeared normal, except that in the neighborhood of the disc there were a few small superficial hemorrhages. Two weeks later vision was 5/10.

Discussion

This case differs from the cases of Dr. Fuchs in its clinical appearance. The disc was not normal but appeared like a very badly choked disc with high elevation and many hemorrhages. Acute retrobulbar neuritis sometimes shows a marked papillitis, but such a highly choked disc is rare. That was the reason we did not make the correct diagnosis at first. We searched for a brain tumor, but the absence of headache, vertigo, and vomiting made a brain tumor very unlikely. Tenderness of the eye led us to the final diagnosis.

2. Against a diagnosis of choked disc in the common sense spoke the development of perfect blindness and absence of light sensation, which never develops so quickly in a common choked disc due to the increase of intracranial pressure. The patient did not become blind as quickly as the cases of Dr. Fuchs.

3. The milk injections did not show any change of the vision but the use of high doses of yatren-casein forte, which was given us by Professor Fuchs, produced an improvement of vision, light sensation appeared and pupillary reaction was visible when the light was directed from the temporal side. The improvement was slow at first and became more rapid. Finally when the vision had reached 6/12 we stopped the injections because the medicine had run out.

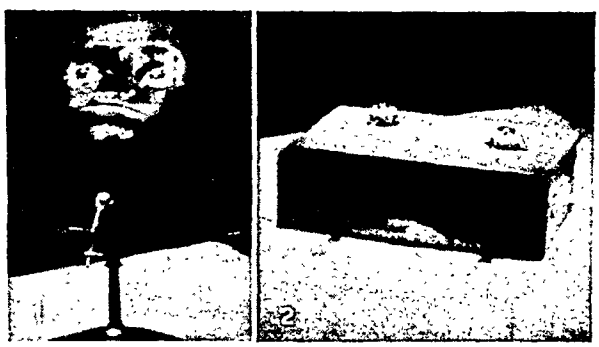
Intramuscular injections of yatren-casein are usually given in small doses (1 cc.) intramuscularly. Even cases which are quite resistant to ordinary therapy and come rather late, react very well to this therapy.

Eye, Ear, Nose, and Throat Hospital.

A PHANTOM FOR ANIMAL EYE SURGERY*

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Figures 1 and 2 represent eye phantoms in common usage for training in pig-eye and cat-eye surgery. The first (fig. 1) is a modification of the Vienna mask which operates by grasping the optic nerve of the eye. A screw arrangement draws the eye into a conical wire basket and also permits the tension to be varied. The second (fig. 2) was designed by the late W. A. Fisher.† In this



Figs. 1 and 2 (Stonehill). (1) Modification of the Vienna mask which operates by grasping the optic nerve of the eye. (2) Designed by Fisher, this type of phantom uses a suture to hold the eye in position.

phantom, a suture is placed through the optic nerve, and the thread is passed through a hole in a cigar box and attached to a wooden rod which protrudes through both sides. As the rod is rotated, the suture is tightened and the eye is held in position.

In our experience the mechanical-type phantom is cumbersome to adjust and requires considerable time to insert material. The eye is not held tightly, nor can it be placed in any desired position. Securing eyes in the Fisher phantom is also a laborious and time-consuming procedure. The human face is not simulated and the eye is unsteady and difficult to fix.

Figure 3 shows a phantom in which the holding device is a vacuum cup. To this is attached a short piece of rubber tubing and a soft rubber bulb. The bulb is squeezed; the eye is inserted in the cup in any desired position and held in place by negative pressure when the bulb is released. The eye is quickly removed by pressing the bulb which still contains sufficient residual air to force the eye out of the cup. A small wire guard prevents the eye from entering too deeply into the cup.

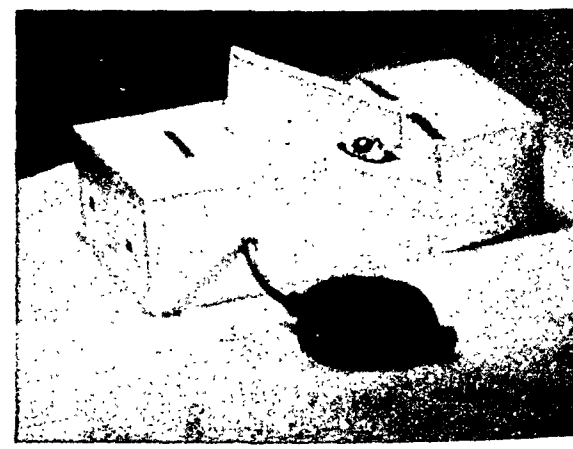


Fig. 3 (Stonehill). The holding device in this phantom is a vacuum cup.

The face consists of a cigar box modified to exaggerate facial contours. A deep orbit is simulated and the obstruction of the forehead and nose is present. These are constructed from cardboard.

The rubber cup is a crutch tip (size 19) and is available in many sizes. To it is attached a short piece of rubber tubing, using a metal connector or rubber cement. The rubber bulb is standard, but valves must be removed and the inlet hole closed with an appropriate plug. These can be obtained from a penicillin or vaccine bottle and cemented in place.

6 North Michigan Avenue (2).

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* From the Harlem Eye and Ear Hospital, New York City.

† Fisher, W. A.: Cataract, Senile, Traumatic, and Congenital. Chicago, Chicago Eye, Ear, Nose and Throat College, 1917, p. 64.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

November 3, 1947

DR. DANIEL KRAVITZ, *president*

SYSTEMATIC EXAMINATION OF THE EYE

DR. HENRY J. MINSKY discussed this subject during the instruction period.

SOME UNSOLVED PROBLEMS IN SQUINT

DR. FRANCIS HEED ADLER first discussed whether comitance rules out paralysis of a muscle in cases of squint. He said that frank incomitance in the angle of squint is generally regarded as a sure indication that the strabismus is either paralytic or due to an anatomic abnormality, such as faulty insertion of a muscle. The one exception to this is the elevation of an eye in adduction which occurs in some otherwise comitant squints, and which is regarded by most authors as representing the normal preponderance of the inferior oblique over that of the superior oblique. This preponderance is due, according to their point of view, to the fact that the inferior oblique is a longer muscle and has a longer arc of contact.

In considering the question, of whether comitance rules out a paralysis, he said that many authors agree that a squint which was incomitant at its beginning may, with the passage of time, become comitant due to either spasm or contracture of the direct antagonist or of the yoke muscle of the paretic muscle. When the paretic muscle recovers from its paralysis, the comitant element remains.

Dr. Adler said that there is very little proof that this is true. It is of more than academic interest to determine whether it is true or not in that it determines our decision as to the nature of the strabismus in any case; that is, whether the squint is paralytic or innervational and this should considerably alter the prognosis and type of treatment.

Contracture of a muscle may undoubtedly occur in severe paralysis and lead to a comitant element in a squint. In such cases, however, the angle of squint still remains incomitant due to overaction of the yoke muscle. A muscle which was paralyzed may regain sufficient power to move the eye completely in the direction of its action, but as long as any weakness remains this will be manifest by the overaction of the yoke muscle, based on Hering's law.

Dr. Adler said that he had never seen a case of paralysis of an ocular muscle occurring in an adult become comitant. There may develop a strabismus in the primary position of gaze, due to contracture of the antagonist muscle; namely, the internal rectus in a case of external rectus palsy, but the squint is still incomitant, even in partial recovery of the externus, due to overaction of the internal rectus in the opposite eye. This is always a sign of paralysis of a muscle.

No one has examined muscles which are thought to be contractured to determine whether or not they are fibrosed. Further the term "spasm" when applied to a muscle is purely hypothetical. Studies should be made to determine the basis of what contracture of a muscle is, and if possible physiologic evidence should be produced to show that a muscle termed "spastic" is really undergoing spasm. Any paper or book in which such terms are used freely should be examined with caution.

Dr. Adler next discussed the question of whether a horizontal strabismus can arise from a paralysis of a vertical muscle. He said that it seems reasonable to suppose that a paralysis of a vertically acting muscle could dissociate the eyes in the same manner as

inserting vertical prisms before one eye changes an existing horizontal phoria to a tropia. Once the dissociation has become manifest and continued for any period of time it might become permanent. An additional component of the strabismus should be comitant while there should always be elicited some evidence of incomitance.

Dr. Adler then spoke of the meaning of anomalous correspondence. He said that there are two fundamental concepts regarding retinal correspondence. (1) That it is innate, and (2) that it is acquired. The vast majority consider it acquired and that anomalous correspondence arises out of squint, perhaps as an adaptation to the angle of squint. It is a poor adaptation, if this is so, since it could only be effective in normal life in those cases of harmonious correspondence where the subjective and objective angles are equal. In most cases of squint with so-called anomalous correspondence, there is no correspondence. Due to suppression, the region of the retina where the image customarily falls is suppressed and no spot in that retina has the same locus in space as the macula of the fixing eye. It is true that, by training, anomalous correspondence may be broken up and normal correspondence established in many cases.

Dr. Adler then asked whether anomalous correspondence could develop in a case that had normal correspondence. He said that it is possible that anomalous correspondence is innate and due perhaps to some anatomic defect in the arrangement of the visual pathways. From this point of view it might even be considered the cause of squint in large-angle squints. In an analysis of our series, we found that the large majority of squints under 15 degrees had normal correspondence, while over 15 degrees they had anomalous correspondence. A sudden break came at this point. It is possible that the region of the retina beyond the optic disc on the nasal side contains fibers which yield anomalous correspondence, while those between the disc and macula yield normal correspondence.

Principles of ocular muscle surgery

Dr. Rudolph Aebli stated that there are three principles in the surgery of extraocular muscles: (1) To weaken a strong muscle or function, (2) to strengthen a weak muscle or function, (3) to confine all surgery to the particular field or fields involved, and not to disturb those fields of action in which the muscle balance is relatively normal.

Generally speaking, he said, it is good policy not to cripple the function of any one muscle excessively but to spread the operation over multiple muscles; for each millimeter of recession one figures to correct 4 to 5 prism diopters. These results vary and are flexible but are a basis for preoperative calculations of the muscles operated. Thus deviations of 20 to 25 degrees can be corrected by operating one muscle, deviations of 40 to 50 degrees are best corrected by operating on two muscles, and deviations of 70 degrees or more should be corrected by operating on three or more muscles. By adhering to these rules no one muscle is excessively crippled and the movements of convergence and divergence and associated lateral movements are well maintained.

Recession of the inferior oblique of about 10 mm. corrects about 20 degrees of hyperphoria in the primary position, and has replaced myectomy at the origin, as the results can be gauged more accurately.

The fixating eye in the primary position and in the six cardinal fields is important and operative procedures should be varied, depending on the choice of fixation. Thus in nonparalytic convergent strabismus where the right eye fixates in the primary position and in eyes right, and the left eye fixates occasionally in the primary position but constantly in eyes left, there is no limitation of outward rotation of either eye but there is generally a marked inward rotation of the

nonfixing eye. In such cases surgical measures applied to the rectus interni to stop the overaction produce very favorable results. In cases of double elevator paralysis of one eye in which fixation is constantly with the sound eye, it is better to raise the lower eye; in those that fixate with the paretic eye, it is better to lower the higher eye; in those that alternate fixation, it is good policy to divide the operation between the two eyes.

A few remarks on technique are in order. It is advisable not to disturb the normal anatomic relationships and to maintain the fascial muscle envelopes. The sutures hold better and less hemorrhage is encountered. Retraction of the caruncle must be avoided and the supporting structures should not be disturbed. Scleral fixation is not foolproof, and clots and raw surfaces tend to produce adhesions to the underlying sclera with disappointing results.

Dr. Aebli concluded his discussion with slides and case reports illustrating the principles he had discussed and showing errors in technique and in operative judgement.

Diagnostic criteria in surgical management of lateral deviations

Dr. Harold W. Brown emphasized the surgical importance of an accurate diagnosis. He said that if the accommodative convergence and the divergence functions are considered as direct antagonists, the comitant convergent squints can be classified as primary convergence excess, or divergence insufficiency and the relationship or amount of the secondary over- or underaction of the antagonistic function will serve as a surgical guide, as to which functions (convergence or divergence) should be strengthened or weakened. The divergent comitant deviations are classified in the same manner.

Dr. Brown discussed the question of whether the deviation is primarily a divergence excess or a convergence insufficiency. He said that the determination of the amount of secondary overaction of the divergence in convergence insufficiency and the amount of secondary underaction of convergence in the primary divergence excess type, will be the determining factor as to the amount of recession of the externi, or the amount of resection of the interni that should be done to correct the divergent lateral deviation.

In the noncomitant or paralytic lateral deviations, the diagnosis of the paretic muscle is usually evident by the failure of the muscle to rotate the eye fully in its field of action. The cause of this failure may be due to a primary weakness of the nerve, congenital anomaly of the insertion, structural change in the muscle, or limitating fibrous bands in the direct antagonist.

A nerve or muscle weakness will usually show a secondary contracture of the direct antagonist or secondary deviation of its associate muscle in the other eye, or both. Surgery of a truly paralytic type is based on a strengthening operation of the paralytic muscle or a weakening operation of the direct antagonist or the yoke muscle of the other eye.

In those cases where the restricted action is due to a limiting fibrous band in the direct antagonist, such as is found in retraction syndromes, there is usually no secondary contractures or deviations, and the surgical management will depend on the functional integrity of both the muscle involved and its direct antagonist. The range of movement is usually limited and surgery should be confined to shifting that range nearer the primary position.

Lateral squints that show a vertical deviation will call for a careful analysis of the lateral deviations, in terms of both the over and underactions of the disjunctive functions of convergence and divergence, by measuring the deviation of distance and near, and in the six cardinal fields of gaze, for the over- and underactions of the individual muscles. After the diagnosis is made, the surgical correction of the greatest devia-

tion, either the vertical or lateral, and the field where that deviation increases, seems to be the safest surgical procedure.

The variations and combinations of the dysfunctions of convergence, divergence, individual anomalies and their secondary deviations and contractures, and the complicating vertical deviations defy any final standardization of the surgical management of these lateral deviations, based on anything other than a diagnostic analysis of each individual case.

Discussion. Dr. James W. Smith said that Dr. Adler had brought some new and stimulating thoughts on ophthalmic physiology. He said that one becomes confused by authors who use the same words with different meanings. He mentioned the use of such terms as muscle overaction, underaction, spasm, contraction, overshoot, paresis, palsy, partial paralysis, and paralysis. To this array, Bielschowsky has added congenital overaction of the inferior oblique muscle; another contribution made by Chavasse (and stressed by Dr. Adler in a recent paper) is inhibited palsy of the contralateral antagonist. Dr. Adler once again made an appeal for uniformity in eye-muscle terminology.

Dr. Smith said that we diagnose, treat, and operate too late in life to achieve binocular single vision. He stressed the need to educate the general practitioner, pediatrician, and some ophthalmologists to the importance of bringing patients for treatment in infancy and early childhood if amblyopia is to be forestalled. Many patients, who recognize deviations early in childhood, have been dissuaded by their medical advisers from seeking ophthalmic treatment immediately. Most of the cases can then only be improved cosmetically. Only a few are brought for observation early enough to effect recovery of binocular single vision.

Bernard Kronenberg,
Secretary.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

November 18, 1947

Dr. Edwin B. Dunphy, *presiding*

Tumors of the orbit

Dr. Arnold Forrest of New York reported an analysis of 204 cases of intraorbital tumor in the files of the Registry of Ophthalmic Pathology. It was noted that, of the 168 primary tumors, there were 89 masses of mesenchymal origin including those related to connective tissue, to the vascular tree, and to the hematopoietic system. Fifteen mixed tumors had arisen in lacrimal gland. Forty-eight neoplasms were of neurogenous origin and included those arising in peripheral nerve sheaths, meninges, and optic nerve. Eighteen dermoids were noted. In 42 instances of primary intraorbital neoplasm, the tumor was malignant; one third of these patients had a five-year cure. In addition, 24 carcinomas, 6 neuroblastomas, 5 melanomas, and 1 pituitary melanoma noted in the orbit had arisen in a primary site elsewhere.

In the discussion that followed, Dr. Frederick Verhoeff noted that the cylindroma, lymphangioma, and liposarcoma were not included in the classified types.

Dr. Forrest replied that the cylindromas were included in the mixed tumors, and that the specific tumors in the Registry to which Dr. Verhoeff referred as lymphangioma and liposarcoma were placed in the groups of angioma and undifferentiated sarcoma, respectively, since there had not been universal agreement among the pathologists on the question of their differentiation.

Dr. Parker Heath said that it was only by such a series of cases as Dr. Forrest presented and other series that other laboratories are trying to produce that one can really arrive at some sort of good surgical judgement in the management of these cases.

OCULAR HYPOTONY

DR. PARKER HEATH of Boston presented this subject which he defined as: intraocular pressure below the normal for that eye. An arbitrary upper limit is 10 mm. Hg (Schiøtz) or the equivalent. Low pressure is often associated with deterioration of the globe.

Facts and theories relating to cause were discussed with the following headings: contusions, nervous origin, perforating wound and injury, myopia, uveitis, detachment of retina, congenital malformation, general disease states, endocrine imbalance, drug and surgical therapy, and spontaneous causes.

The pathology of hypotony related to severity and duration. Occasional signs are edema of lid; enophthalmos; cornea thickening; wrinkles of cornea; radius of curvature lessens; edema of epithelium; iris congested, cystic at times, pigment movement; anterior chamber deepened; iris angle more right angled; angle trabeculum looser; diameters increased; aqueous plasmoid and contains cells; ciliary body atrophic or inflammed; cyclitic lens change common; scelra thickened; vitreous and aqueous more xanthotic; suprachoroidal space enlarged by fluid; choroid congested or disorganized; retina cystic—pigment migration; detachment often; nervehead edematous, sometimes choked. Clinical significances were discussed.

Dr. Frederick Verhoeff opened the discussion of the paper. He mentioned the hypotony that occurs in eyes with subsiding infection. The eye may have good light projection, so that one hesitates to take the eye out. He had never observed the tension in such eyes to become normal, and he asked Dr. Heath if he knew how to raise the tension in such cases.

Dr. Verhoeff took issue with Dr. Heath, who, he said, apparently agreed with Dr. O'Brien in regard to the great frequency of separation of the choroid 24 hours after the operation. He felt that the appearance is due to indentation of the sclera, since the eye is examined when it is still soft. He personally did not believe separation of the choroid occurs in every case. However, he felt that one does get a separation quite often when there is prolonged low tension. He noted that it was Barkan who first thought the separation of the choroid was due to leak of aqueous through the wound.

In cases in which the choroid did not go back in a reasonable time, he thought a scleral puncture should be done. He mentioned two cases of spontaneous separation of the choroid, one in a low-tension eye. In one case the retina was not separated, the fluid behind the choroid contained very little serum, the patient had had diarrhea for years. In the other case there was also some separation of the retina.

Dr. Verhoeff observed that several cases of choroidal separation have been associated with hypertension with nephritis, which caused trouble in the choroid. He felt that the fact that separation of the choroid does not occur more commonly is proof that aqueous is a secretion, not a transudate, for by simple transudation the fluid could go more easily into the ciliary body, thence to the subchoroidal space, than through the membranes, and so forth to the aqueous.

Dr. William Beetham pointed out that in diabetics studied by Dr. Waite and himself only the ones in coma and with true glaucomas showed demonstrable variations in tension. He thought that an iridencleisis was the operation of choice in chronic glaucoma, especially in older people, since hypotony may develop with the trephining operation.

Dr. Paul Chandler pointed out that in those cases of contused globe with reduced vision, the reduction is due to a refractive error, usually a high astigmatism from pressure of the lids on the cornea. A chalazion of the upper lid may cause pressure on the globe sufficient to cause astigmatism of considerable degree if the intraocular pressure is 15 mm. Hg (Schiøtz) or less.

Dr. Judd Beach asked which comes first,

the hypotony or the uveitis. Dr. Cogan inquired as to where the vitreous goes if there is a separation of the choroid.

Dr. Heath in reply said that myopia was present in one third of the cases with hypotony. In detachment of the retina there may be noted marked reduction in caliber of the blood vessels of the retina. He has the impression from laboratory material that the fluid outside the choroid is transient, while the fluid under a separated retina is more permanent. In reply to Dr. Beach, he thought the uveitis usually came first. In regard to where the vitreous goes, he said the vitreous was mostly water, and this may be resorbed and later replaced by more water, by some process not fully known at present.

Mahlon T. Easton,
Reporter.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

December 18, 1947

Dr. Burton Chance, *chairman*

Mixed-cell tumor of lacrimal gland

Dr. I. Edward Rubin (by invitation) presented a follow up on a case of mixed cell tumor of the lacrimal gland which was presented to this society one year ago.

Case Report. F. Y., a 36-year-old white man, developed a tumor of the left lacrimal gland at the age of 10 years. The tumor was excised when he was 16 years of age and was reported to be a "mixed tumor" of the lacrimal gland. It recurred 11 years later, when the patient was aged 27 years, and failed to respond to a full course of X-ray therapy. A retrobulbar tumor mass was removed from the left orbit of the patient now aged 33 years. Again, the pathologic report was "mixed tumor" of the lacrimal gland.

The tumor soon recurred, producing complete ptosis of the left upper lid and a moderate proptosis. In March, 1946 (age now 35 years), papilledema of the left nervehead was first noted and an intracranial extension of the tumor was feared.

In July, 1946, at the Graduate Hospital, Dr. Robert Groff performed a left frontoparietal craniotomy and found no intracranial extension; but the left orbit was filled with tumor tissue which compressed the left optic nerve. Dr. Groff removed most of the tumor. The pathologic report was adenocarcinoma.

Two weeks later in August, 1946, Dr. Edmund B. Spaeth exenterated the entire left orbit. This was followed by large dosage X-ray therapy, and the patient developed marked X-ray sickness.

In January, 1947, six small metastatic nodules were noted in the left scalp under the skin. X-ray films now disclosed a small area of metastasis in the left sphenoid bone. The exenterated socket granulated well, with no recurrence of tumor lesions in the socket at any time. In March, 1947, X-ray studies revealed metastases in the left frontal bone. In June, 1947, the patient had a severe spell of vertigo, falling to his right side and vomiting. Then he had frequent episodes of speech aphasia with loss of memory and with weakness in his right arm.

Examination disclosed paralysis of the left fifth cranial nerve including the motor division, diminished right corneal sensitivity, slight deafness in the left ear, weakness of the right arm, slight dyssynergia of the left arm, and an ataxic gait. X-ray studies now showed further metastases to the left sphenoidal ridge and to the posterior portion of the left ninth rib. A spinal tap revealed clear fluid under normal pressure with a heavy globulin reaction, and a colloidal gold curve of 5,443,322,000. A ventriculogram was negative, but metastases to the left cerebrum and to the posterior fossa were strongly suspected.

The patient steadily went down hill with frequent episodes of speech aphasia and

with progressive weakness of his right arm and his right leg.

During all this time his right eye remained normal, although possibly the retinal veins and arteries were slightly more full and slightly more tortuous than they had been one year before.

A few days before death he became drowsy and developed a paralysis of the right sixth nerve. He died in a coma August 29, 1947. Autopsy permission was refused. The immediate cause of death was thought to be due to increased intracranial pressure, which in turn was due to cerebral metastases.

This case well illustrates that mixed tumors of the lacrimal gland tend to recur if followed long enough and that they tend to become malignant. These tumors have a strong tendency toward bony invasion. Roentgen therapy has little effect on this type of tumor. If the tumor invades the soft tissues of the orbit, immediate exenteration is indicated. If there is bony involvement, a complete bone resection of the involved osseous portion is advisable. Finally, the best surgical approach is through the roof of the orbit by a frontal bone flap.

(I wish to thank Dr. Spaeth again for giving me the privilege of presenting this interesting case.)

Discussion. Dr. I. S. Tassman: Mr. Chairman, may I present a case, which in several ways is similar to the case that was presented by Dr. Rubin a year ago, and again with a final report tonight.

This case first came under my observation at the Wills Hospital a little over a year ago. However, the patient had attended the clinics at the Wills Hospital since 1934—a total of nearly 14 years. In 1934, he first noted a swelling of the left upper eyelid over the region of the lacrimal gland. An excision of the mass was done at that time. There was a recurrence, and a second excision was made in April, 1938. There was another recurrence. He returned in 1943, when the mass was again excised; in July, 1945, when there was a similar recurrence and again an excision of a portion of the mass. A biopsy was done each time. The laboratory report from Dr. Perce DeLong was "a mixed tumor."

In October, 1946, the patient again returned, and that was the first time that he came under my observation. He suffered another recurrence of a mass over the lacrimal gland on the left side.

This slide (showing slide) presents the general external appearance of the patient, showing a ptosis of left upper eyelid and the swelling over the upper, outer quadrant of the left orbit. Again we excised some of the mass for biopsy, and this time the report from Dr. DeLong in the pathology laboratory at Wills Hospital was, "tumor cells that are definitely adenocarcinoma."

An exenteration of the orbit was then done. The mass in the upper eyelid, and the infiltration of the soft tissue of the orbit were diagnosed by Dr. DeLong as adenocarcinoma. There was apparently no involvement of the bones of the orbit. At the present time the patient is still living and well, and in apparently good condition.

I believe this is another case of mixed tumor which, after a period of years, became malignant and was found to be an adenocarcinoma of the lacrimal gland.

Teratoma of the orbit

Capt. Frederick Harbert (MC), U.S.N. (by invitation) spoke on this subject and gave a case report.

Congenital tumors are classified embryologically according to the number of germ layers from which the tumor is derived. Thus osteoma, angioma, and so forth, are derived from a single germ layer. Dermoids are characterized by tissue derived from two germ layers; namely, ectoderm and mesoderm. These are characterized by the presence of squamous epithelium and derivatives from it, such as hair, nails, and teeth; sudoriferous and sebaceous glands. The dermis, derived from underlying mesenchyme, may become differentiated to form

cartilage, bone, fat, muscle, or other specialized tissue. Dermoids may occur as cysts or solid tumors. In the former, the dermis is on the outside and the epithelium lines a cavity, usually filled with inspissated oil secretion and hair. In the more common solid type, the epithelium is exposed to the surface of the body; a common site is astride the corneal margin. Solid dermoids are more common than the cystic variety about the orbit.

True teratomas must contain tissue derived from all three germ layers. These are exceedingly rare in the orbit and are usually malignant. The identification of tissue derived from the entoderm is sometimes difficult, and some pathologists rely on the complexity and variety of tissue in making a diagnosis of teratoma. The finding of tissue consisting of cavities lined by pure mucous epithelium with an arrangement characteristic of gut is considered diagnostic of endodermal origin. The dermoid variety of tumor is often referred to in the literature as teratoma, teratoid tumor, mixed tumor, and epibulbar tumor. A perusal of the literature for the past 10 years failed to disclose a single case of pure teratoma that is composed of tissue derived from three germ layers.

The most common locations of dermoids and teratoma are the ovaries, testes, and sacral regions, but they have been reported in nearly every part of the body. An analysis of dermoid cysts seen at the Mayo Clinic from 1910 to 1935 showed that out of 1,495 cases, 45 percent occurred in the postanal region, 42 percent in the genitalia, 7 percent in the head and neck, and 6 percent elsewhere. Among the dermoids of the head and neck, half were in the orbital region, and of these 60 percent occurred in the outer third of the eyebrow. Half of these were noted at birth. Only 10 percent of the dermoids of the orbital region (six in 25 years) were within the orbit, usually in the upper outer quadrant of the right orbit.

Case report. Baby M. was born on December 11, 1946, with a very large mass in the left orbit causing marked proptosis. At birth the conjunctiva and cornea were normal, but within 24 hours the conjunctiva became increasingly chemotic, and the cornea showed beginning cloudiness and infiltration. This process continued in spite of moist-chamber dressings during the following two days before permission for operation was obtained. The cornea was well formed, and measured 9 mm. in diameter. The globe could be palpated through the mass, and seemed to be definitely flattened anteroposteriorly. Behind the globe a solid tumor mass filling the entire orbit could be palpated. The outline of the mass was smooth except inferiorly where several nodules were felt. Transillumination of the mass gave the same consistency as the cheek. The globe transilluminated clearly. A needle passed into the mass for diagnostic aspiration failed to demonstrate fluid. The eye was not fixed, but motion was restricted to random irregular very slow oscillations.

The iris of the right eye was normally blue, but that of the proptosed eye was dark brown. The pupil was miotic, but dilated well with atropine. Slitlamp examination showed persistence of a well-marked pupillary marginal vessel. X-ray films of the orbits showed distinct enlargement of the left orbit with intact bony walls.

Physical examination was negative for other developmental defects, and the right eye was normal. A clinical diagnosis of microphthalmos with cysts was made, and exenteration of the orbit was advised at once to avoid deep infection of the eye and orbit, which was considered inevitable because of exposure and edema. Operative permission was obtained on the third day.

Operation was performed under infiltration anesthesia with no objection from the patient except to the injections. Two-percent procaine with adrenalin was injected into the lids and along the orbital walls to the apex in minimal amounts, and the conjunctiva was anesthetized by pontocaine instilla-

tions. The conjunctiva was first separated at the limbus on the temporal side, and the globe and outer aspect of the mass were exposed to ascertain the relation of the mass to the eyeball, and determine whether the mass was resectable without sacrificing the eye. It soon became apparent that the optic nerve passed through and seemed an integral part of the mass, and that the extraocular muscles and Tenon's capsule were so attenuated that they were not recognizable. An incision into the exposed mass showed it to be composed of solid tissue with multiple cysts containing clear fluid. A line of cleavage between the mass and the periorbita was readily obtained, and the mass could be easily separated.

The entire orbit was filled with tumor which extended to the orbital fissures and optic foramen. When the eye and mass were removed, a plastic implant was placed in the apex of the orbit, and the conjunctiva closed over it. A conformer was inserted in the conjunctival sac. When healing was completed and contraction of the cul-de-sac had stabilized, the conformer was replaced by an acrylic prosthesis made from a casting of the cavity. This has been worn continuously since then.

Measurement of the excised specimen showed the globe to be 18 by 19 mm. at the equator, and 15 mm. in the antero-posterior axis. The retrobulbar mass was roughly 5 by 4 cm., and contained multiple cysts on the surface.

Convalescence was uneventful, and the baby is developing normally with no evidence of recurrence to date.

Pathologic report. The microscopic sections of the excised specimen were examined by Dr. Jonas S. Friedenwald, Wilmer Ophthalmological Institute of The Johns Hopkins Hospital. His diagnosis was: Teratoma of orbit, microphthalmos, exposure keratitis, and hypopyon ulcer of the cornea.

The globe is quite small. The cornea is infiltrated and scarred. The anterior chamber is filled with polymorphs, many of which are seen in the iris stroma, but there is an abscess in the ciliary body. There are many retinal and subretinal hemorrhages, and a few tiny choroidal hemorrhages. The optic nerve shows partial atrophy.

The tumor is a large cystic mass containing fat, bone, cartilage, and many cysts lined with epithelium of varying forms. The epithelial forms include squamous epithelium with many hair follicles and sebaceous and sudoriferous glands, ciliated, columnar, and cuboidal mucous membrane with a papillary structure and arrangement characteristic of intestine. There are also small scattered glands of the racemose type resembling salivary or lacrimal gland.

The matrix of the tumor is young connective tissue. Other tissues that are embedded in this matrix are lymphoid follicles with germinal centers and nerve tissue including large ganglion cells.

Zentmayer Award

The third Zentmayer Award was presented to William M. Hart, Ph.D., for his paper "Hydration Properties of Excised Cornea and Factors Responsible for Transparency." This paper was presented at the October, 1946, meeting. See the JOURNAL, 30: 1022 (Aug.) 1947.

Fusional Vergence

DR. EDWIN FORBES TAIT (by invitation) presented a paper on "Studies in Fusion: Fusional Vergence," an abstract of which follows.

The fusional process in vision is a twofold entity. It is, first, concerned with sensory perception, which is that which should properly be designated as "fusion," and, second, the varying of the position of the visual axes of the eyes in order to retain single binocular vision, which should be considered as "fusional vergence."

Fusional vergence may be defined as the modification produced by the fusional process in the distribution of tonic reciprocal

innervation to the extraocular muscles, in order to preserve or to gain single binocular vision.

The author reports on 500 subjects, who were selected as normal individuals in view of the fact that they possessed clear, comfortable, and efficient single binocular vision and were wearing suitable glasses, if needed.

Prism convergence break and recombination tests, and prism divergence break and recombination tests were carried out with extreme care under certain standard conditions. Results were recorded with suitable allowance for the experimental variations and the patient's reaction time. The data show that in a group of 500 subjects, as prism convergence is increased, more persons will fail to maintain fusion. At 26-28$^{\Delta}$ only 10 percent can still maintain fusion but of these few, some can overcome as much as 38-40$^{\Delta}$. The midpoint of the range is about 18-20$^{\Delta}$.

With prism divergence, half of the subjects cannot maintain fusion with as much as 12-14$^{\Delta}$, although 10 percent can go as far as 18-20$^{\Delta}$, and some can go as far as 22-24$^{\Delta}$.

After the break, and the consequent diplopia, the prism power is reduced until eventually fusion is regained. With prism convergence, over 10 percent of the patients will regain fusion when 10-12$^{\Delta}$ remain, and 100 percent have regained fusion at 2-4$^{\Delta}$.

With prism divergence, the extramacular fusion area is apparently smaller, as only 20 percent have regained fusion at 6-8$^{\Delta}$, 50 percent at 4-6$^{\Delta}$, and the remaining 30 percent at 2-4$^{\Delta}$.

The data suggests that the response of the extraocular muscles to gradually increased prism power base-out or base-in is dependent primarily upon the stimulation of receptors which immediately encircle the macular area. Reversion to fusion, however, once diplopia has been established, is dependent upon the sensitivity of more peripheral receptors than the perimacular ones, and the area in which these are found is considered as the extramacular fusion area.

On the basis of these studies, we may consider perimacular and extramacular receptors, and the ocular movements which result from their excitation, as the essential parts of the stimulus-response mechanism which is charged with the maintenance of single binocular vision.

Using the results of the reversion to fusion tests, it is possible to plot the lineal dimensions of the extramacular fusion area upon each retina under given conditions of fixation and stimulation.

In general, it was suggested that the function of the perimacular fusional receptors, those immediately surrounding each macula, is to retain single binocular vision, once it is established, while the function of the extramacular fusional receptors, further in the periphery, is to aid in obtaining single binocular vision.

The use-amplitude fraction in fusional vergence is described and defined as the amount of fusional vergence constantly in use (in order to correct the faulty position of the visual axes for the point of fixation), over the amplitude of fusional vergence available in the same direction. In esophoria, relative to fixation at 6 meters, for example, a patient has a constant repeated stimulation of his nasal perimacular receptors of either or both maculas. If he has an adequate amplitude of fusional convergence, which means a sufficient number of perimacular receptors available, his esophoria may be compensated for without difficulty.

The use-amplitude fraction may be used practically in orthoptic problems to determine the probability of comfort or discomfort in binocular vision, and also to indicate the extent to which the fusional vergence amplitude values will have to be developed in order to compensate for heterophoria.

Discussion. Dr. Robert H. Peckham: Dr. Tait's paper is of perhaps unrecognized, but really quite tremendous, theoretical importance.

The function of binocular fixation in maintaining singleness of visual perception

with two stimuli is a matter of clinical importance, because of the asthenopia resulting from interruptions of that function. This function is also of considerable theoretical importance in explaining the phenomena of binocular vision. The oldest theoretical explanation is that of exactly corresponding retinal points. This theory was modified by Panum, who proposed that a point and an area are involved; that is, that an area in one eye is associated with a point in the other.

A paper which I had the privilege to read to this society, in 1934, summarized experimental evidence that binocular vision could occur with noncorresponding points, and that noncorrespondence could be quite great without loss of stereoscopic vision, or without loss of binocular fusion.

Now Dr. Tait has offered experimental evidence concerning the mechanism for the return to binocular fixation, after breaking binocular fusion with prism convergence or prism divergence. He has offered an explanation of this return which does not require the stimulus of exactly corresponding points, because, if the stimulus of corresponding points were required for the return to binocular fixation, it would be necessary for the prisms to be reduced completely to zero value before the two maculas could be stimulated with the same image, and binocular vision result. He has suggested a function which would permit the binocular fixation to return without the retinal images being moved, by the prism power, to both maculas, or to exactly corresponding points. Unfortunately, he has not been able to demonstrate the actual eye movements involved, so that we are not in a position to trace fully the course of events in terms of perception and movement, and thus infer the stimulus and response mechanisms involved throughout the prism divergence and convergence. Nor did the measurments I made in 1934 carry the problem to completion, because I did not allow my subjects to break in their fusion.

However, it now becomes possible for us to anticipate a method of attack on the problems of stimulus-response mechanisms in binocular vision, since Dr. Tait has shown that the fusional areas near the maculas are of statistical nature; that is, with increasing distances from the maculas there are decreasing probabilities of stimulus for return to binocular fixation. It may be possible with more experimental work, perhaps with objective eye-movement studies correlated with Dr. Tait's observations, to explain the entire binocular function in terms of the fusion of corresponding and noncorresponding points, and the probabilities of the stimulus values of such points for the maintenance of binocular fixation.

Dr. Francis Heed Adler: I am particularly interested in this work, which merits consideration, because the author has been carrying out in experiments on normal subjects what we hope sometime to be able to do in cases of strabismus. The first part of his presentation deals with the reflex fusional movements of the eyes, which are independent of the will and brought about, as the author states, reflexly by the potency of the receptors in the region of the fovea. He has succeeded in mapping out the area of that reflex innervation. On top of that is a voluntary innervation. It is this innervation which the patient brings into play when he is given prism exercises. Although both of these mechanisms work hand in hand and simultaneously, the reflex mechanism is the one which is the more important, and which is the true measure of fusion. Ordinarily, fusion is measured subjectively. This provides a method of measuring fusion objectively. We should be able to determine an individual's fusional capacities by the reflex movement of his eyes, if we can eliminate the voluntary mechanism. Such studies would afford us a quantitative measure of the fusional movements which keep the eyes in alignment and would be, therefore, an objective measure of fusion, independent of any subjective phenomena.

We are hoping in the very near future to be able to measure the fusional capacity of children with squint. We wish to know whether the objective measurements of these children correspond to their subjective responses to fusional stimuli. Further than this, we wish to know whether orthoptic exercises can change these objective values as well as the subjective values.

I feel that Dr. Tait has made a valuable contribution to our knowledge.

Dr. Edwin Forbes Tait: I should like to thank Dr. Peckham and Dr. Adler for their helpful discussions.

Regarding the question which Dr. Adler asked relative to changes in the basic tonic convergence after orthoptic procedures, in my experience there has been, in most cases, very little change in the lateral heterophorias after such exercises. However, it seems that when the appropriate fusional convergence amplitude is increased by exercise, which can easily be done in the convergence insufficiency cases, the patient usually is more comfortable, probably because of increased ability to compensate for his heterophoria.

Mass survey for detection of glaucoma

Dr. Carroll R. Mullen gave a preliminary report concerning activities and results associated with a mass study for the presence of glaucoma being conducted by the Philadelphia Committee for Prevention of Blindness under its executive director, Miss Evelyn Carpenter, with the guidance and advice of its medical advisory committee. The actual examinations were conducted by Dr. Victor I. Seidel, Dr. Harry A. Felice, and Dr. Solomon S. Brav.

A total of 2,455 individuals were studied and 33 cases of chronic simple glaucoma have been diagnosed, together with one case of secondary glaucoma. All of those examined in this survey were volunteers. The largest group examined was made up of the employees of several department stores, totaling 1,788. Employees of home offices of several insurance companies totaled 508, and another group of 159 from one industry was observed.

Difficulty in inducing employers to allow their workers to take time and set aside space for these examinations had been anticipated, but this did not occur. Actually, the employees were solicited to volunteer for examination.

In the department store group, 41 were below the age of 35 years, 508 were between the ages of 35 and 45 years, 705 were between 45 and 55 years, 435 between 55 and 65 years, and 98 were over 65 years of age. Three ages were undetermined, probably falling in the last older age classification. In this group, a diagnosis of chronic simple glaucoma was made in 33 employees, and one worker had secondary glaucoma. There were 13 men and 20 women; 1 woman, designated as having glaucoma, belonged in the undetermined age group; 2 men and 3 women were between 35 and 45 years of age; 3 men and 8 women were between 45 and 55 years; while 6 men and 8 women were between 55 and 65 years; 2 men were more than 65 years of age.

Of the insurance company office workers examined, 4 were under the age of 35 years; 194 were between 35 and 45; 177 were between the ages of 45 and 55; and 120 were between 55 and 65 years of age; while 13 were aged over 65 years. Glaucoma was diagnosed in two of these workers with a possible diagnosis in one other case. The two cases were men between the ages of 55 and 65 years, and the one probable case was a woman between the age of 35 and 45.

In the one industry in which a total of 159 employees volunteered for examination, the group included two under 35 years of age; 16 between the ages of 35 and 45; 61 between the ages of 45 and 55; 53 between the ages of 55 and 65; and 27 over the age of 65. In this group, one probable case of glaucoma (a 66-year-old man) was found. Two additional cases have now been diagnosed, and they are in the age group of 45 and 55 years.

The procedure for this study was to make an initial plea to workers to volunteer for examination. Visual acuity was first recorded, then an external examination was made by an eye physician. An ophthalmoscopic study through the undilated pupil was recorded. Intraocular-pressure examinations were made using a Schiøtz tonometer. In all cases in which tension was recorded at 25 mm. Hg or higher the volunteer was reexamined. If his record still remained higher than 25 mm. Hg, the individual was referred to an eye clinic or to his own private ophthalmologist for visual-field studies, provocative tests for glaucoma, further tension recordings, and treatment.

It is probable that there are people working in the above establishments who have glaucoma, know that they have it, and are already under treatment, and, not wishing to discuss the fact with their employers, did not volunteer for examination. It is of interest to note that none of the 33 cases of chronic simple glaucoma had any knowledge of the condition of their eyes. Only five of these employees had every consulted an ophthalmologist for any previous type of eye care.

This mass survey for the presence of glaucoma is a progressive step in the endeavor of the Philadelphia Committee for Prevention of Blindness to locate diagnosed cases of glaucoma, to follow them up, and to aid the ophthalmologist in preventing total loss of vision.

Until February, 1940, there was no organized follow-up service for glaucoma patients in eye clinics in Philadelphia. In his presentation Dr. Mullen reviewed the formation of this service under the Philadelphia Committee for the Prevention of Blindness. He likewise reviewed the number of glaucoma cases that had been observed and followed in the Wills Hospital in conjunction with this survey.

This report outlines the endeavor to determine the number of individuals with undiagnosed glaucoma who are not aware of their condition and have not had medical attention. With more than 2,400 patients studied, the over-all total is 1.3 percent, which is somewhat less than previous figures estimated for the general population. Gathering of this information may be of great service to all workers in the ophthalmic field who are especially interested in the study of glaucoma.

George F. J. Kelly,
Clerk.

Historical Miniature

Although Fabricius ab Aquapendente recognized the true position of the lens he looked upon it as the organ of vision. The surgeons were expected to be very ignorant of optics. Kepler, the great astronomer, thought that an error in optics made by Felix Platter, a distinguished student of the physiology of vision, was excusable because he was a physician.

Hirschberg, *Graefe-Saemisch Handbuch.*

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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Subscriptions, application for single copies, notices of changes of address, and communications with reference to advertising should be addressed to the *Manager of Subscriptions and Advertising, 664 North Michigan Avenue, Chicago 11, Illinois.* Copy of advertisements must be sent to the manager by the fifteenth of the month preceding its appearance.

Author's proofs should be corrected and returned within forty-eight hours to the *Manuscript Editor, Mrs. Katherine F. Chalkley, Lake Geneva, Wisconsin.* Twenty-five reprints of each article will be supplied to the author without charge. Additional reprints may be obtained from the printer, the George Banta Publishing Company, 450-458 Ahnaip Street, Menasha, Wisconsin, if ordered at the time proofs are returned. But reprints to contain colored plates must be ordered when the article is accepted.

THE OXFORD OPHTHALMOLOGICAL CONGRESS

The 34th annual meeting of the Oxford Ophthalmological Congress was held on July 8th, 9th, and 10th at the School of Geography in Oxford. Members were housed at Hertford College nearby. About 100 ophthalmologists attended.

The meeting was called to order by the Master, Mr. F. A. Williamson-Noble, who then gave the address of welcome.

The morning of the first day was devoted to a discussion on "The Use and Abuse of Topical Ocular Therapy." Mr. F. Ridley gave an excellent talk on the structure and function of the tear film and its surface tension and absorption properties. He spoke of the biochemistry of the tears, on which he is a recognized authority, and how their bacteriocidal properties are related to their interaction with applied remedies and to the physical structure of ointments. He emphasized that the lysozyme content of tears is definitely diminished in local epiphora and that atropine affects the lacrimal gland by decreasing epiphora and relatively increasing lysozyme. Hence atropine might well be used in certain stubborn cases of conjunctivitis.

Dr. F. E. Preston continued the discussion with a historical resume of local therapeutic agents and made a plea for more uniformity in drug terminology.

Further discussion was contributed by Dr. J. M. Robson of Guys Hospital, whose contributions to the literature of chemical warfare are so well known. He gave a thorough review of local therapeutic methods. In discussing the use of detergents, he pointed out that increased corneal permeability was not due to their surface-tension reducing effect alone, since, if one removes the corneal epithelium of a rabbit, the addition of a detergent does not increase permeability of drugs. With regard to intravitreal injection he felt that streptomycin was toxic to the retina, but that pure crystalline penicillin was not.

In the afternoon Dr. J. J. Healy presented the case histories of a series of unusual ocular injuries. Dr. Grant Peterkin gave a talk on "Dermatological Conditions Affecting the Ocular Adnexa," and Mr. Dickson Wright spoke on "The Approach to Orbital Tumors." Mr. Wright's talk was outstanding for its clarity of expression, and the excellence of the moving-picture film shown. He freely removes the orbital rim for better exposure.

Mr. Frank Law presented a report on a case of retinoblastoma at the second morning session. The highlight of the meeting occurred when Sir Stewart Duke-Elder gave the Doyne Memorial Lecture on "The Blood-Aqueous Barrier." This consisted in an outline of the development of our conceptions of the intraocular fluid and a comparison of earlier techniques with more modern methods, particularly those employing tracer elements.

The author stated that results obtained by these newer techniques have shown that his original theory, that the aqueous is a simple dialysate, is wrong, and that the process is a far more complicated one involving a combination of dialysis and secretion.

The afternoon was devoted to a discussion on "The Operative Treatment of Chronic Glaucoma," by Mr. F. A. Williamson-Noble and Mr. Maurice Whiting. Many others also participated. The consensus of opinion was that the trephining operation gave the best results, but the iris-inclusion operation had its advocates. What impressed a visitor was the apparent disregard of the anterior-chamber depth and the condition of the iris angle in contemplating surgery. This was never mentioned.

On the final day there was a morning session only. Prof. A. Lowenstein gave a beautifully illustrated talk on "Some Facts and Aspects of the Anterior Drainage System in the Human Eye." Mr. J. Minton spoke on "Occupational Eye Diseases of the Lens and Retina." Dr. Gunnar von Bahr of Sweden discoursed ably on the "Measurements of the Effect of Solutions of Different Osmotic Pressure on the Thickness of the Living Cornea." Dr. Winnifred Fish gave a short paper on "Hereditary Mesodermal Atrophy," reporting four cases, and Dr. Margaret Dobson spoke on "Dynamic Retinoscopy."

The social aspects of the congress were, as usual, delightful. Tea was served in Hertford College in the late afternoons following the scientific sessions and was enjoyed amid the charm of old-world surroundings. The annual dinner took place in the refectory of the college on the night of July 8th.

The Oxford Congress, founded by Doyne in 1914, continues to hold a secure place in British ophthalmology.

Edwin B. Dunphy.

READING EFFICIENCY

A study of the reading skill of adults shows that the ocular movements account for but 10 percent of the reading time—the fixation pauses for 90 percent. As reading skill progresses from the grades to college, the fixation pause decreases from two-thirds second to about one-fifth second and the regressive movements decrease from an

average of five per line to one-tenth as much. Retinal perception requires less than one-tenth second, although the fixation pause is at least double this period. The convergence is not fixed but relaxes slightly with each fixation pause so that between the beginning and end of each line there is a rhythmic lessening of convergence of about one-half prism diopter. Peripheral vision provides unconscious clues and so prepares for the next fixation pause. Hence a narrow span of the visual field retards the speed of the reading process.

In both children and adults the rate of reading is not much affected by the size of type, between 6 point and 36 point but, for the most efficient reading, size of type, length of line, and interlinear space must be correlated. As there is a certain correspondence between area and reading speed, size of type and interlinear space, may, to some extent, be substituted for each other. An excessively short line (37 mm.) does not permit maximum use of peripheral vision, while with excessive length of line (180 mm.) the long return movement is accompanied by increased regressions at the beginning of successive lines. Between such extremes, size of type and length of line can be balanced for maximum effectiveness. In a test on second graders with a 61.5-mm. line, 3-point leading, the 12-point type placed first in speed, 14-point was second, and 18-point a poor third. For adult reading, 10-point type on an 80 mm. line with 2-point leading is considered optimal.

The most readable type is that which is fairly simple in design. Paradoxically, features that increase clarity for distance may, nevertheless, slacken the reading pace. Words in capitals when compared to lower case are read at a greater distance, but for speed of reading the order is definitely reversed. In distance tests, the least visible type form was Scotch Roman, a lightface type, while the most visible was American Typewriter; yet, the former led the latter in reading speed by 5 percent.

As checked by the rate of reading, black print on a white or cream background is superior to any other combination. The quality and texture of the paper is of relatively minor import.

The best quality of illumination for reading is daylight from the north sky. In the most favorable light distribution, the brightness of the central field and that of its surroundings are approximately equal. For exceedingly fine work, the normal eye does not require more than 20 foot-candles, but for ordinary reading 8 to 10 foot-candles are considered adequate. A study lamp with a 60-watt Mazda bulb provides by itself about 7 foot-candles on the reading surface.

The study of eye movements by photography of the corneal reflections has several drawbacks. The procedure necessitates the elimination of head movement, the presence of light in the visual field, and the restriction of the reading span to less than 20 degrees. But the electrical method about to be described allows any amount of continuous and unrestrained reading under any desired conditions.

When the reader has small electrodes affixed to his outer canthi and these electrodes are connected with an equipment like that used in electrocardiography and electroencephalography, a tracing results—the electro-oculogram—that is quite similar to the familiar photographic record. As the eye moves, the electrodes are affected reversely by the intrinsic corneoretinal potential, since the electrode on the side of the approaching cornea receives more positive units and that on the side toward which the retina advances, more negative units. The voltage change follows closely the extent of the ocular excursion. When the apparatus is equipped with an ink-writing oscillograph it can furnish an automatic record of continuous reading of many hours' duration, and with extra leads the heart beat, brain waves, and the blinking reflex can be simultaneously registered.

Using such a complete set up, the problem of fatigue in reading was exhaustively studied by the educational psychologists,

Leonard Carmichael and Walter F. Dearborn. Forty high-school and college students read for six hours continuously, first a historical novel and then a formal treatise on economics. Comprehension was checked by a multiple choice questionnaire interspersed at about every 25 pages. Conditions were optimal—both books were in the same approved format, and the well-distributed illumination provided 16 foot-candles on the reading surface.

Statistical analysis of the six-hour records revealed no significant change in reading behavior, nor any distinction in performance between the type of material, between the high-school or college group, between books and microfilm, or between those wearing and those not wearing glasses.

In a previous study by Hoffman, 30 subjects who read for four hours continuously without comprehension checks displayed increasing reading deterioration after the first hour, as was shown by increased blinking, decreased reading rate, word skipping, and wandering attention. Evidently the comprehension tests, by inspiring motivation, made the striking difference in the objective results. The first evidence of fatigue in reading is an altered attitude toward the task, not in any breakdown of the neuromuscular visual mechanism. Motivation is the all-important variable and, when present, reading can be maintained for hours at a high level of efficiency. The action of the ocular musculature, like that of the heart, is intermittent and so permits adequate recuperation.

James E. Lebensohn.

OBITUARY

ELIAS SELINGER

(1898-1947)

Elias Selinger, son of Joseph Selinger and Rosa Feuereisen Selinger, was born in Moravska-Ostrava, Czechoslovakia, August 23, 1898, and came to the United States at the age of 15 years. He received the degree of Doctor of Medicine from Northwestern University in 1924 and decided at once to specialize in ophthalmology. After internship and residency at Cook County Hospital, he furthered his training in Vienna in 1926, and again in Paris and Vienna during 1932-1933. He became clinical assistant in the department of ophthalmology of Northwestern University Medical School in 1926. He left that department with the rank of instructor in 1929 to become associated with the eye department of the Rush Medical



Elias Selinger

College of the University of Chicago. When he resigned from that institution in 1941, he held the rank of assistant professor. Only a few months before his death, Dr. Selinger was appointed professor and chairman of the department of ophthalmology at the reorganized Chicago Medical School.

Dr. Selinger was certified by the American Board of Ophthalmology in 1931. He was attending ophthalmologist at Mount Sinai, Cook County, and Michael Reese Hospitals, and was a member of the American Medical Association, the Chicago Ophthalmological Society, the American Academy of

Ophthalmology and Otolaryngology, the Pan-American Ophthalmological Society, and the American Society for the Advancement of Science.

Among his numerous contributions to ophthalmology, the most original was the introduction of the topical application of quinine in treatment of trachoma and interstitial keratitis; his *Office Treatment of the Eye* was widely acclaimed by ophthalmologists throughout the country.

Elias Selinger was an outstanding surgeon. For his associates, it was a source of continuous amazement to see him approach each individual case on its own merits instead of following a standardized procedure. This and his meticulous deftness of technique, as well as his painstaking postoperative care of each patient, accounted for his superior surgical results.

As a consultant he always respected the opinion of the referring surgeon but seldom failed to make constructive suggestions. He had a rare gift as an organizer. Not given to compromises, he was never satisfied with half measure in whatever he undertook, and succeeded in inspiring his associates with the same spirit. He was always interested in the problems of the younger men in his specialty and ready not only to advise but to take active steps to assist them on the road to the practice of ophthalmology.

His activities in various committees allowed him little time for relaxation, and that was spent with his family.

There was little warning to his immediate family, and it came as a complete shock to his numerous friends, colleagues, and patients when a coronary thrombosis caused his untimely death in El Paso, Texas, on December 21, 1947. In his death, ophthalmology loses one of its most promising members, just at the summit of his career.

He is survived by his wife, Mildred Williamson Selinger, and a daughter, Suzan Mae.

Stefan Van Wien.

CORRESPONDENCE

Near point of accommodation

Editor,
American Journal of Ophthalmology:

In their highly scientific paper on "Effects of Practice and the Consistency of Repeated Measurements of Accommodation and Vergeance," by Brozek, Simonson, *et al.* (Am. J. Ophth., 31: 191 (Feb.) 1948), the authors say: "The true accommodation near point should be determined as the distance from the anterior focus of the eye, located about 14 mm. in front of the cornea, to the point of blurring. The correction is essential when the power of accommodation is expressed in terms of diopters. . . ."

Now the point from which the near point of accommodation should be measured has not yet been completely standardized. But most authorities figure that for determination of true accommodative power the near point should be measured from the first principal point of the eye. It may be sufficiently accurate (to within less than 2 mm.) to measure the distance from the cornea, but measurement from the anterior principal focus of the eye seems less desirable.

The increase of refractive power, which is termed accommodation, takes place at the principal planes of the eye. The power of all refractive systems is determined by the principal focal length; that is, the distance measured from the corresponding principal point. The refractive power of the static eye and the far point of the static eye are thus expressed and there is no reason not to use the same reference points for the power of the dynamic (accommodated) eye.

It is true that in calculations for conjugate foci, and the near point is the conjugate focus to the retina of the accommodated eye, several fixed points of reference can be used, including the principal foci. It is also true that where lenses are worn it is convenient to make measurements from the plane of the lenses which are practically in the first principal focal plane of

the eye. But these considerations are not sufficient to change the generally accepted reference points which are the principal points. Where measurements are made from the plane of the correcting lens, 15 mm. (in round numbers) is added to get the distance *from the principal point.*

Another consideration is that, while measuring the near point, from F_1 of the eye is convenient for figuring the power of the lens which replaces accommodation; when used for measuring accommodative power it does not disclose the intrinsic difference in accommodative activity as between the natural emmetrope, the corrected hyperope, and the corrected myope. For example, a near point, say, of 10 cm. measured from F_1 of the eye of the natural emmetrope, the 4.0D. corrected hyperope and the 4.0D. corrected myope, would give each one 10 diopters of accommodation.

Actually, this near point shows that the natural emmetrope can accommodate—that is, increase the power of his eye by 8.7 diopters; the 4.0D. corrected hyperope can accommodate 10.09 diopters, and the corrected myope can accommodate only 7.66 diopters.

An accurate determination of accommodative power in all cases is best determined by measuring the near point from the principal plane of the eye, which measurement gives the number of accommodative units the patient has. The value in diopters is then found from the dioptral value of the accommodative unit (Pascal: Tr. 2nd Pan-American Congress of Ophthalmology, 3:53-77; Eye, Ear, Nose & Throat Monthly, 25:354-362 (July 1946).

Whatever method is used, the discrepancies may not be large, but in the interests of scientific accuracy they are worth noting.

(Signed) Joseph I. Pascal,
New York.

BOOK REVIEWS

DISEASES OF THE EYE. By Sir John Herbert Parsons and Sir Stewart Duke-Elder. New York, Macmillan Company, 11th edition, 1948. 732 pages, 368 figures, 21 plates, and index. Price, $7.00.

Parsons' *Diseases of the Eye* is a perennial favorite with ophthalmologists and general physicians and their teachers, both in this country and abroad. It is a little more elaborate than the textbooks of May and of Gifford, since it is written more for the general practitioner than for the medical student. Because of this, however, it is of particular value to the physician who wishes to have in his reference library a book on ophthalmology that covers the unusual conditions, as well as those subjects more commonly encountered.

Since the 10th edition that appeared in 1942 and was reprinted in 1944, many advances have been made in the practice of ophthalmology, especially those produced by chemotherapy, new concepts of the etiology of choroiditis, and many others. The authors have taken great care to incorporate these advances in the new text and, in weeding out the old beliefs, have retained what has been shown by the passage of time to be useful.

It is pleasing to see, yoked with the notable name of Parsons, that of Duke-Elder. These two eminent and authoritative ophthalmologists, each a top-flight author in his own right, together insure that the information contained in their book is accurate and unquestioned. It cannot be recommended too highly.

Derrick Vail.

HANDBOOK OF OPHTHALMOLOGY. By Everett L. Goar. St. Louis, C. V. Mosby Company, 1948. 166 pages, 45 text illustrations, and 7 color plates. Price, $5.50.

There have been several attempts during the past few years to present the field of

ophthalmology in outline form for the benefit of undergraduate medical students. This trend recognizes the overburdened medical curriculum and the fact that the limitation of time and the somewhat meager interest of most students in such a specialized subject preclude adequate perusal of the more extensive texts. These handbooks, therefore, have a very definite place in undergraduate teaching and, perhaps, may be of help to the general practitioner who desires a broad perspective of this branch of medicine; for the graduate student and practicing ophthalmologist they are, of course, too incomplete to be of value.

The present *Handbook of Ophthalmology* was first written as a series of lectures for medical students at Baylor University and presents in an abbreviated and concise form the essential facts about the eye with which the student should be familiar. Dr. Goar has done his editing judiciously, and little fault can be found either with the subject matter included or omitted or with the manner of presentation. The book is well printed on a good grade of paper and contains numerous and fairly adequate illustrations.

Somewhat unusual in a work of this limited scope is the introductory historical chapter, and the author is to be congratulated for including this cultural background. Separate chapters deal with anatomy, embryology, and physiology. A chapter on "Methods of Examination" describes not only routine but also the more refined instruments of diagnostic value, and a separate chapter deals with the ophthalmoscope and normal fundus. Twelve pages are devoted to refractive errors and the principle of their correction. External diseases are discussed in orderly fashion, and the common fundus lesions are described and illustrated. Subsequent chapters deal with glaucoma, intraocular tumors, strabismus, and the eye in general disease. The final chapter discusses eye injuries and first aid and ocular therapeutics, including a few helpful prescriptions.

This *Handbook of Ophthalmology* appears most useful for the purpose for which it is intended and deserves wide use in medical schools. William A. Mann.

THE ANATOMY OF THE EYE AND ORBIT. By Eugene Wolff. Philadelphia, The Blakiston Company, 3rd edition, 1948. 440 pages, 323 illustrations including 24 in color, bibliographies, and index. Price, not listed.

Wolff's *Anatomy of the Eye* is too well known to require much discussion. The handsome third edition, beautifully printed and illustrated, is superior in many ways to its predecessor. The chief changes in the text are "in the descriptions of the ciliary muscle, the substantia propria of the cornea, the vitreous, the zonule of Zinn, the distribution of the lacrimal fluid, the mucocutaneous junction at the lid margin, the precorneal film, the retinal capillaries, and the central connections of the visual apparatus" in the light of the latest information.

It is certain that every student and practitioner of ophthalmology will require this authoritative book in his daily work for study and reference. Derrick Vail.

THE BLIND PRESCHOOL CHILD. Edited by Berthold Lowenfeld, Ph.D. New York, American Foundation for the Blind, Inc., 1948. 148 pages. Price, $2.00.

The ophthalmologist having easy access to the social services discussed in this collection of papers presented at the National Conference on the Blind Preschool Child, March 13 to 15, 1947, will have no urgent need for the book, although he will find it stimulating and interesting reading.

Ophthalmologists in more isolated communities, however, to whom these services are not available, can glean many constructive suggestions from the pages of this slim volume—suggestions that will give them a

more understanding and sympathetic insight into the problems faced by the parents of blind babies.

The contents are arranged according to three phases of the problem of the blind preschool child—the social work, educational, and medical aspects. There is also a summary of the conference written by Berthold Lowenfeld and a message from Helen Keller.

Under the division, "Social Work Aspects," authorities in this field discuss such pertinent subjects as: "The Influence of *Institutionalization on the Young Child*," "Parental Attitudes," "Individual Case Work with Parents," and "Group Work with Parents." Legislative provisions for the blind preschool child, social workers' responsibilities, and reports from four states—Illinois, New Jersey, New York, and Wisconsin—in regard to the number of cases, cause and degree of blindness, and age groups complete this section of the book.

"Educational Aspects" include thoughtful studies on "The Emotional and Social Development of the Young Child," "Training Problems and Techniques," "Measuring the Mental Development of Blind Preschool Children," and "Facilities for the Education of Blind Preschool Children."

Under "Medical Aspects," Dr. Arnold Gesell discusses "Development and Guidance of the Blind Infant"; Dr. Brittain F. Payne, "Early Diagnosis of Visual Defects"; Dr. Robert R. Chace, "The Hereditary Aspects of Blindness"; and Dr. Merrill J. King, "Retrolental Fibroplasia."

Negative attitudes never solve any problems. Because this book offers dynamic counsel, the ophthalmologist can recommend it without hesitancy to the parents of the blind preschool child.

Katherine Chalkley.

THE SKULL, SINUSES, AND MASTOIDS. A HANDBOOK OF ROENTGEN DIAGNOSIS. By Barton R. Young, M.D. Chicago, The Year Book Publishers, Inc., 1948. 148 plates, bibliography, index. Price, $6.50.

There has long existed a need for this book. Only the exceptional ophthalmologist is competent to make a roentgen diagnosis of the area within his field. Every day in an active practice, this problem is met, and the ophthalmologist has had to be dependent upon the interpretation of the X-ray findings reported by the X-ray department to help him.

Superbly printed on excellent paper and beautifully illustrated, the volume is a most lucid exposition of its title. Unfortunately, the subject of foreign bodies in the orbit or within the globe is not discussed. Ophthalmologists would like to see a chapter devoted to this matter with a discussion and evaluation of the many methods of localization. Perhaps, in the next edition, the author can be persuaded to add this information.

As a compensation for this lack, however, the reader will gain a better understanding of the X-ray pictures of diseases and conditions affecting the orbit and the sinuses than perhaps he has hitherto enjoyed. It is recommended reading. Derrick Vail.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

6

OCULAR MOTILITY

Caballero del Castillo, D. **Bilateral, symmetrical, partial paralysis of the oculomotor.** Arch. Soc. oftal. hispano-am. 8:396-402.

A case of bilateral paralysis of the superior, internal and inferior rectus muscles of 11 years' standing, due to lues, is reported in a woman, 76 years of age. There was also paresis of the elevators of the upper lid. The pupils were miotic, with Argyll Robertson reactions. The anatomy and vascular supply of the oculomotor nuclei are reviewed in detail, and it is concluded that the lesion was produced by an endarteritis of the basilar artery. The intraocular muscles were spared because the vascular supply of their nuclei comes from the posterior cerebral arteries. The sparing of the inferior oblique muscles makes questionable the accuracy of Bernheimer's scheme for the nuclei of the oculomotor nerves in which the nucleus for the inferior oblique is placed in front of the nucleus for the inferior rectus muscle. This lesion suggests that the nucleus of the inferior oblique is situated most posteriorly. (3 figures.) Ray K. Daily.

Danis, P. **Congenital muscular anomalies—the syndrome of Stilling-Türk-Duane.** Ann. d'ocul. 181:148-181, March, 1948.

In this outstanding contribution, the 175 references employed illustrate the author's thoroughness and understanding. Primary global retraction of orbital origin characterizes the unilateral form of this syndrome. The cardinal symptoms are diminished abduction, global retraction on adduction, and decrease of the palpebral opening. Less frequent are ocular protrusion and palpebral enlargement on abduction, vertical deviations on adduction with or without convergence weakness. The secondary angle of strabismus is greater than the primary, which is characteristic of orbital lesions. Spontaneous diplopia is absent. The left eye is much more frequently affected, and the disturbance is more common in women. The external rectus is aplastic, frequently only a band of fibrous tissue, and the internal rectus insertion is frequently too far posterior. If the external rectus subnormality is dominant, divergent strabismus follows; if the internal rectus is dominant, convergent strabismus results; if both are involved, the strabismus may be external or internal.

With passive motion made with a fixation forceps adduction without retraction suggests abnormal insertion of the internal rectus, adduction with retraction suggests primary external rectus involvement, and abduction with difficulty, internal rectus inextensibility. Global retraction is essentially due to displacement of the ocular center of rotation backwards and laterally, with resulting unequal ocular alignment. Because of the slightly oval shape of the globe combined with unequal traction, the eye is potentially forced backward during adduction and forward during abduction. Associated vertical imbalance indicates that the oblique muscles are involved. Palpebral involvement is a passive process.

In the bilateral form, males and females are equally affected; the manifestations are frequently not symmetrical and other constitutional subnormalities such as bilateral absence of the lacrimal glands and deformities of the extremities are often associated. Different forms of hereditary transmission are known to exist, the genealogical trees having been traced through three generations in several cases. The most frequent conditions associated especially with the bilateral form of the Türk syndrome are hypofunction of the facial and other cranial nerves, somatic subnormalities, and vertical ocular deviations.

Vertical involvements of primarily muscular origin are due to dysfunctions of convergence or to imbalance of the oculogyric mechanism. Congenital abduction palsy with global retraction and with vertical motor and other muscular weaknesses is one of the numerous groups of vertical and horizontal motor involvements possible.

In primary peripheral congenital abnormalities, abduction palsy may be associated with global retraction-protrusion, vertical dysfunction, and isolated palsies of individual muscles. Three basic etiologic factors must be evaluated singly and as a unit. These factors are constitution, environment, and time. Thus the more frequent left-sided occurrence of the monocular form is due to excessive pressure on the left side of the head or left orbit before or during birth, combined with constitutional or genetic tendencies, the exact nature of which is unknown. In one group the ocular involvement is but a variable part of the dysraphic syndrome. In primary mesoblastic subnormalities somatic malformations seldom exist. In epiblastic subnormalities diffuse malformations are frequently associated. Several illustrative cases are presented.

Chas. A. Bahn.

7

CONJUNCTIVA, CORNEA, SCLERA

Agnello, F. **Ocular mycoses in East Africa. Two voluminous epibulbar granulomas caused by fungi.** Boll. d'ocul. 27: 111-118, Feb., 1948.

In 1938 and 1940, the author observed in the eye hospital of Addis Ababa two patients with ascaris infection, who had unilateral indolent glossy hemispheric tumors of appreciable size and of red or whitish color. The masses were fixed on the sclera and did not involve the cornea. The tumors were removed in local anesthesia. Cultures could not be taken, but microscopically hyphae and spores were found. The size of the tumors may be explained by the virulence of the fungi and by climatic and enviromental factors.

K. W. Ascher.

Amsler, M., and Verrey, F. **The taking of the keratoplastic graft.** Arch. d'opht. 8:150-151, 1948.

The authors state that removal of the whole eye from the cadaver is an unecessary, mutilating procedure. They excise the two corneas at the limbus, leaving the pupils and irises intact. This is important

psychologically for the relatives of the deceased. The corneas are conserved in liquid paraffin in the refrigerator until the time of operation. Particular care is necessary not to damage in any way the zone of the grafts.

The grafts are obtained by trephining the posterior surfaces of the corneas first which makes for perfect section of the endothelium and Descemet's membrane. To facilitate this procedure the graft is placed in a depression made in a block of paraffin and the trephine used by pressure alone, without rotation, in order to avoid damaging the epithelium. The authors claim that by means of this technique the graft is adapted perfectly to the opening in the receptor eye and has received minimal trauma in manipulation.

Phillips Thygeson.

Busacca, A. **The lymphatic vessels of the human bulbar conjunctiva studied after vital staining with trypan-blue.** Arch. d'opht. 8:10-32, 1948.

Busacca studied biomicroscopically the lymphatic vessels of the normal bulbar conjunctiva after subconjunctival injections of trypan-blue and states that the conclusions drawn from previous research must be modified radically. He found the lymphatic vessels in the zone of the end capillary loops at the limbus to be situated in general in a plane posterior to the blood vessels and to be larger than the vessels and arranged radially for the most part. In the palisade zone the lymph vessels were larger than the veins of the region and were arranged radially with few anastomoses. The lymph vessels of the limbus region were found to continue without interruption into a rich network of vessels of different calibres, many of which possessed valves. Some collector vessels were found to run parallel to the limbus. In the upper fornix certain vessels disappeared towards the orbit whereas in the lower fornix the collector vessels ran horizontally towards the external canthus where they disappeared. Busacca noted further that over the entire cornea there was an extremely fine network of lymphatics just beneath the epithelium. No lymphatic ganglia, even rudimentary ones, were found in the conjunctiva and there was no episcleral network.

The author concludes that the interpretation of many authors (Gallemaert, Koby, Rollin, Cuenod and Nataf, Ascher, and others) that the limbal palisades are perilimbic lymph vessels is erroneous.

Phillips Thygeson.

Landau, J. and Stern, H. J. **Flare-up of trachomatous pannus due to ariboflavinosis.** Am. J. Ophth. 31:952-954, Aug., 1948. (1 figure.)

Much, V. **Bee venom in the treatment of herpetic keratitis and superficial punctate keratitis.** Ophthalmologica. 115: 89-100, Feb., 1948.

Much reports definitely beneficial results with bee venom (injected intracutaneously) in cases of typical herpetic (dendritic) keratitis as well as in cases of an epidemic form of superficial punctate keratitis.

Peter C. Kronfeld.

Rapisarda, Dante. **Further considerations on the keratoconjunctival tuberculids.** Ann. di ottal. e clin. ocul. 73:107-114, Feb., 1947.

The licheniform tuberculids (lichen scrofulosus) of the conjunctiva and cornea have been noted by Rapisarda as not uncommon in regions where the population has suffered from undernutrition, particularly from lack of vitamin A, and where the incidence of tuberculosis has increased.

The keratoconjunctival tuberculids (lichen scrofulosus and phlyctenular keratoconjunctivitis), especially when occurring in infancy, should be reckoned among the

ocular signs useful in the diagnosis of general diseases. They are as important as tuberculin tests and merit the attention of internists and particularly pediatricians.

Fascicular keratitis is becoming progressively rare, at least in Catania. This may indicate a modification in the nature and behavior of the tuberculids.

Rapisarda considers the keratoconjunctival tuberculids to be manifestations of an allergic state, occurring not only in infective (tuberculous) allergy, but also in various forms of noninfective allergy.

Harry K. Messenger.

Rosen, Emanuel. **Pterygium.** Brit. J. Ophth. 32:300-304, May, 1948.

The author decries the inadequacies of the McReynolds transplantation technique for the treatment of pterygia and states that recurrence of the disease is the rule even in the hands of the experiencd. He describes his own technique which resulted in only one recurrence in twenty-five cases. The head of the pterygium is dissected from the cornea with a knife and the conjunctiva is separated from the limbus above and below the growth for 3 mm. The growth is separated along its edges and a double-armed silk suture is inserted into the head toward the sclera. The pterygium is then doubled back under itself so that episcleral tissue is approximated to episcleral tissue. The sutures are brought out through the center of the caruncle and tied over a rubber button. If the pterygium is very wide, it is sliced in its middle and folded under in two sections. The edges of the conjunctiva are approximated with interrupted sutures. The sutures are removed on the tenth day. (8 figures.) Morris Kaplan.

Saba, Vittorio. **Herpetic episcleritis.** Ann. di ottal. e clin. ocul. 73:168-70, March, 1947.

Saba reports a typical herpetic keratitis occurring in an eye with a subsiding episcleritis, and concludes that the episcleritis is also a manifestation of the same virus. Harry K. Messenger.

Thygeson, Phillips. **Acute central (hypopyon) ulcers of the cornea.** California Med. 69:18-21, July, 1948.

The author presents a series of 50 cases of acute central (hypopyon) ulcers of the cornea, of which 70 percent were caused by pneumococci. The role of solution-bottle contamination in the production of pyocyaneus ulcers is discussed. Proper systemic and topical use of the sulfonamide drugs arrests progress in all but very exceptional cases. The finding of sulfonamide-resistant strains of beta hemolytic streptococci and pneumococci has been rare. Orwyn H. Ellis.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Costi, C. **Treatment of iris prolapse by Blascovics cicatricectomy.** Arch. Soc. oftal. hispano-am. 8:354-362, April, 1948.

The usual methods of dealing with iris prolapse are discussed, and the Blascovics cicatricectomy is described and illustrated in detail. Experience with the latter in four cases of prolapse convinced the author of its superiority over the usual methods of excision or cauterization. (6 figures.) Ray K. Daily.

Gardilčić. A. **A new iridodialysis operation.** Ophthalmologica 115:141-155, March, 1948.

The ciliary border of the dialyzed iris is "incarcerated" in a slightly scleral keratome incision and fastened there by means of corneo-iridoscleral sutures of the de Mendoza type. Two successfully operated cases are reported.

Peter C. Kronfeld.

Orzalesi, Francesco. **The pathogenesis of serous detachment of the choroid.** Ann. di ottal. e clin. ocul. 73:129-167, March, 1947.

The various pathogenetic theories of detachment of the choroid are discussed in detail. The determining factor in all cases is held to be the sudden or rapid reduction of the intraocular pressure and the resulting persistent hypotony. Detachment may occur following any perforation of the globe but especially when by reason of imperfect closure of the wound the aqueous continues to escape. The anterior chamber is usually but not necessarily abolished. However, the abolition of the anterior chamber is not a consequence of the detachment, but both are dependent on the one determining factor of hypotony. It is not the absolute hypotony that is important but rather the rapidity with which the intraocular pressure is lowered from its preëxisting level. A slow and gradual lowering, even to the extreme limit, is not sufficient to cause detachment. The effective mechanism is an exaggerated transudation from the choroidal vessels, due to a disturbance of the equilibrium between the pressure in the choroidal vessels and in the ocular cavity, when adequate compensatory mechanisms cannot properly enter into play. In a word, the detachment results from an exaggeration of the normal method of aqueous formation, and the fluid under the detached choroid should be regarded as secondary aqueous or a transudate. Little or no importance should be attributed to senile rigidity of the sclera as a factor in detachment. The sclera is never so rigid that it will not collapse when the intraocular pressure is suddenly lowered, hence the hypothesis of an aspiration *ex vacuo* from the choroidal vessels is untenable.

Even great and sudden hypotony is not sufficient to determine the formation of a choroidal detachment without the intervention of very important predisposing factors linked with anatomic changes in the choroid itself. These predisposing factors are always absent in the young and rare even in the aged. Chief of these factors is the reduced elasticity and distensibility of the choroidal tissue and of the walls of the blood vessels as found in senile involution of the choroid. In consequence, in the young a sudden and persistent hypotony does not result in transudation of fluid and detachment of the choroid, since equilibrium in pressure is rapidly restored by dilatation of the vessels and by edema of the easily dissociated choroidal tissue; whereas with rigidity transudation and detachment are more likely to occur. Without doubt arterial hypertension, which promotes transudation and consequent detachment, and increased vascular permeability of any origin are also predisposing factors. It is very probable that the site of the detachment, which is almost always anterior, is determined by the structure of the vessels in the anterior portion of the choroid, where the large and numerous veins with their simple endothelial walls are essentially blood sinuses.

Orzalesi was unable to produce detachment of the choroid experimentally in either the dog or the rabbit by establishing a fistula to drain the anterior or vitreous chamber. He attributes this failure to the structure of the eyes of these animals and to the absence of the above mentioned concomitant factors.

Harry K. Messenger.

Sien, Auw-Yang. **A case of choroidal apoplexy diagnosed as a sarcoma of the choroid.** Ophthalmologica. 115: 1-10, Jan., 1948.

A white woman, 56 years of age, complained of sudden loss of vision in her right eye. Examination revealed a normal anterior segment, absence of any red reflex from the posterior segment (upon ophthalmoscopy as well as upon transillumination) and reduction of vision to

bare light perception. The eye was enucleated. The histological examination revealed a fresh intrachoroidal hemorrhage which had originated from a ruptured atheroma of a short posterior ciliary artery. The hemorrhage had broken through the lamina vitrea and caused a well-circumscribed subretinal blood clot. The vitreous was densely infiltrated with red blood cells. Most choroidal arteries showed extensive sclerosis. The author reviews the literature on this rare condition, the spontaneous rupture of an atheromatously diseased choroidal artery or choroidal apoplexy, as he calls it.

Peter C. Kronfeld.

Vouters. **An interesting case of spontaneous choroidal detachment.** Ann. d'ocul. 181:293-299, May, 1948.

A 67-year-old man observed progressive sight loss of vision in his left eye for six weeks and a positive scotoma. In maximal mydriasis an elevation was observed in the lower peripheral part of each fundus, but more marked in the affected eye. The elevations were gray with a darker background and composed of a number of cell-like compartments or cysts. There was slight pericorneal injection, obliteration of the anterior chamber angle, corneal edema, and increased tension. During several months the vision and the gray plaques observed in the choroid remained unchanged. About one year later the patient died.

The author believes that the lesion was a choroidal detachment secondary to hemorrhage in a patient with a cardiovascular degeneration. Chas. A. Bahn.

9

GLAUCOMA AND OCULAR TENSION

Arkin, Wiktor. **A modification of Elliot's operation and its application to high trephination: A preliminary report.** Am. J. Ophth. 31:975-978, Aug., 1948. (2 figures.)

Boase, A. J. **Acute glaucoma in an adolescent.** Am. J. Ophth. 31:997-999, Aug., 1948.

De Leonibus, F. **Further considerations concerning a patient with sympathetic ophthalmia following sarcoma of the choroid.** Boll. d'ocul. 27:65-75, Feb., 1948.

De Leonibus reported about this patient three years ago, and described the findings in the sarcomatous eye (Boll. d'ocul., 24:266, 1945). In spite of all efforts, the vision in the other eye fell rapidly from 6/10 to amaurosis, the bulbus became soft and very painful and eventually, the second eye had to be enucleated. The time that elapsed was sufficient for complete destruction of the retina and the development of granulation tissue in its place. While plasma cells are a rarity in this lesion, they occurred with great frequency in the author's sections. (4 photomicrographs, bibliography.)

K. W. Ascher.

Lisman, Jack V. **Rubeosis iridis diabetica.** Am. J. Ophth. 31:989-994, Aug., 1948. (5 figures.)

Payne, Brittain F. **Operative failures for chronic simple glaucoma.** Am. J. Ophth. 31:965-971, Aug., 1948. (7 figures.)

Posner, A. and Schlossman, A. **The clinical course of glaucoma.** Am. J. Ophth. 31:915-934, Aug., 1948. (12 figures.)

Romero, Eduardo. **Two statements and a schematic demonstration relative to glaucoma.** Arch. Soc. oftal. hispano-am. 8:351-354, April, 1948.

Two arguments are presented. One emphasizes the functional antagonism between the circular and radial fibers of the ciliary muscle, and in the other the pathogenesis of glaucoma is attributed to a sympathetic hyperactivity of the radial muscles of the ciliary body. The conten-

tion that the circular fibers focus for near, and the radial for distance is supported by the author's studies and experiments on accommodation, and by the fact that in general, wherever there are longitudinal and circular fibers, their function is antagonistic. The author holds that in spasm of accommodation or transitory myopia only the circular fibers of the ciliary muscle participate. Spasm of the radial fibers, caused by hyperactivity of the sympathetic is manifested by a paralysis of accommodation for near, by a mydriasis because of the synergistic action of the radial fibers of the ciliary muscle and the iris and by ocular hypertension, because the canal of Schlemm is shut by its posterior wall which is formed by the tendon of the radial fibers inserted into the corneoscleral spur. All of these constitute an attack of glaucoma. Romero believes that this pathogenesis of glaucoma has not been known long because the function of the radial fibers in refraction has not been recognized. Romero demonstrates schematically how the effect of sympathetic hypertonicity on the dilator of the pupil, the vascular walls, and the radial fibers of the ciliary muscle leads to obstruction of Schlemm's canal, intraocular hypertension, and venous stasis and how the arterial ischemia and venous stasis lead to nutritive disturbances, degeneration of the ocular tissues, glaucomatous excavation, and visual loss. Ray K. Daily.

Zaretskaya, R. B. **Some experiments with green spectacles prescribed to glaucomatous patients.** Am. J. Ophth. 31:985-989, Aug., 1948. (4 figures.)

10
CRYSTALLINE LENS

D'Andrade, L. **Direct zonulotomy in intracapsular cataract extraction.** Ophthalmologica 115:78-83, Feb., 1948.

D'Andrade's direct zonulotomy consists of the breaking of the anterior zonula fibers along the lower half of the lens equator by means of a zonulotome which is introduced underneath the iris and engages the zonula fibers directly. What the actual shape of the engaging part of the zonulotome is, the reviewer is unable to tell from the article or the illustrations. The lens is tumbled and delivered by external pressure applied to the limbus by means of two separate instruments, a "dented compressor" and a "propulsor." The author recommends this method only for senile cataracts in highly myopic eyes, early and late hypermature, and intumescent cataracts. He reports a series of 129 zonulotomies. Vitreous filled the anterior chamber at the end of the operation in 4.1 percent and was lost in another 4.1 percent of the cases. D'Andrade proposes the term total phacectomy instead of the conventional term intracapsular extraction.

Peter C. Kronfeld.

D'Ermo, F. **Three cases of recurrent iritis with hypopyon as a late complication after cataract operation.** Boll. d'ocul. 27:98-110, Feb., 1948.

In the three cases described extensively, local as well as general treatment proved to be inefficient. All clinical and laboratory examinations were negative except for the successful inoculation of rabbit's cornea with aqueous humor withdrawn during a paracentesis in one of the cases. The possibility of a virus infection in this case was considered. Preoperative bacteriologic tests or antiseptic treatments are not mentioned in the case histories. (References.) K. W. Ascher.

Sen, K. **Anterior lentiglobus. An atypical case.** Brit. J. Ophth. 32:305-311, May, 1948.

Anterior lenticonus is a small conical projection of the lens at its anterior pole and anterior lentiglobus is a similar ir-

regularity that is globular. Both these conditions are extremely rare. It is confined to the anterior capsule and cortex only and the rest of the lens is unaffected. It has a tendency to increase and because of its high curvature produces myopia. Its cause is unknown.

Sen describes a 14-year-old Sikh who complained of sudden reduction in vision of one eye. Examination revealed a globular projection on the lens partly in the pupillary area and partly covered by iris. Vision was 5/60 and could be improved only by contraction of the pupil to 6/24. It measured 3 by 2 mm. and was egg-shaped. The capsule seemed to be entirely absent over it but this is unlikely because the cortex over it remained clear. The other eye was quite normal. (7 figures.) Morris Kaplan.

11

RETINA AND VITREOUS

Dor. **Retinal detachment cured by intravenous novocaine injection.** Ann. d'ocul. 181:300-301, May, 1948.

The retina was detached below in a 57 year old man who had noted progressive loss of sight for one month. A preliminary subconjunctival injection of cyanide-novocaine-dionin was followed by improvement. The retinal detachment was apparently due to a spastic lesion which was further reduced by an intravenous novocaine injection. Five months later vision was 0.5 and one year later the retinal detachment had not recurred.

Chas. A. Bahn.

Hambresin, L., and Schepens, C. **Retinal detachment operation with constant ophthalmoscopic control.** Ann. d'ocul. 181: 257-273, May, 1948.

This interesting contribution marks a step forward in retinal detachment surgery. The authors control the operation for retinal detachment by means of constant ophthalmoscopic examination, and externally by transillumination which is maintained throughout the operation. The binocular ophthalmoscope which is used by the indirect method is mounted on a stand. The combined pyrometric electrode and transilluminator can be sterilized and permits the use of both the right-angled and straight electrodes as well as two transilluminator tips from a common collar on the handle. The electric diathermy mechanism consists of two separate units one for transillumination, and the other for diathermic applications. They are insulated from each other and are regulated by separate foot controls. Before the operative procedure the fundus, including the detachment and tears, is diagrammed on the Weeve Chart which is about eight inches in diameter. A three-man team is necessary for this operation: the surgeon, his assistant and the ophthalmoscopic observer. The procedure consists of a series of superficial applications followed by several perforating applications of 8 to 10 seconds duration. The amount of current is individually determined. Air injections are used according to the Barraquer-Amsler technique. Chas. A. Bahn.

Lijó Pavía, J., and Lis, M. **Obliteration of the central retinal artery. Partial recuperation of vision and retinographic aspects.** Rev. oto-neuro-oftal. 22:97-104, Sept.-Dec., 1947.

In addition to embolus, thrombus, and local endarteritis as causative fractors in obliteration of the central retinal artery, angiospasm must be considered, and not necessarily in the elderly only. Two cases are reported in which there was sudden loss of unilateral vision and a diagnosis of occlusion of the central artery was made. The fundus picture was typical. Acetyl-choline and nicotinic acid, together with liquemine (an anticoagulant) were administered and some definite im-

provement of vision followed. (5 retinographs.) Edward Saskin.

Pascheff, C. **Angioid streaks of the retina as a transitory phenomenon.** Arch. d'opht. 8:152-155, 1948.

Pascheff reviews the various theories of the origin of angioid streaks and reports a case which he was able to follow for eight years. The patient, a woman of 32 years, did not have the commonly associated pseudoxanthoma elastica or diabetes but did have typical angioid streaks in both eyes and reduced vision. Seven years later the streaks had disappeared completely and vision had notably improved in each eye. In commenting on the case, the author describes the condition as a veritable melano-reticular retinitis and notes that both the vascular hypothesis and the hypothesis of rupture of the lamina vitrea are untenable in view of the result in this case. He considers a metabolic disorder the probable cause. In his patient the sole discoverable metabolic abnormality was a hypercholesteremia and this was still present after the disappearance of the streaks. Pascheff concludes that the streaks are probably an infiltration with pigment.

Phillips Thygeson.

Scuderi, G. **Exudative affections of the external layers of the retina of tuberculous nature. Part I.** Rassegna ital. d'ottal. 17:103-128, March-April, 1948.

Scuderi divides the rather rare and not too well understood affections of the external layers of the retina into two groups. The juvenile form includes Coats's disease, the macular juvenile form of Junius, and the central serous retinitis of Masuda. The senile group is composed of the disciform degeneration of Junius and Kuhnt, exudative senile macular retinitis, central chorioretinitis with arteriovenous anastomosis of Oeller, the fibrochondroma of the elastic layers, exudative retinitis with bone formation of Axenfeld, the tumor-like accumulation of tissue at the macula of Elschnig and the senile macular alterations of arteriosclerosis (Possek).

Radiographic examinations of the writer's patients disclosed alterations of the hilar lymph glands from which he believes that tubercle bacilli, or more probably their toxins, find their way into the circulation and, passing through the choriocapillaris to the epithelial pigment, give rise to an abnormal secretion.

Two cases are reported and the literature reviewed. (8 figures.)

Eugene M. Blake.

Vail, Derrick. **Some thoughts on the surgery of retinal detachment.** Wisconsin M.J. 47:687-689, July, 1948.

The essentials for success in the treatment of retinal detachment were recognized and clearly stated by Gonin. They are the finding of a tear, hole, or disinsertion of the retina, the exact localization of the hole, the production of adhesive choroiditis in the area of the hole and nowhere else, and the evacuation of the subretinal fluid. The penetrating needle should not be too long. The anaesthetic of choice is pentothal sodium. The cornea should be kept clear for frequent ophthalmoscopic examinations during the operation. Scleral resection should be done if a scleral staphyloma is the cause of the detachment. The ciliary region and the vortex veins should be avoided. The prognosis is poor when there are delayed hemorrhages, a severe postoperative reaction, bilateral spontaneous idiopathic retinal detachment and when the retina has not returned to its normal position and the pigmented scars of the ignipuncture are not easily visible at the end of three weeks.

I. E. Gaynon.

Winkelman, J. E. **Angioid streaks.** Ophthalmologica 115:84-88, Feb., 1948.

Winkelman reports the case of a white female patient, 72 years of age who died of heart failure. A conspicuous clinical

finding was the presence of multiple pseudoxanthomata elastica. Because of this finding, the patient's eye grounds were examined carefully just before her death, but no angioid streaks were found. Histological examination, however, revealed the typical pathological changes of Bruch's membrane (thickening, ruptures, abnormal staining reactions) which have been described by Böck (Zeitschr. f. Augenheilk. 95:1, 1938 and Hagedoorn (Arch. of Ophth. 21:746, 1939). These changes may therefore be present before the angioid streaks become ophthalmoscopically visible. Peter C. Kronfeld.

12

OPTIC NERVE AND CHIASM

Casanova, José. **Papilledema.** Arch. Soc. oftal. hispano-am. 8:221-290, March, 1948.

This extensive monograph comprises a thorough review of the literature, and a comprehensive bibliography, classified under the headings of symptomatology and diagnosis, pathologic anatomy, pathogenesis, clinical significance, and therapy. The original features of the monograph are two colored fundus drawings, and visual fields in a case of serous meningitis, and one of gumma of the occipital lobe; the histo-pathologic material used to illustrate the chapter on pathologic anatomy; and a report of Casanova's investigations with injections of China ink into the intervaginal space of a cadaver after doing an orbital exenteration. As the photomicrographs demonstrate, the ink is seen to distend the intervaginal spaces, but does not penetrate into the lymphatic spaces about the central retinal vessels, or extend through the perivascular spaces towards the dural surface.

Ray K. Daily.

13

NEURO-OPHTHALMOLOGY

Raski, K. **Concentric contraction of the visual fields in gunshot wound of the brain and in brain contusion.** Acta ophth. Suppl. 29, 1948, pp. 1-137.

Brain lesions caused by trauma either of lighter degree or severer cerebral contusion were followed by a concentric contraction of the visual fields. The region of the brain affected by the trauma had no direct influence on the concentric contraction of the visual field. The visual field for white was contracted in 78.4 percent and for color in 96.8 percent. The greatest contraction occurred for blue whereas the field for red was less affected. The visual field changes persisted and could be ascertained even after the lapse of several years. Psychogenic disturbances evidently had no effect on the result of the visual field changes. R. Grunfeld.

Rich, W. M. **Permanent homonymous quadrantanopia after migraine.** Brit. M. J. pp. 592-594, March 27, 1948.

Permanent quadrantanopia, in the patient's superior right visual fields, following twenty years of repeated attacks of idiopathic migraine is described. It is assumed that the defect results from permanent occlusion of the vessels, with softening of the brain tissue, after a long period of merely functional disorder, rather than the possibility that the friction from an ossified clinoid ligament damaged the optic tract. A review of the literature is given. (4 figures, references.)

Bennett W. Muir.

Smorto, Guido. **Some ocular reflexes in electroshock convulsion.** Riv. oto-neuro-oftal. 22: 272-291, July-Aug., 1947.

In 22 patients, 15 of them men, affected by schizophrenia, melancholia, or psychasthenia, the behavior of the reflex ocular movements in convulsion from electric shock was tested at the beginning of the tonic phase and during the comatose phase. In the tonic phase, when the epileptogenic stimulus slowly expands, an initial crossed rotation of the head and the eyes was noted. This is a tonic reflex

originating in the deep receptors of the neck. During the comatose phase compensatory ocular movements were noted which the author relates to stimuli originating in the nonacoustic labyrinth.

Melchiore Lombardo.

Wagner, H. P. **Visual hallucinations.** Am. J. M. Sc. 215:226-232, Feb., 1948.

Visual hallucinations are not due to local cortical excitability but are psychic phenomena involving the total integrative activities of the mind. Visual memory and visual experience are necessary for visual hallucinations, as it is well known that congenitally blind children do not have visual hallucinations. As to the localizing value of visual hallucinations, much data has been collected, and a careful study reveals that there is none, except that when the hallucinations are projected in a blind homonymous field it is a confirmatory sign that the lesion is located in the contralateral hemisphere. Many clinicians believe, however, that complex lateral visual hallucinations furnish supportive evidence that the lesion is in the temporal lobe, and unformed ones originate in lesions of the occipital lobe.

Orwyn H. Ellis.

Weekers, Roger. **Tonic pupillary reaction (Adie's syndrome) following retrobulbar alcohol injection.** Ann. d'ocul. 181: 193-198, April, 1948.

The retrobulbar injection of ethyl alcohol is not infrequently employed in Europe to relieve ocular pain, especially in blind eyes. Among the infrequent complications following its use is a transient extraocular muscular weakness and the more permanent tonic pupillary reaction (Adie's syndrome). Four cases of the latter are reported. The semidilated pupil in the second stage reacts imperfectly with accommodation and convergence, and does not react at all to light. Myosis is promptly produced by cholinergic drugs that are stable derivatives of acetylcholine, but not to cholinergic drugs that inhibit or destroy cholinase. The former group includes acetylbetamethylcholine (mecholin), the latter, eserine and D.F.P. which have no myotic effect. Adrenergic drugs such as adrenalin produce only slightly increased dilatation which proves that the sympathetic mechanism is not involved.

Chas. A. Bahn.

14

EYEBALL, ORBIT, SINUSES

Babel, J. **Chronic orbital myositis.** Ophthalmologica 114:312-319, Oct.-Nov., 1947.

The clinical symptoms of chronic orbital myositis are: (1) slowly progressive, painless, irreducible exophthalmos without lateral or vertical displacement of the eyeball; (2) lid edema, often associated with ptosis and chemosis, and always associated with dilation of the conjunctival vessels; (3) limitation of active ocular movements in all directions, and (4) limitation of passive ocular movements (Dunnington and Berke, Arch. of Ophth. 30: 446, 1943). These four symptoms do not always permit the differentiation of chronic myositis from true orbital tumors, inflammatory pseudotumors and orbital diseases due to endocrine disturbances. With very rare exceptions, chronic orbital myositis is a disease confined entirely to the orbit (or in one-fourth of the cases to both orbits), without involvement of any extraorbital muscles, without any signs of thyroid or pituitary dysfunction, without any blood dyscrasia and without any circulatory disease (other than arteriosclerosis in elderly patients). Keeping all these possibilities in mind, the diagnosis on the basis of the clinical findings may be so uncertain that orbital exploration and biopsy are resorted to. The author describes a case in which the presence of an orbital tumor was suspected. Exploration

of the orbit revealed fibrosis, an abundance of dilated blood vessels and, posteriorly, a hard mass, pieces of which were removed. Histologic study disclosed a diffuse, inflammatory process which was much more pronounced in the muscles than in the interstitial fatty tissue. The author believes that the characteristic difference between chronic myositis and inflammatory pseudotumors is the specific involvement of the orbital veins in the former disease. More thorough clinical investigation of the circulatory disturbance may permit recognition of chronic myositis. Another clinical clue may be a limitation of ocular movements out of proportion to the degree of exophthalmos.

Peter C. Kronfeld.

Cibis, P. **A new plastic implant made of "Supramid" for sockets after enucleation.** Klin. Monatsbl. f. Augenh. 112:313-316, 1947.

A plastic ball implant is described which has a central tubular hole which penetrates almost its whole diameter. Plastic sutures or catgut are threaded into this tubular cylinder through two small openings at the base and leave it at the opposite side. After the implant is in place, the sutures are threaded through the four rectus muscles and through Tenon's capsule in the usual circular fashion. Firm connection between implant and overlying muscle is thereby established and leads to good movements of the base of the socket and the prothesis. The recently developed implants by American authors are not mentioned. (References.)

Max Hirschfelder.

Devoe, A. G. **Fractures of the orbital floor.** Tr. Am. Ophth. Soc. 45:502-526, 1947.

Thirty-four cases of fracture of the orbital floor were observed. The immediate care of such fractures will rarely be an ophthalmological problem because of the multiplicity of injuries, often of a vital nature, which usually accompany the condition. Immediate treatment is reviewed. Late treatment which may take the form of operation on the extraocular muscles or substitution of inert material in the orbital floor is in the province of the ophthalmologist. Restoration of the orbital floor may improve the cosmetic appearance.

David O. Harrington.

Doctor, L., and Kennedy, R. J. **Tumors of the orbit.** Cleveland Cl. Quart. 15:99-103, April 1948.

A brief review of the clinical manifestations and incidence of orbital tumors is given. The measurement of exophthalmos with a forward displacement over 20 mm. is the most consistent finding. The use of additional diagnostic methods and the differential diagnosis is discussed. The treatment varies with the final diagnosis. Operation should be performed when visual acuity becomes endangered.

A neurilemmoma in a woman 50 years of age is reported with the description of the tumor; a lymphosarcoma in a 65-year-old man (a tumor which involves muscle as well as the eyeball) is described and finally a report of an adenocarcinoma of lacrimal gland which is cylindroma in type is given. (1 figure.)

H. C. Weinberg.

Favory, Albert. **Some new points in the technique of implant in Tenon's capsule after enucleation.** Brit. J. Ophth. 32:366-372, June, 1948.

The author presents an acrylic implant for use after enucleation. The implant is essentially a ball, 10 mm. in diameter, with four arches for the attachment of the rectus muscles and a square projecting peg. Tenon's capsule and the conjunctiva cover all but the peg which finally is fitted into a square hole in the back of the specially made prosthesis. In a further modification the projecting arches were re-

placed by a disc which had four kidney-shaped holes for the attachment of the rectus muscles. Silk is used in suturing the muscles and this, after being passed a second time through the muscle tendon, is passed out through the conjunctiva and tied. Good results followed two early failures. Orwyn H. Ellis.

Fischer-Galati. **Myositis and subacute orbital cellulitis.** Ann. d'ocul. 181:302-303, May, 1948.

A previous contribution is briefly discussed and the following case is presented. A 64-year-old man complained of pain and decreased vision that had followed the feeling of a foreign body in his left eye. Only slight conjunctival injection was found. Three days later a progressive monocular exophthalmus developed. Improvement began after the use of penicillin and treatment of the diseased maxillary sinus. Chas. A. Bahn.

Gát, L. **The plastic repair of symblepharon.** Ophthalmologica 114:414-418, Dec., 1947.

The original title of this paper is "on partial plasty of the socket." Actually it deals with the plastic repair, by means of mucous membrane grafts from the mouth, of posterior or total symblepharon in the presence of a seeing eye. In posterior symblepharon in which there is enough bulbar conjunctiva to line the fornix the tarsal conjunctiva is incised parallel to and close to the lid border and undermined toward the bony orbital margin. Thus enough conjunctiva becomes available to form a fornix. The resultant defect of tarsal conjunctiva is filled in with mucous membrane. In total symblepharon the scar tissue is completely removed and both walls of the resultant cavity are lined with *one* mucous membrane graft wrapped around a thin piece of properly shaped plastic or stent composition.

Peter C. Kronfeld.

Grignolo, Antonio. **Results of penicillin treatment in ocular complications of septic thrombophlebitis of the cavernous sinus, with particular consideration of a case complicated by bilateral occlusion of the central retinal arteries.** Boll. d'ocul. 26:749-763, Dec., 1947.

In spite of the early administration of penicillin in large doses the patient, a man 38 years of age, developed bilateral occlusion of his central retinal arteries on the fifteenth day of his disease. This rare complication is extensively discussed. (Bibliography.) K. W. Ascher.

Hickman, W. R., **Periorbital cellulitis; a report of four cases.** J. Indiana St. M.A. 41:501-504, May, 1948.

Periorbital cellulitis is uncommon and in children and young adults is secondary to sinusitis. Findings are edema and redness of both lids on the affected side, pain in and over the affected eye, elevated temperature and generalized headache. The combined use of sulfamines and penicillin is most effective. Pus must be evacuated. Irwin E. Gaynon.

Hughes, W. L. **Further experiences with integrated eyes and vitallium implants.** Am. J. Ophth. 31:854-860, July, 1948. (3 figures, 5 references.)

Kniper, A. **Roentgentherapy of an orbital pseudotumor.** Boll. d' ocul. 26:719-723, Nov., 1947.

Pseudotumors of inflammatory character are recognized by long duration and recurrent deteriorations. Surgical intervention is not advisable because of the good effect following irradiation. (1 photomicrograph, bibliography.)

K. W. Ascher.

Lederer, J. **Folliculine in some cases of thyroid exophthalmus.** Ann. d'ocul. 180: 37-45, Jan., 1948.

Exophthalmus decreased after follicu-

line administration in five patients. All patients were women in the fourth decade whose ovarian functions had been eliminated surgically or because of the climacteric. In each case the exophthalmus followed decreased ovarian function, varied from 2 to 7 mm., and was binocular. Folliculine administration is indicated in the thyrotropic form accompanied by defective ovarian function. This form is apparently due to imbalance of the diencephalic mechanism which coordinates individual glandular activities into patterns of vasomotor function. Endocrine exophthalmus in one sense is a glaucoma in the orbit. The retained fluid produces degenerative changes in the orbital tissues. Chas. A. Bahn.

Montresor, Dante. **Orbital inflammation treated with penicillin.** Ann. di ottal. e clin. ocul. 73:92-96, Feb., 1947.

Treatment with sulfonamides of a 36-year-old man with an infiltrative phlegmon of the left orbit and signs of cavernous sinus thrombophlebitis had been ineffective and had caused anemia. The response to penicillin was prompt and rapid, and complete recovery resulted.

Harry K. Messenger.

15

EYELIDS, LACRIMAL APPARATUS

Cassady, J. V. **Dacryocystitis of infancy.** Am. J. Ophth. 31:773-780, July, 1948. (7 figures.)

Cockrum, W. M., Slaughter, H. C., Lynch, H. D., and Austin, E. W. **Styes: the role of nutrition in etiology and treatment.** J. Indiana St. M.A. 41:489-491, May, 1948.

The authors found that styes occur in children who are on a low protein-high carbohydrate diet, regardless of their economic state. A well-balanced protein intake, with minerals and vitamins is most important, whereas local treatment, refraction and search for foci are procedures of secondary importance.

Irwin E. Gaynon.

Couzi, J. **Staphylococcal blepharitis.** Ann. d'ocul. 181:274-292, May, 1948.

In a series of 48 patients with blepharitis it was shown by accepted laboratory methods that the staphylococcus was the cause in 46. This same ratio has been previously verified. An anatomical classification is preferred. Cutaneous lesions may be eczema, impetigo, herpes, psoriasis, pemphigus, or the lesion may be predominantly glandular or ciliofollicular. The allergic or hypersensitive factor is manifested by a quantitative and qualitative disproportion of effect and cause. The number of potential allergens is tremendous. Tissue hypersensitivity may be local, as determined by intradermal tests, or bodily, as determined by tests such as that of Pausnitz-Kustner or by eosinophilic increase. Refractive errors may aggravate blepharitis because both have photophobia. Its reduction with correcting lenses potentially reduces blepharospasm through improved marginal venous circulation.

The author concludes that most of the eye drops, washes and compresses frequently used in the treatment of blepharitis retard rather than hasten recovery. Much more important are the expression of abnormal secretion from the oil glands, the removal of diseased lashes and crusts, and the avoidance of physical or chemical irritation. Penicillin and sulphonamides are the most effective remedies. The latter has been found the less efficacious. Resistance to penicillin is not infrequent and may occur immediately or after a time. The local or extraocular use of both drugs singly or together may be advisable and 2,500 units of penicillin combined with a sulpha compound, cod liver oil, vaseline and lanolin is preferred

for local use. In the general desensitization of these patients regulation of their way of life is of primary importance. Hemo- and autoserotherapy have sometimes been followed by improvement. More efficient are autovaccines injected into the lids. Stock vaccines have not been found satisfactory.

Chas. A. Bahn.

Dupertuis, S. M. **Eyelid reconstruction in the blinded.** Plast. and Reconstruct. Surg. 3:269-282, May, 1948.

A series of ten war casualties is utilized to illustrate various principles and procedures used in the reconstruction of the eyelids of anophthalmic sockets.

Twenty-eight photographs and four excellent plates of surgical diagrams in sequence illustrate the article.

Alston Callahan.

Espildora Luque, C., Mosser, J., and Gormaz, A. **Sjögren's syndrome.** Arch. Soc. oftal. hispano-am. 8:333-350, April, 1948.

A review of the literature is followed by a brief report of nine cases. In none of these was there any demonstrable anatomic change or hypertrophy of the lacrimal glands. One patient related that the disturbance set in with swelling of the salivary, parotid, and submaxillary glands, and an annoyance in the upper lids which was probably caused by a swelling of the lacrimal glands. When first seen these swellings had disappeared and there was marked atrophy of the parotid glands. Another patient with marked gross hypertrophy of the parotid actually had a pseudohypertrophy, and as shown photomicrographically, the glandular elements were replaced by fibrous tissue. Mosser devised a quantitative test for the dryness of the mouth, similar in principle to Schirmer's test. He placed the filter paper at angles of the mouth. All nine patients suffered to some extent from arthritis, the symptoms of which preceded symptoms of Sjögren's syndrome. Three patients who had gastric analysis were found to have achylia and hypochlorhydria. Since it is generally believed that Sjögren's syndrome is a disease of the menopause, it is worthy of note that one of the patients became affected at the age of eleven years and one at 26. An unusual history is that of the patient in whom the disease set in at the age of 33 years with an acute attack of dryness of the lids, mouth, and throat after an electric shock. Cauterization of the lacrimal puncta with a thermocautery is recommended as the most effective means of alleviating the ocular discomfort. Vitamin therapy is used with variable and uncertain results. (7 figures.)

Ray K. Daily.

Fuchs, A., and Wu, F. C. **Sleep with half-open eyes (physiologic lagophthalmus).** Am. J. Ophth. 31:717-720, June, 1948. (9 figures, 2 tables.)

Heath, Parker. **Mikulicz's disease and syndrome.** Am. J. Ophth. 31:955-964, Aug., 1948. (12 figures.)

Hirschfelder, M. and Frost, J. **Carcinoma of the inner canthus and forehead.** Am. J. Ophth. 31:999-1001, Aug., 1948. (2 figures.)

Jorio, S. **Concerning blepharoplastic surgery.** Rassegna ital. d'ottal. 17:85-103, March-April, 1948.

After a historical review of plastic surgery of the eyelids Jorio describes in detail and illustrates with pictures the method he used in a variety of deformities. Some were corrected with sliding flaps, some by torsion flaps and others with Wolfe grafts. Grafts were removed from the postauricular region or from the inner surface of the arm.

Many years of experience in lid surgery have lead the author to the conclusion that patients are often late and distrust-

ful in seeking surgical relief, but that good functional and cosmetic results may be obtained if the procedure is not postponed too long. (27 figures.)

Eugene M. Blake.

Kettesy, A. **On genesis and operation of senile entropion.** Brit. J. Ophth. 32: 311-313, May, 1948.

Senile or spastic entropion is a simple turning in of the unchanged tarsus of the lower lid. Normally, the lid is held in proper position by two forces: the tarso-orbital fascia and the equally distributed tension of the orbicularis muscle.

The latter plays the much more important role and its normal distribution is maintained by connective tissue which branches between the bundles. In senility there is a slackening of this connective tissue so that the orbicularis becomes a single bundle near the margin of the lid and the disturbance of the distribution of pressure results in entropion. Remedial measures which do not repair this cause can only result in recurrence or, if overdone, in ectropion.

The solution of the problem is excision of the orbicularis muscle, nothing further. Under local anesthesia, with a lid plate in the lower fornix, a skin incision is made immediately below the lashes and the skin is undermined down to the orbital margin. The palpebral part of the muscle as well as the lower portion is thoroughly extirpated until tarsus and orbital fascia are exposed. Sutures are unnecessary as coaptation is perfect. The results are immediate and lasting and lid action remains perfectly normal. Removal of skin is never done and over-correction is not possible.

Morris Kaplan.

Kurz, O. **Unusual causes of blockage of the lacrimal passages.** Ophthalmologica 115:101-109, Feb., 1948.

A chalazion had perforated into the lower canaliculus. After incision and careful curettage of the chalazion by the conjunctival approach the canaliculus was sutured. The final result was excellent (no lacrimal fistula, no tearing).

In a second patient there was eversion of the lower punctum by a small tumor located on the conjunctival surface just below the border of the lid. Excision of the tumor augmented by the excision of a rhombic piece of tarsus and conjunctiva just below the tumor corrected the eversion of the punctum and the epiphora. The tumor consisted of lymphoid tissue.

Elongation and kinking of a lower canaliculus, probably after trauma (incomplete rupture) was corrected by plastic repair in a third patient.

Peter C. Kronfeld.

Malatesta, C. **Width of the lid fissure and length of the lacrimal canaliculi.** Boll. d'ocul. 27:88-97, Feb., 1948.

In 1916, Van der Hoeve described a congenital anomaly consisting of a reduction in length of the lid fissure, internal ankyloblepharon, a wide nasal base, enlargement of the lacrimal caruncle, and elongation of the lower lacrimal canaliculi. Similar but not identical cases were reported by Halbertsma (1929), Gualdi (1930), Leonardi (1931), Tirelli (1932), and Waardenburg (1933). Three cases are described, photographed, and the exact measurements reported in a table; the main findings are congenital ptosis, epicanthus, reduction in width and in length of the lid fissure, fusion of the lids at their internal extremities, increased distance of the nasal canthi from each other with normal interpupillary distance, and elongation of the lacrimal canaliculi. (References.)

K. W. Ascher.

Panzardi, D. **Results of the operations by Blaskovicz and by Bietti for the correction of a permanent trachomatous ptosis.** Boll. d'ocul., 27:76-87, Feb., 1948.

The author operated on six eyes with permanent trachomatous ptosis, two of them by the original method of Blas-

kovicz, one by the method of Blaskovicz as modified by the author, and three by Bietti's method. Panzardi gives a new explanation of the pathogenesis of permanent trachomatous ptosis. A cicatricial mass which joins the levator palpebrae to the large palpebral ligament is responsible for this type of ptosis. Eight photographs show patients before and after operation. (Bibliography.)

K. W. Ascher.

16

TUMORS

Anastasi, Giovanni. **On the histogenesis of the limbal epithelioma.** Ann. di ottal. e clin. ocul. 73:65-82, Feb., 1947.

Anastasi presents nine cases of epithelial neoplasm of the limbus in ascending order of their supposed histogenesis: a simple tyloma, an atypical tyloma, a simple papilloma, a papilloma in an early stage of transformation into a basal cell epithelioma, a papilloma undergoing transformation into a prickle cell epithelioma, a mixed papillomatous epithelioma, with proliferation of both the prickle cell layer and the basal cell layer, a prickle cell epithelioma, an invasive (terebrant) prickle cell epithelioma, and a basal cell epithelioma.

Contrary to Poleff, whose histogenetic scheme posits the existence of an "initial epithelioma," Anastasi considers that the histogenesis of limbal tumors can be explained on the basis of our knowledge of tumors in general. They are characterized by a gradual increase in alteration of the cells, which become more and more atypical as they go from precancerous forms (in tyloma and papilloma) to the truly cancerous prickle cell and basal cell forms. The differential diagnosis is not always possible clinically but is easily made histologically. The proper treatment is still surgical, though X-ray and radium therapy may be used as adjuncts. (25 figures, including 18 photomicrographs.)

Harry K. Messenger.

Calhoun, F. P., Jr. **Pigmented lesions of the eye and adnexae.** J. Med. Assn. Georgia 37:140-141, April, 1948.

Various pigmented conditions that involve the conjunctiva, lid, and uveal tract are briefly discussed. In early life the appearance of an area of pigmentation in the conjunctiva, or an increase in its size, may not connote serious trouble but in the adult these changes may be signs of danger. Rational therapy can be employed only after proper histologic study of the lesion, and complete local excision for this purpose where possible is recommended.

Bennett W. Muir.

D'Aquila de Castañe Decoud, A. **Histopathology of ocular gliomas.** An. argent. de oftal. 8:41-45, April-May-June, 1947.

Histogenetically, nervous tumors manifest themselves as astrocytomas, oligodendrogliomas, and other forms, whereas gliomas are either glial or nervous. The author presents the Bailey-Cushing histo-evolutionary classification of gliomas as opposed to the Hortega classification. Both these groupings, however, make use of the glial or neuroepithelial origin of the neoplasms. In the cases presented, the author feels that embryologically the undifferentiated type of retinal glioma is extremely malignant, whereas the optic nerve type of glioma has a much slower growth without metastasis (sic). Histologically, glio-epithelial perivascular pseudo-rosettes were commonly found and true rosettes were found in but one case. (8 figures, 1 table, references.)

Edward Saskin.

Dellaporta, A. **A case of bilateral malignant lymphomatous infiltration (lymphosarcoma?) of the lids of a four-year-old boy.** Proc. Ophth. Soc. Vienna. p. 85, Oct. 23, 1944.

One week after small-pox vaccination a sudden indolent swelling of the lids appeared in a four-year-old boy. In the beginning it was present only during the night and disappeared almost completely during the day time. The skin and conjunctiva were not involved. Beneath the skin, inside the orbital rims, pea-sized globular masses could be felt in the orbital tissue behind the skin-muscle layer of the lids. Very small retro-auricular glands were palpable. Blood count and the bone marrow obtained by sternal puncture were normal. Biopsy of one of the nodules revealed malignant lymphomatous tissue, possibly lymphosarcoma. The child died a few months later. F. Nelson.

Dunnington, J. H. **Granular cell myoblastoma of the orbit.** Tr. Am. Ophth. Soc. 45:93-101, 1947.

Granular cell myoblastoma is a relatively common tumor found in different locations throughout the body. Its occurrence in the orbit is rare. Two tumors are reported that arose in the orbit, one of which was malignant. There is no characteristic clinical picture and the differential diagnosis is purely a histologic one. In spite of a considerable literature on the subject there is still much confusion in terminology.

David O. Harrington.

Edgerton, A. E. **Chloroma: report of a case and a review of the literature.** Tr. Am. Ophth. Soc. 45:376-414, 1947.

This very complete review of the subject of chloroma presents the clinical and pathological picture of the disease, lists 366 cases collected from the literature and reports one new case in great clinical and pathologic detail.

David O. Harrington.

Hutchinson, B. B. **Management of intra-ocular foreign bodies.** Texas St. J. Med. 44:48-51, May, 1948.

Intraocular foreign bodies must be demonstrated by direct observation and X-ray if possible. A penetrating wound in the avascular portion of the globe with subconjunctival hemorrhage is indicative of a double perforation. The Sweet method of localization is most accurate. Anterior chamber foreign bodies may be removed through keratome incision at an angle of 45 degrees. Nonmagnetic foreign bodies in the lens may be allowed to remain in situ. Posterior segment foreign bodies should be removed through a scleral incision, followed by a diathermy barrage about the wound.

Irwin E. Gaynon.

Levitt, J. M. **Malignant melanoma of the iris.** Am. J. Ophth. 31:863-864, July, 1948. (1 figure.)

Matteucci, P. **The melanogenesis of uveal sarcomas. On the oxidation of tyrosine and 3,4-dioxyphenylalanine in melanotic uveal tumors and in the normal human uvea.** Ann. di ottal. e clin. ocul. 73:183-186, March, 1947.

Tyrosine and 3,4-dioxyphenylalanine are readily oxidized when introduced into a preparation of neoplastic tissue obtained from melanotic sarcomas of the choroid, whereas their addition to preparations of normal human uveal tissue has no effect on the consumption of oxygen. In the case of normal choroidal tissue the results of this study accord with those of other investigators, but the data referring to tumor tissue are entirely new. Matteucci's experiments seem to confirm the hypothesis that the tumor pigment melanin has its origin in the neoplastic cells themselves. Harry K. Messenger.

Radnót, M. **Flat sarcoma of choroid.** Ophthalmologica 114:409-414, Dec., 1947.

There were two cases of "flat sarcoma" of the choroid among the 53 eyes with uveal sarcoma enucleated and examined

histologically at Imre's clinic in Budapest during 1940 to 1943. Because of its extensive contact with ciliary vessels and nerves the flat sarcoma invades and perforates the sclera earlier and in more places than the circumscribed inward-growing sarcoma. Peter C. Kronfeld.

Schmid, M. **Local recurrence of a melanosarcoma of the iris after extirpation of the tumor.** Proc. Ophth. Soc. Vienna. p. 82, Oct. 23, 1944.

A triangular pigmented tumor in the lower half of the right iris of a 40-year-old woman, extending from the chamber angle toward the pupillary margin and touching the posterior surface of the cornea was excised thoroughly. Apparently healthy tissue of the adjacent sector of the ciliary body was included. Histologic examination revealed a melanosarcoma. After three years recurrence in the sclera near the operative scar and nevoid pigmentations in the nasal section of the iris were found. Histologic examination of the enucleated globe revealed an infiltrating growth of pigmented spindle cells and confirmed the diagnosis.

F. Nelson.

Schulz, M. D., and Heath, P. **Lymphoma of the conjunctiva.** Radiology 50: 500-505, April, 1948.

The authors summarize the scanty reports both in the radiologic and ophthalmic literature on this rare condition. The cytology of the lesions is presented and classified. Treatment was successful in lymphoma limited to the conjunctiva, but in contrast to these, all patients whose conjunctival involvement was part of a generalized condition were dead in less than two years, or had uncontrolled disease. Orwyn H. Ellis.

Vrabec, F. **Melanoblastoma of the human choroid cultured in vitro.** Ophthalmologica 115:129-140, March, 1948.

With Carrel's method of tissue culture Vrabec obtained good in vitro growth from four cases of malignant melanoma of the choroid. P. C. Kronfeld.

17
INJURIES

Grant, W. M. **Ocular injury due to sulfur dioxide.** Arch. Ophth. 38:755-761, Dec., 1947.

Ocular injuries result from spraying of liquid sulfur dioxide and oil into eyes in refrigeration accidents. Four such cases are described in detail. The injuries were characterized by immediate damage to the corneal epithelium, as in acid burns, with underlying stromal and endothelial injury as in alkali burns. There is an early absence of severe pain, due apparently to a temporary anesthesia. In mild injury the outcome was complete recovery, while in severe damage dense opacification followed corneal infiltration and interstitial vascularization. John C. Long.

Leon Gangoso, Martin. **Traumatic aphakia and aniridia.** Arch. Soc. oftal. hispano-am. 8:402-403.

A 19-year-old food handler sustained a blow on the left eye, which perforated the globe and led to a complete loss of the iris and lens, and an intraocular hemorrhage. The intraocular blood gradually became absorbed and the eye recovered with a visual acuity of two-thirds, with a +9.00D. lens. The question of estimating the visual disability for legal purposes is raised, inasmuch as there is no binocular vision with unilateral aphakia but if his good eye were injured a unilateral visual acuity of two-thirds would permit him to continue his occupation. Ray K. Daily.

Marucci, Luigi. **A simple apparatus for outlining directly on the X-ray film information for the localization of intraocular metallic foreign bodies by the**

method of Comberg Borsotti. Giorn. ital di oftal. 1:36-46, Jan.-Feb., 1948.

The author briefly reviews the Comberg-Borsotti method of localization of intraocular foreign bodies and describes the Dufour technique. In the latter one uses the ring of Goldman and Bangerter, exposes two films, one anteroposterior and the other lateral and uses a transparent screen for outlining directly on the film the position of the foreign body. He then describes an original apparatus which allows direct reading of the position of the foreign body, both in the antero-posterior and the lateral view. The two schematic representations of Dufour are retained but one needs neither geometry nor drawing instruments.

Francis P. Guida.

Wall, Walton. **Acute tetanus following a perforating injury of the eye.** Eye, Ear, Nose and Throat Monthly. 27:179-182, April, 1948.

The author reports an interesting case of acute tetanus that occurred five days after a perforating ocular injury. Although the incubation period was probably prolonged by its use, penicillin did not seem to affect the clinical course of the disease. The patient responded to antitoxin. In reported cases the mortality for this condition is high.

Orwyn H. Ellis.

18

SYSTEMIC DISEASE AND PARASITES

Anderson, W. B., Nicholson, W. M., and Iverson, L. **Temporal arteritis with associated optic atrophy.** South. M. J. 41: 426-434, May, 1948.

Two case reports are given of temporal arteritis with optic atrophy caused by occlusion of the central retinal artery. Ocular signs occur in about one-third of the reported cases. The pain of the arteritis seems to be helped by section of the vessels for histologic study. The etiology is entirely obscure. (Bibliography, 8 figures.)

Bennett W. Muir.

Bansi, H. W. **The pathological physiology of undernourishment and deficiency diseases.** Klin. Monatsbl. f. Augenh. 112: 289-299, 1947.

This article was written for the postgraduate education of German specialists, particularly oculists, who in the Europe of today are in close contact with various stages of undernourishment. It discusses metabolic happenings during qualitatively and quantitatively deficient protein intake, the disturbed metabolism of nitrogen and oxygen and the various vitamin deficiencies. One finds disturbances in the field of enzymes and hormones, hypothyroidism, hunger edemas and pathological behavior of the liver function.

Max Hirschfelder.

Böck, J. **Subretinal cysticercus.** Proc. Ophth. Soc. Vienna p. 89, Dec. 11, 1944.

In the macular region of the retina of a man, 48 years of age, a round bullous lesion was found about 1.5 disc diameters in size. At its lower border hemorrhages and white spots were seen. The disc was blurred and somewhat prominent. The vitreous body was opaque and detached posteriorly. Four weeks after the first examination the focus had doubled in diameter and the worm could be observed moving inside the cyst. Cysticercus reaction was positive in the blood. After temporary detachment of the external rectus and the inferior oblique muscles the sclera was incised with guidance of the localizing method of Weve-Lindner by transillumination. After incision no choroidal tissue was seen and no hemorrhage occurred probably because the choroid had been changed by the presence of the cysticercus. The cyst could be removed in toto. Resulting vision was 2/60. The cysticercus reaction in the serum be-

came negative within a few weeks and remained negative. F. Nelson.

Brinkhorst, C. D. **Toxoplasmosis.** Ophthalmologica 115:65-77, Feb., 1948.

The author reports a case of a six-year-old girl with characteristic symptoms of toxoplasmosis, namely psychomotor disturbances, microcephaly, microphthalmos and chorioretinitis. The clinical diagnosis was confirmed by the demonstration of toxoplasma-like parasites in animals inoculated with the patient's spinal fluid. "This is the first case known in the European literature, in which the diagnosis was made intra vitam, and it is one of the few non-fatal cases of infantile toxoplasmosis described." The author also reports three other, less conclusive, cases and reviews the literature.

Peter C. Kronfeld.

Bruce, G. M. **The ocular fundus in pheochromocytoma of the adrenal gland. Report of three cases.** Tr. Am. Ophth. Soc. 47:201-228, 1947.

Three cases of this condition in children, all showing retinal lesions are reported. The literature is reviewed with special reference to ocular pathology. The dominant finding in such cases is vascular hypertension, in the course of which pathologic conditions may be found in the retina, in its blood vessels, or in both. The findings cannot be differentiated ophthalmoscopically from those of essential hypertension. Sooner or later failure of vision will bring the ophthalmologist into consultation and the condition should be considered wherever evidence of vascular disease is found. David O. Harrington.

Brun, J. **Early and late tuberculosis, including paraglandular.** Ann. d'ocul. 181: 81-105, Feb., 1948.

In this outstanding contribution, 740 cases of ocular tuberculosis are analyzed according to their place in four categories.

Extraocular semiology. Primary infections before the age of 20 years are classed as youthful; after that age, adult. The initial signs of primary pulmonary-glandular infection are: recent exposure to contact; slight systemic toxemic reactions, not infrequently with local cutaneous and ocular phlyctenules; mediastinal adenopathy; strongly positive cuticular or other tuberculin reactions; positive tubercle inoculation from gastric contents. In the later stages of infantile and youthful infection, the more positive signs are persistent but apparently recent cervical and/or subclavicular adenopathy and recent idiopathic serofibrinous pleurisy. The less positive signs are enlarged pulmonary and/or subclavicular nodules, often fibrosed or calcified as determined radiologically, clinical symptoms of pleurisy, asthenia, loss of weight, fever, and transient involvement of the eyes, testicles, kidneys, and other organs. The early signs of primary pulmonary-glandular infection in adults and recurrences of primary infections in infancy and childhood are frequently similar. The more positive signs are persistent cervical or mediastinal adenopathy with or without suppuration, infiltrative lung lesions, recurrent or old, usually in the upper lobe, and various extrapulmonary lesions involving the eyes, especially deep keratitis and uveitis, viscera, skin and joints. The less positive signs include prolonged infectious contact, cervical or mediastinal calcified gland lesions radiologically determined, enlarged glands, especially apical and subclavicular, variable, but usually transient, local and serous reactions like pleurisy, synovitis, phlyctenulosis, deep keratitis, or uveitis, and strongly positive cuticular reactions, of greater importance in ages beyond 40 years. Recurrence of lesions is usually associated with increased immunity. The complete sequence of ocular involvements especially in youthful infections is phlyctenulosis,

deep keratitis or scleritis, uveitis, iritis, iridocyclitis, choroiditis.

Phlyctenular keratoconjunctivitis. 404 cases. This most frequent ocular manifestation of tuberculosis of which 404 cases were observed usually occurs before the age of 12 years and is essentially a local, serous, hypersensitive reaction. It occurs within one year of the primary infection in 80 percent of patients. In 94 percent of patients a strongly positive cuticular reaction usually develops several months before the onset of the phlyctenulosis which coexists with mediastinal adenopathy in 16 percent of the patients. There are recurrences in 50 percent which usually are accompanied by persistent strongly positive cuticular reactions. In 63 percent the history of tuberculous familial or parafamilial prolonged contact was obtained. Primary nasopharyngeal and tonsillar infection is especially frequent in the very young, with resulting early cervical adenitis. Phlyctenulosis may follow numerous infectious and metabolic diseases especially in children with or without an associated glandular tuberculosis. The most frequent sequel and complication of recurrent phlyctenulosis especially in youth is deep keratitis and scleritis which may be followed by uveitis. In adults phlyctenulosis is infrequent and usually there is coexistent mediastinal adenopathy.

Deep keratitis and scleritis. 138 cases. This group usually begins at a later age than phlyctenulosis, between the ages of 10 and 20 years in the younger group, and between 20 and 50 years in the older group. In younger persons these diseases follow primary infection by not less than six to nine months and often represent a sequel to one or more attacks of phlyctenulosis. They are also secondary to a persistent mediastinal and cervical adenopathy and in 15 percent were associated with pleurisy. In older persons they follow the primary infection usually by years and correspond somewhat to the early tertiary stages of syphilis. Familial and other probable sources of infection were reported in 50 percent and strongly positive cuticular reactions existed in 58 percent.

Uveitis. 198 cases. This group includes iritis, iridocyclitis, choroiditis, and retinal hemorrhages, singly or in combination. In the earlier stages of youthful infection, iritis, although the most frequent of the group, occurred in but 4 percent. Of the eight cases analyzed, extrapulmonary infectious processes existed in four and a strongly positive cuticular reaction in five. The usual sequences in youthful primary infection are phlyctenulosis, deep keratitis or scleritis, and uveitis. Of the 190 primary infections of adults, 152 were in the iris and other anterior uveal tissue. Uveal involvement in the older group usually began between the ages of 30 and 40 years. Evidences of past or present pleurisy existed in 25 percent of the iritis patients. Apical pulmonary nodules were observed in 40 percent. Collapse therapy was frequently followed by marked ocular improvement. The cuticular reaction was strongly positive in 52 percent. The respective ages, probable source of infection, extraocular evidences of tuberculosis, and cutaneous allergy are analyzed in detail for each uveal group.

Paraglandular ocular tuberclosis: In this section, the relationships of phlyctenulosis, deep keratitis, and scleritis, as well as the different forms of uveitis are analyzed from the standpoint of the pulmonary-glandular and other tuberculous processes such as mediastinal, apical, and cervical adenopathies, in their relationship to youthful and adult primary and secondary ocular involvements.

Therapeusis. The favorable ocular progress of tuberculous patients treated with calcium, gold salts, methylic antigen, and tuberculin, has frequently been so slight that one cannot but wonder

whether or not their use was justified. The treatment of enlarged tuberculous glands by radiotherapy is not new, but is now sufficiently understood to be more efficiently employed. Radiotherapy is contraindicated in very recent adenopathies, such as usually exist in early phlyctenulosis. It is indicated in the later stages and is without danger if employed with reasonable prudence. It reduces the infectiousness and toxicity of the glands through which most of the toxins reach the eye, but does not directly kill tubercle bacilli. Coincidental infections, especially staphylococcal and streptococcal, are not affected. Caseous glands should be evacuated before radiotherapy is begun. In cervical adenopathies, doses of 100 R are repeated every five days to form a series of five or six treatments. After a rest period of one month, the treatments may be repeated. Glandular retrogression usually begins within a month. The hygienic treatment of all tuberculous patients including those who have ocular involvements is the most important factor in tuberculous therapy. The author and most French writers on ocular tuberculosis insist upon the advantages of a high altitude, 4,500 feet or more above sea level. The successful treatment of ocular lesions is frequently complicated by secondary infections such as influenza and the infections of childhood. Ocular involvements usually signify tissue reactions to toxins transmitted to the eye through the lymph stream rather than hematogenous emboli. These lymphogenous toxins attack tissues which have been previously sensitized, injured, or which are constitutionally imperfect. Ocular involvements are therefore inversely proportionate quantitatively and qualitatively to pulmonary tuberculosis alone, because glandular infection and transmission is the dominant factor in ocular involvement.

The original article is but an abstract of a large monograph. Its thoroughness and understanding facilitate a better coordination of the clinical, pathological and etiological factors in the diagnosis and treatment of the ocular manifestations of tuberculosis. Chas. A. Bahn.

Goedbloed, J. **Capillary hemorrhages of the retina and capillary fragility.** Ophthalmologica 115:174-179, March, 1948.

One patient with hypertensive cardiovascular disease and one with diabetes showed small retinal hemorrhages associated with a high Goethlin index. Under treatment with rutin the Goethlin index returned to normal and most of the retinal hemorrhages disappeared.

P. C. Kronfeld.

Hartmann, E., Collin, P., and Vergne, P. **Scleroderma and fundus lesions.** Ann. d'ocul. 181:220-225, April, 1948.

Fundus lesions associated with scleroderma have until now not been recorded. Associated lens opacities, however, are not infrequent. In a woman, 57 years of age, with the classical structural and functional symptoms of generalized scleroderma, the following fundus picture was observed. Fifteen to 20 small gray-yellowish areas were irregularly arranged around the macula in both eyes. They were round or oval, and variable in size, averaging one-fourth disc diameter. Some were slightly pigmented, located in the deeper retinal layers and not associated with any vessels, and, in one eye, very faint deep radial lines were observed about the disc. Vision was normal as were the functions and structures of the orbit and its contents. The author apparently believes that the fundus condition is an unusual manifestation of the sclerodermal process which began in Bruch's membrane. The clinical picture suggests to me an atypical bilateral, progressive, presenile, perimacular, constitutional degenerative disease in a patient with another constitutional disease of the neuro-vascu-

lar type, scleroderma. Both have in common progressive mesodermal deterioration with imperfect repair. The differential diagnosis of the condition involves drusen as well as tapetoretinal, punctate, and vascular degenerative diseases of the retina. Chas. A. Bahn.

Hartmann, K. **Removal of a living cysticercus from the anterior chamber.** Klin. Monatsbl. f. Augenh. 112:333-338, 1947.

Cysticercus invasion of the bulbus has now become a rarity. Invasion of the anterior chamber is much more infrequent than localization in deeper parts of the eye. A case is described which presented the picture of a severe iridocyclitis. Only after repeated puncture of the anterior chamber and removal of the dense serofibrinous exudate was the cysticercus discovered as the cause of the inflammation. The parasite was alive and was removed in toto after keratome incision. The eye recovered. The life cycle of the taenia solium is described and the literature surveyed. (References.)

Max Hirschfelder.

Meneely, J. K. **Fever of undetermined etiology associated with bronchopneumonia, conjunctivitis, stomatitis, and adenopathy (Stevens-Johnson syndrome).** New York State J. Med. 48:1399-1400, June 15, 1948.

A febrile clinical complex of considerable severity and lesions in several systems of organs is described as seen in a 13-year-old girl. No causative organism was isolated. The author believes that his patient had a variant of the Stevens-Johnson syndrome. F. H. Haessler.

Much, V. **Eye findings after amebic dysentery and in ameba-carriers.** Ophthalmologica 114:384-396, Dec., 1947.

In Tel Aviv amebic dysentery with and without definite gastrointestinal symptoms is apparently a common disease. The diagnosis of the latter form is based on stool examinations for ameba, on stool cultures and on the complement fixation test. Because of the many borderline cases that are seen in Palestine, the ophthalmologist has been asked to be alert for eye manifestations of amebiasis. The most important and apparently quite common eye-symptom is a partial gray discoloration of the disc which ordinarily would be suggestive of multiple sclerosis. Observation of these patients over a period of several years reveals no signs of nervous system involvement nor any appreciable loss of visual function. An ocular manifestation of the impaired liver function in amebiasis is an abnormal increase in the permeability of the blood-aqueous barrier as evidenced by a more rapid passage into the anterior chamber of fluorescein taken by mouth than is characteristic of normal control individuals. Peter C. Kronfeld.

Németh, L. **Ocular changes in tuberculous skin diseases.** Ophthalmologica 115:167-173, March, 1948.

The eye findings in 36 patients suffering from various forms of tuberculosis of the skin are reported. Cicatricial ectropion, dacryocystitis and deep corneal scars were the more common manifestations of active or healed ocular tuberculosis. Eight patients showed involvement of the posterior segment in the form of choroiditis or chorioretinitis. The clinical picture and the course of the choroiditides varied a good deal. Striking are the noncharacteristic or even negative pulmonary findings. P. C. Kronfeld.

Redslob, E. **The problem of diabetic retinopathy.** Ann. d'ocul. 181:129-135, March, 1948; 181:224-243, April, 1948.

In some instances, insulin has apparently aggravated diabetic retinopathies. This may be due to impurities in the insulin, allergic reactions, or other factors. It is possible that in some persons insulin,

by increasing the fat content of the blood and tissues, may increase the tendency to lipid degeneration especially of the hemorrhagic type. Diabetic retinopathies are slightly more frequent since the use of insulin. It is therefore advisable to use the minimal dosage of insulin in patients who have rapidly progressive diabetic retinopathies, especially hemorrhagic. Diabetic retinopathies are less related to age than to the duration of the diabetic process. The amount of glycosuria and hyperglycemia is apparently not of major importance. The pathologic processes in diabetic retinopathies are not characteristic. The frequent, deep punctate hemorrhages, hyaline degeneration and circinate arrangement form a clinical picture which is not pathognomonic of diabetes. Arterial and arteriolar sclerosis is a frequently associated or a complicating condition. Ophthalmoscopically, the differential diagnosis may be difficult. The diabetic process may provoke atherosclerosis, hypertension and nephritis, especially intercapillary glomerulosclerosis. The last named apparently plays an important part in the progress of diabetic retinopathies. In compound diabetic and hypertensive retinopathies too rapid lowering of the blood sugar is not advisable because the blood sugar is usually inversely proportionate to the hypertension.

Chas. A. Bahn.

Ricca, Salvatore. **Two cases of solitary oriental button, of the prelacrimal region and on the lid.** Ann. di ottal. e clin ocul. 73:115-125, Feb., 1947.

Two cases of oriental button (cutaneous leishmaniasis) are reported. In one patient the chronic ulcerative granuloma was in front of the lacrimal sac and simulated a fistulizing peridacryocystitis; in the other the lesion was on the upper lid. In both cases the Leishmania tropica was found in smears. The differential diagnosis is discussed. In each case two local injections of emetine hydrochloride (2 cc. of 1 percent and 2 percent solutions, respectively, at four and six day intervals) brought about rapid recovery with excellent cosmetic results.

Harry K. Messenger.

Shannon, C. E. G., and Hunt, W. **The hyperophthalmopathy of Graves' disease.** Tr. Am. Ophth. Soc. 45:240-253, 1947.

Clinically hyperophthalmopathy is seen in the hyperthyroid, hypothryroid states and with a normally functioning thyroid and the type may vary in many ways. In the thyrotoxic state the exophthalmos is as much apparent as real, but it may be actual when the thyrotropic factor of the pituitary is excited.

Exophthalmos increases in 50 percent of cases after thyroidectomy. The pituitary secretion may sometimes be controlled by X-ray therapy. Where ocular symptoms are out of proportion to the thyrotoxicosis and in the presence of a low basal metabolic rate, thyroidectomy is contraindicated. The choice of treatment must be based on the morbid mechanism.

David O. Harrington.

19

CONGENITAL DEFORMITIES, HEREDITY

Biró, I. **Data concerning the heredity of astigmatism.** Ophthalmologica 115:156-166, March, 1948.

The author had the opportunity of examining 31 members of one family representing three generations. The transmission of astigmatism seemed to follow a somewhat irregular but, in principle, dominant pattern.

P. C. Kronfeld.

Franceschetti, A. **Embryopathy from German measles in pregnancy.** Ann. di ottal. e clin. ocul. 73:1-7, Jan., 1947.

Comment is made on three cases, in one of which there were numerous pigment spots of various sizes in the retina, espe-

cially at the posterior pole. To designate this fundus picture Franceschetti proposes the name of pseudo-retinitis pigmentosa. He also calls attention to a digito-ocular phenomenon, which he has observed in cases of congenital cataract and of amblyopia from microphthalmos and albinism, but which he has never met in cases where light perception is absent. The affected child spontaneously presses upon the eyes with the fingers and presumably produces phosphenes thereby. He has also noted an analogous digito-auricular phenomenon in one case. Illustrations are given of these phenomena, as well as of postrubeolic congenital cataract and of pseudo-retinitis pigmentosa. Harry K. Messenger.

Lloyd, R. F. **The clinical course of the eye complications of arachnodactylia.** Tran. Am. Ophth. Soc. 45:342-354, 1947.

It is generally thought that the lens dislocations and rigid irides seen in archnodactylia are nonprogressive congenital defects. Observations on 43 cases has convinced the author that many are true abiotrophies. While some patients complain only of reduced visual acuity, many have progressive lens dislocation and a degeneration that ends in detachment of the retina.

The hereditary pattern and clinical development of the disease and its eye complications is discussed. Operative hazards are reviewed. Five families and six individual cases are presented.

David O. Harrington.

Patrick, P. R. **Report of a survey of children born in 1941 with reference to congenital abnormalities arising from maternal rubella.** M. J. Australia. 1:421-425, April, 1948.

A severe outbreak of German measles occurred in Queensland in 1940 after which a large increase in the number of children admitted to the school for the blind and deaf occurred. Many of the affected children were examined and 7,822 returned questionnaires are analyzed. The most frequent abnormality found was deafness; then followed congenital heart disease, mental deficiency and cataract. A pigmentary abnormality in the fundus of these "rubella" children was noted, but their vision was unaffected. The problems of treatment, education, and prevention are discussed. Orwyn H. Ellis.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Bailliart, P. **What should we conceal from and what should we tell our patients?** Ann. d'ocul. 181:304-306, May, 1948.

Only moral honesty and professional responsibility can determine what should be concealed from the patient. Numerous illustrations are presented. Conditions which may be incurable today may tomorrow become remediable. Those who make positive statements should be doubly sure and realize the accompanying responsibility. Even a death sentence may be pronounced in a merciful manner. Those who are probably very soon to be sightless should be given the opportunity of adjusting themselves through Braille and other facilities for the sightless. The risks of operations should be thoroughly understood by the patient. Only too often patients are misled concerning the risks of operations. A difficult problem involves the time factor in the adjustment to blindness. Is it better for the patient to know the whole truth quickly in order that the adjustment may be more rapid, or should he be allowed to realize the truth more slowly so that he may have more time for adjustment? Chas. A. Bahn.

Clark, W. B. **Ocular onchocerciasis in Guatemala. An investigation of 1,215 natives infected with Onchocerca vol-**

vulus. Tr. Am. Ophth. Soc. 45:461-501, 1947.

The incidence of ocular onchocerciasis is still undetermined. Ocular manifestations were found in 44 percent of 1,215 patients with onchocerciasis or with a history of the disease and 0.43 percent of those with the ocular type of disease were blind or practically blind.

Unless the possibility of vitamin deficiencies, endocrine disturbances, focal infections, syphilis and tuberculosis are ruled out in persons with the disease all the ocular lesions found in patients with onchocerciasis cannot be attributed to the disease. Additional histopathologic studies are needed on the eyes of patients with onchocerciasis. The author considers that the characteristics of the fundal lesions suggest a degenerative rather than an inflammatory process. The possible methods of spread to the United States are discussed but this occurrence seems unlikely.

David O. Harrington.

Del Rio Cabana, J. L. **Appraisal of disability and compensation of industrial ocular injuries.** Arch. Soc. oftal hispano-am. 8:358-394, April, 1948.

At present the estimate of disability in ocular injuries in Spain is determined solely on the basis of visual acuity and is classified as temporary, partial permanent, total permanent, and absolute permanent. The loss of one eye, with one good eye remaining is defined as partial permanent disability. Disability is total permanent when one eye is lost and the other eye has less than a 50 percent impairment. Loss of one eye, with more than a 50 percent impairment in the other is classified as absolute permanent disability. Del Rio Cabana suggests a definite scale of compensation, similar to the one used in this country, based on loss of visual acuity, changes in the visual fields, disturbances in ocular motility, injury to the ocular adnexa, and factors which modify evaluation such as malingering or failure to use protective measures. The estimation of the impairment in these various functions is discussed in detail, and a compensation scale is presented. (6 figures.) Ray K. Daily.

Flowers, W. S. **Causes of blindness in China.** Chinese M. J. 66:38-46, Jan., 1948.

Blindness in China is caused by smallpox, trachoma, ophthalmia neonatorum, phlyctenular conjunctivitis, keratomalacia, ulcerative keratitis and muco-purulent conjunctivitis. Irwin E. Gaynon.

Gözcü, Niyazi. **Certain considerations on blindness in Turkey.** Göz Kliniği 6:1-5, 1948.

The positive results of the antitrachoma campaign which has been carried on in southern and southeastern Turkey since 1925 can be seen in a definite decrease of blindness rather than a decrease in the incidence of trachoma. The author compared the official statistical data of the trachoma campaign with those on blindness in the 1935 census. F. H. Haessler.

Imus, H. A. **Visual examination of flyers returned from combat.** J. Aviation Med. 19:62-93, April, 1948.

Two hundred and fifty naval aviators were given complete eye examinations upon their return from combat. The men who had been selected because of their superior visual capacity had retained it.

Irwin E. Gaynon.

Marisco, Vincenzo. **The battle against trachoma.** Boll. d'ocul. 26:710-715, Nov., 1947.

In the Lucania area of Italy, an apparent diminution of the number of trachomatous patients was due to the improvement that followed treatment with sulfa drugs. The number of infected families, and therefore the number of infectious foci, remained equal over the period 1940

to 1946. A comprehensive table shows the distribution of patients and of their complications.

K. W. Ascher.

Pereyra, Georgia. **The eyes of men of genius and historical personages.** Giorn. ital. di oftal. 1:73-83, Jan.-Feb., 1948.

This paper, read before the Lay Medical Society of Florence, discusses briefly the eyes and ocular affiictions of many well-known men of the past, starting with Homer and including Adolph Hitler.

Francis P. Guida.

Sorsby, A., and Bishop, W. H. **A portrait of Richard Banister.** Brit. J. Ophth. 32:362-366, June, 1948.

The authors present evidence to show that a certain painting in possession of the Royal College of Surgeons is really that of Richard Banister, one of England's early ophthalmologists. In his writings he gave the first account of hardness of the eye as a diagnostic and prognostic sign.

Orwyn H. Ellis.

Historical Miniatures

St. Yves gave the first satisfactory description of glaucoma in 1722. His predecessors could not bring themselves to discard the Hippocratic word "glaucosis," although this word was used by the ancients for any incurable clouding of the pupillary area. St. Yves, on the other hand, referred to glaucoma as one of the false cataracts and described a clinical picture of which pain, dilated pupil, loss of visual acuity and field, and finally loss of transparency of the lens were parts.

Hirschberg, *Graefe-Saemisch Handbuch.*

The diagrammatic cross section of the eye that appears in the famous *Anatomy* of Vesalius, published in 1543, makes it clear that even then the true position of the lens was not understood. The Hellenistic-Arabic conception of the tremendous depth of the anterior chamber is the basis for the then-current belief that the couching needle, after it had penetrated the cornea, entered a huge space in which it could move in great arcs in all directions without touching the lens.

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NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
601 Union Trust Building, Cincinnati 2
News items should reach the editor by the 12th of the month

DEATHS

Dr. Roy M. Armstrong, Franklin, Kentucky, died May 3, 1948, aged 64 years.

Dr. Albert Stewart Barr, Ann Arbor, Michigan, died April 27, 1948, aged 65 years.

Dr. William Robert Morrison, Billings, Montana, died May 2, 1948, aged 72 years.

MISCELLANEOUS

ARMY RESIDENT TRAINING PROGRAM

A limited number of senior residencies in ophthalmology and a substantial number of assistant residencies in ophthalmology in Army general hospitals are available for newly commissioned officers under the military resident training program.

Under this program, any physician who qualifies for and accepts a commission in the Regular Army Medical Corps will be given the opportunity of competing for an approved residency in the field of his choice.

Applications for these residencies are currently being received in the Office of the Surgeon General.

HONOR SIR JOHN PARSONS

In honor of the 80th birthday of Sir John Parsons, his colleagues and friends presented to him his portrait painted by John Gilroy. The presentation was made on the afternoon of September 3rd in the library of the Royal College of Surgeons, Lincoln's Inn Fields, London.

FRANCIS I. PROCTOR LECTURE

On Friday evening, September 10, Dr. David G. Cogan of the Harvard University Medical School, Boston, delivered the third Francis I. Proctor Lecture on Ophthalmology at Toland Hall, University of California Medical School, San Francisco. The subject of Dr. Cogan's address was: "The Physio-Pathologic Basis for Some of the Signs and Symptoms of Corneal Disease."

ANISEIKONIC CLINIC

An aniseikonic clinic has recently been established in the eye department of the George Washington University Hospital, Washington, D.C. Facilities are available for the patient to have the frames measured and fitted in the hospital. The iseikonic lenses will be made according to prescription at the Southbridge plant of the American Optical Company. Dr. Ernest Sheppard, professor of ophthalmology, is the director of the clinic.

The patients are seen by appointment only. Arrangements for appointment can be made by writing to Miss Margaret W. Boudren, secretary, eye department, The George Washington University Hospital, 901 23rd Street, N.W., Washington 7, D.C.

WANTED: CASE REPORTS

If any ophthalmologist has had occasion to see a closure of the central retinal artery first recognized shortly after the patient came out of a general anesthetic will he be so kind as to convey the details of the case or cases observed to Dr. I. Givner, 108 East 66th Street, New York 21, New York. Please note which eye was affected, type of anesthesia used, length of the operation and its nature, whether or not the patient went into shock at the time of the operation, and if there were any evidences of the eye having been pressed upon during the anesthesia such as corneal abrasion, ecchymosis of the lids, and so forth.

DE SCHWEINITZ LECTURE

The 11th annual de Schweinitz Lecture sponsored by the Section of Ophthalmology of the College of Physicians of Philadelphia will be delivered by Dr. William L. Benedict on November 18th on the "Surgical Treatment of Tumors and Cysts of the Orbit."

UNIVERSITY OF GLASGOW LECTURES

During October a series of lectures are being given in the department of ophthalmology, University of Glasgow. The meetings, open to all medical practitioners and senior students interested in ophthalmology, are held at 8 o'clock each Wednesday evening. Tea is served after the paper and a discussion follows. On October 6th, Mr. Frank W. Law spoke on "Physiotherapy of the Eye." Dr. Paul Bacsich discussed "Experimental Corneal Grafting" on October 13th. "Plastic Surgery of the Eyelids" will be the subject presented by Dr. Byron Smith on October 20th, and Professor Loewenstein will speak on "Histopathology of the Drainage Angle" on October 27th.

SOCIETIES

WEST VIRGINIA MEETING

The fall meeting of the West Virginia Academy of Ophthalmology and Otolaryngology was held at the Greenbrier, White Sulphur Springs, September 20th and 21st. Dr. James A. Moore, New York, spoke on "Endaural Surgery in the Modified Radical and Radical Mastoidectomies," and Dr. Oscar B. Nugent, Chicago, on "Management of Strabismus."

ROUMANIAN SOCIETIES ORGANIZED

Word has been received that two new ophthalmic societies have been established in Roumania. The first of these is a clinical society, the Roumanian Society of Oculists, and is located at Timisoara.

Dr. Nicolas Blatt is president and Dr. Nicolas Zolog, secretary general.

The second, the Roumanian Society for the Prevention of Blindness, is also located at Timisoara. The president is Dr. Nicolas Blatt and the secretary general, Dr. Virgil Popovici.

Southern medical meeting

The ophthalmic program for the Section on Ophthalmology and Otolaryngology to be held in Miami at the annual meeting of the Southern Medical Association is:

Monday, October 25th

1. "Sympathetic Ophthalmia," Dr. Sam McPherson, Durham, North Carolina.
2. "Iridencleisis," Dr. E. G. Gill, Roanoke, Virginia.
3. "The Use of Erisophake in Cataract Extraction," Dr. E. R. Veirs, Temple, Texas.
4. "Keratitis Nummularis (Dimmer): A Report of Five Cases," Dr. Stacy Howell, Atlanta, Georgia, and Dr. Curtis Benton, Jr., Fort Lauderdale, Florida.
5. "Vertical Phorias," Dr. J. L. Berg, Albany, Georgia.

Wednesday, October 27th

1. "Selections of Operations for Glaucoma," Dr. Conrad Berens, New York.
2. Chairman's Address: "Malignant Melanoma of the Iris," Dr. Shaler Richardson, Jacksonville, Florida.
3. "The Management of Convergent Strabismus," Dr. Frank Costenbader, Washington, D.C.
4. "Cataract Surgery," Dr. Mason Baird, Atlanta, Georgia.
5. "Complications of Glaucoma Surgery," Dr. P. M. Lewis, Memphis, Tennessee.
6. "Sodium Pentothal in Elective Eye Surgery," Dr. William M. Boles, New Orleans, Louisiana.

Milwaukee meeting

The Milwaukee Oto-Ophthalmic Society held a joint luncheon meeting with the E.E.N.T. section of the Wisconsin State Medical Society on October 6th for its honorary members, Dr. Frederick A. Davis and Dr. A. D. Prangen. Dr. Davis presented a paper and motion picture on "Cataract Extraction."

Central Illinois society to meet

The next meeting of the Central Illinois Society of Ophthalmology and Otolaryngology will be held at the Abraham Lincoln Hotel, Springfield, Illinois, on November 13th and 14th.

Dr. F. Bruce Fralick, professor of ophthalmology, University of Michigan will speak on "Surgical Anatomy of Operations for Glaucoma," and will illustrate his lecture with moving pictures. Dr. Francis L. Lederer, professor of otolaryngology, University of Illinois, will discuss "Modern Approaches to the Prevention and Treatment of Defective Hearing." Dr. Roth, Belleville, Illinois, will present a paper on the "O'Connor Cinch Operation," and Dr. Judd, Kankakee, Illinois, will talk on "Malignancies of the Paranasal Sinuses."

Personals

Illinois faculty promotions

Dr. Georgiana D. Theobald has been promoted to associate professor of ophthalmology at the University of Illinois College of Medicine, and Dr. Joseph S. Haas has been given the rank of assistant professor of ophthalmology.

Attends Hawaiian meeting

Dr. Arthur J. Bedell, Albany, New York, attended the meeting of the Pan-Pacific Surgical Association in Honolulu, Hawaii, August 30th to September 13th, at which he presented a series of three lectures.

ERRATUM

The Journal regrets that in the paper, "Senile Macular Lesions," by Dr. Ralph I. Lloyd, appearing in the September, 1948, issue, credit was not given to Dr. Bonacolto for Figure 4 on page 1138 and to Dr. Dunnington for Figure 6 on page 1139.

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 31 NOVEMBER, 1948 NUMBER 11

*Symposium: Corneal Transplantation**

I. SELECTION OF CASES

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No general rule may be applied for the selection of cases favorable for corneal transplantation. Each case must be dealt with individually, and a general appraisal made. In studying the patient's eye condition, the following factors must be taken into consideration.

Environmental Factors. What are the indications and need for the operation? A patient with reduced vision as a result of a scarred cornea, but who is well-adjusted to his environment and self-supporting, might better be left alone, even though the corrected visual acuity is below 20/200 in either one or both eyes. This is especially true if the eye falls into that group of cases which is designated as doubtful for the improvement of vision. This group of cases will be considered in more detail later. The ophthalmologist should be especially guarded in giving advice to one-eyed patients.

The physical condition and age of the patient are important factors, as in other types of intraocular surgery. Examination should include a medical survey such as is usually done preliminary to cataract operations. Some knowledge of the patient's psychologic reactions should also be known. Highly nervous and poorly emotionally adjusted persons make especially poor candidates for this type of ocular surgery.

Age Group. Another important factor to remember is that corneal grafting cases belong to a much lower age group than do cataract patients. A failure following a cataract operation does not lead to quite as serious consequences from an emotional and economic point of view. Most cataract patients have reached the retiring age and do not look forward to a very active life. Successful operations have been performed however on babies as well as people in their seventies and eighties. Transplantation in the very young is to be avoided because of the difficulty in the handling of the patients. Early postoperative dressings have to be done under general anesthetic, and if a small stitch abcess or some other type of infection develops, the surgeon is greatly handicapped. A sudden or violent movement during the early postoperative stage might cause a collapse of the anterior chamber and resulting anterior synechias as well as a dislocation of the graft.

Iridectomy. No case of scarred cornea should be operated on if an iridectomy would bring about an improvement in vision. Just how much improvement in vision should be obtained by an iridectomy must be left up to the patient to decide. The greater risk of performing a corneal transplanting operation should be explained to him. Before making

* Presented at the 52nd annual session of the American Academy of Ophthalmology and Otolaryngology, October 12 to 17, 1947, Chicago. For the discussion of this symposium see: Tr. Am. Acad. Ophth., March-April, 1948, pp. 347-353.

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this decision it is well to see how much improvement in vision may be obtained by dilating the pupil. If there is material improvement in vision, there can be no question that an optical iridectomy should be performed. In doubtful cases there is no great disadvantage in first doing an iridectomy. If there is no improvement in sight, a transplant may subsequently be performed. If the

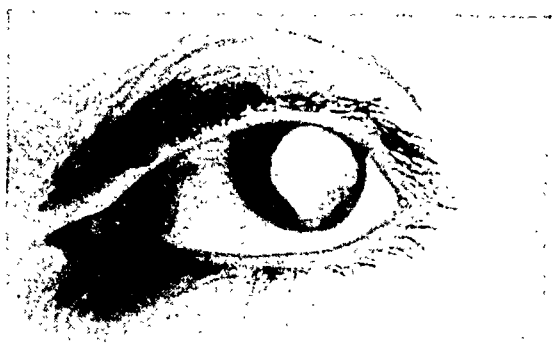


Fig. 1 (Paton). Dense leukoma with some clear surrounding cornea favorable for operation if no corneal blood vessels are present.

cornea is so densely scarred that the pupil cannot be seen, transillumination should always be done, and an accurate idea obtained as to the size and shape of the pupil.

CLASSIFICATION OF CASES FOR OPERATION

1. Favorable for improvement of vision
2. Partially favorable for improvement of vision
3. Unfavorable for improvement of vision
4. For cosmetic improvement
5. For treatment of descemetocele
6. Where preliminary surgery or treatment is necessary before final opinion may be given

1. *Favorable for improvement of vision.* The most favorable cases are those in which there is a nebulous type of opacity, quite central, and in an otherwise normal eye. There must be no active corneal disease present, nor active infection of the conjunctiva, sclera, or uveal tract. There must be no increased intraocular pressure, and no vascularization of the cornea. Blood staining of the cornea and conical cornea are usually favorable cases.

A very definite policy in the selection of conical cornea cases should be followed. At our clinic no case is operated on if the visual improvement with correction is better than 20/200 in either one or both eyes. This also includes those cases where vision can only be improved by means of a contact glass.

An exception is made in those cases that do not tolerate the wearing of contact lenses, or where there has been a rapid deterioration of vision due to the development of central corneal opacities. It would seem more advisable to operate on these cases early and do as large a graft as seems feasible. It is interesting to note that the contact glass, if necessary for the improvement of vision, although not well tolerated before the operation, may usually be worn with comfort after operation.

2. *Partially favorable for improvement of vision.* Partially favorable cases include those in which there is some corneal vascularization present such as in old cases of interstitial keratitis, and where the opacity, although

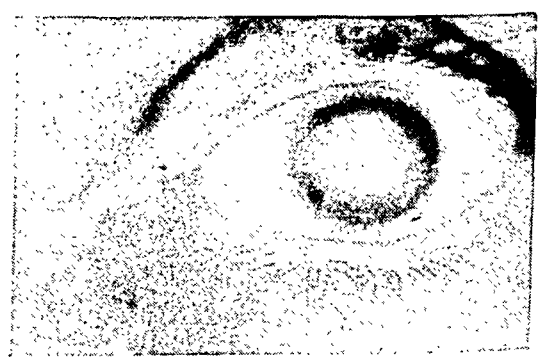


Fig. 2 (Paton). Large central corneal opacity with many fine peripheral blood vessels seen with the slitlamp—also surrounding cornea faintly opaque—not favorable for operation.

central, is not too dense and with only a small amount of clear cornea surrounding it. Cases of adherent leukoma do not do well as a rule, unless the adhesions are first destroyed by a preliminary operation or irradiation. An extremely shallow anterior

chamber adds little to the technical difficulties of the operation, although there may be greater danger of anterior synechias forming after the operation.

The diagnosis of glaucoma in the presence of keratectasia or keratoconus is most difficult to make. Its presence should always be suspected. A Bailliart type of tonometer may be helpful, as with this instrument the degree of scleral rather than corneal indentation is measured. If there is any doubt concerning the diagnosis of glaucoma, an attempt should first be made to lower the intraocular pressure by one of the filtering types of operations.

Most cases of corneal dystrophy are not favorable for corneal transplantation. This is especially true of the Fuchs's endothelial and epithelial types of dystrophy. From present knowledge it would appear advisable to operate early in the course of the disease when the opacification of the cornea is not too dense and does not include all the layers of the cornea.

Salzmann's[5] corneal dystrophy usually has some blood vessels present, but if these vessels can first be destroyed by irradiation, the transplant should be attempted on one eye, if the other eye has useful vision.

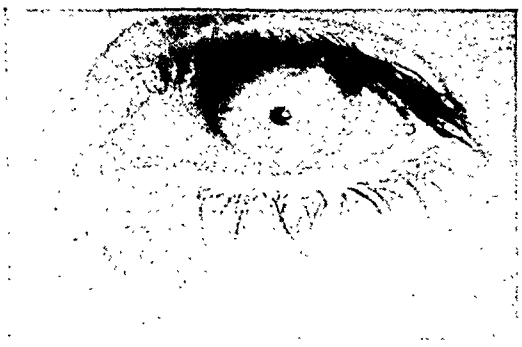


Fig. 3 (Paton). Descemetocele about to rupture—corneal transplantation indicated although no improvement in vision can be expected.

Groenouw's[3] dystrophy appears to give a more favorable result. Here again it is a question of degree and density of the opacification of the cornea. Some cases of fatty or lipoid degeneration of the cornea may be favorable for operation. Calcareous degeneration, if it involves the entire cornea and the full thickness of the cornea, should not be operated on. However, if the degeneration is band-shaped and not too dense, with some clear corneal tissue surrounding the scarred area, corneal transplantation should be performed.



Fig. 4 (Paton). Conical cornea ideal for corneal transplantation.

3. Unfavorable for improvement of vision. These are cases with marked nystagmus, as these eyes are amblyopic and, although a clear graft may be obtained, the visual results are disappointing. Densely scarred corneas from powder burns do poorly following transplantation. The same applies to lime burns of the cornea, but only if all the layers of the cornea are involved.

Any eye which is hypersensitive to light trauma—for example, such as might occur in measuring the intraocular pressure—should not be operated on until the cause of the hypersensitivity is discovered. Little experience has been had in operating on old trachomatous eyes, but the general principles laid down concerning degree of vascularization and opacification would hold in the selection of these cases for operation.

4. Cosmetic improvement. Many cases where tattooing was formerly resorted to in order to hide a disfiguring scar might be improved by corneal transplantation. In some few cases, an improvement of vision may be obtained, although this is not the general rule due to many complicating fac-



Fig. 5 (Paton). Groenouw's corneal dystrophy favorable for operation.

tors. In general, tattooing and corneal transplantation do badly in the presence of a highly vascularized cornea.

5. Treatment of descemetocele. There is perhaps no more favorable treatment of descemetocele than corneal transplantation. Cauterization and repeated paracentesis are usually palliative measures. Conjunctival flaps only add to the disfigurement of the patient's eye, and often the flap becomes incarcerated in the wound. Transplantation should not however be attempted if there is a markedly increased tension or in the presence of large corneal blood vessels. The degree of vascularization should be one of the most important and determining factors.

Where there is extensive vascularization of the cornea, preliminary radiation (Iliff[4]) should be performed, and unless all the larger vessels are completely destroyed, keratoplasty is bound to meet with failure. It is true, however, that in a few cases where



Fig. 6 (Paton). Unfavorable for operation because of vascularity.

smaller blood vessels have been present before operation, after the transplant operation has been done, the vessels will grow to the edge of the graft and tend to extend along the scarred area without actually penetrating into the graft itself. Apparently the scarred tissue formed in the cornea following a transplant operation will act as a barrier against their invasion, but it is not wise for the surgeon to depend on this, as there is no way of predicting whether the vessels will penetrate the graft or not.

6. Preliminary surgery or treatment necessary. It is not always necessary to do preliminary surgery for anterior synechias, for

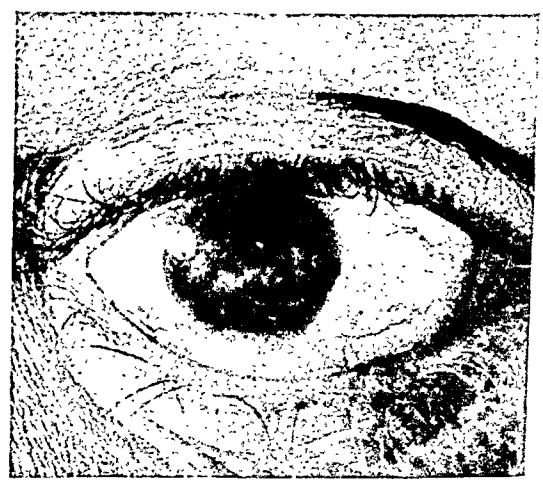


Fig. 7 (Paton). Diffuse nebulous opacification involving the anterior third of the cornea —ideal for corneal transplantation. Preoperative vision, 20/200; postoperative, 20/15 with correction.

if they are small and of delicate structure, these can be attended to at the time of operation.

It is poor surgical judgment to operate on any case in which there is an active uveitis present, but it is an interesting fact that several cases have been operated on in which, immediately after the operation, a recurrence of a previously active uveitis was noticed, with large keratic precipitates noted on the posterior surface of the graft. All these cases made an uneventful recovery and the keratic precipitates have since disappeared.

One such case has been followed for a period of three years with no recurrence of the uveitis, and the transplant has remained clear. The same may be true in dealing with scarred corneas in conjunction with episcleritis.

I have had no experience with therapeutic keratoplasty but many references have appeared in the literature advocating its efficacy. Feldman and Shartz[1] and Filatov[2] advocate a partial penetrating keratoplasty for such conditions as serpent ulcer and tubercular interstitial keratitis. It does not appear to me, however, that this form of treatment is advisable excepting as a last resort measure.

Little has appeared in English literature concerning partial nonpenetrating keratoplasty, but from foreign reports it would appear that the results of this method are nearly as good as results from a penetrating type of keratoplasty and may be less hazardous. It may be that this method may eliminate the need for keratectomy in many instances. It is not the purpose of this presentation, however, to discuss this subject.

927 Park Avenue (28).

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II. TECHNIQUE

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In my portion of this symposium, I plan to cover the actual surgical techniques of corneal grafting, both in a brief survey of their development and in a more comprehensive discussion of those in use at present, and the methods of obtaining and preserving donor material. Time will not allow a complete recital of the many steps which have led up to present techniques but I shall try to touch on the more important ones.

HISTORICAL SURVEY

Although attempts at corneal grafting had been made before, the first important step was that of von Hippel in 1887.[16] He cut a round graft from the center of the scarred cornea and replaced it by a similar round plug of tissue from a donor eye with clear cornea. His grafts were not beveled. They were not held in place by any sutures. They were not sufficiently satisfactory to stimulate many others to try his technique. However, they did point the way for further development.

The next significant step was made by Zirm, in 1906,[18] when he introduced the idea of holding the graft in the recipient cornea by overlying sutures. These sutures crisscrossed the graft from limbus to limbus and added an important feature to the developing operation.

Elschnig, in 1911,[4] took further steps following the technique of von Hippel. His results would not be considered up to modern standards but he did add encouragement to subsequent workers in this field.[5,6,13]

In 1928,[7] Filatov added a number of innovations. His use of preserved donor material will be considered later. He used a hand trephine and several different types of prophylactic spatulas.[8] These spatulas were introduced across the anterior chamber to protect the lens and iris from inadvertent damage by the trephine.

Further refinements in protective spatulas have been suggested by Paton but these devices are no longer widely used. The reasons for abandoning them are several and include further complication of the technique, additional incisions and softening of the eye, increased opportunity for anterior synechias, and even of iris prolapse.

Filatov also advocated the use of inverted conjunctival flaps or, in the absence of adequate conjunctiva, of egg membrane to hold the graft in place instead of sutures. Further investigations in substitutes for sutures are now in progress in this country. As yet they have not had adequate trial and nothing has been published on these methods. Conjunctival flaps and egg membrane have not proved sufficiently strong to compete with directly overlying sutures.

Thomas, in 1930,[14] published his methods which introduced certain new concepts. He used a considerable bevel of both graft and recipient site. This bevel was attained by oblique trephining and the use of scissors to complete the incisions. Such an incision, *of course, did not produce a perfect truncated* cone but was close enough to be practical and has been used until relatively recently by various surgeons.

One of the principal objectives was to prevent the graft from falling into the anterior chamber, but this has proved to be unnecessary when the graft is cut to the exact size of the incision in the host cornea. Thomas,[15]

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however, did not do this but deliberately cut the graft smaller than the host incision to allow for early postoperative swelling of the graft. He used multiple corneal sutures (usually two), directly over the graft, but not into it. These sutures, placed directly into the cornea just beyond the edges of the graft, held much tighter closure than the previously used limbus-to-limbus overlying sutures or conjunctival flaps.

Castroviejo, in 1932,[1] described his new technique. He used a square graft accurately outlined by parallel knives and cut with keratome and scissors. At first he advocated a bevel of 45 degrees at all of the edges. This was to increase the area of corneal healing as well as to keep the graft out of the anterior chamber. As time went on,[2] he decreased the angle of bevel down to his present technique of straight edges, as the use of a bevel became obviously less and less necessary.

He also advocated a single continuous overlying suture as near the graft edges as possible. The argument for a single continuous suture was that it would adjust itself better for even distribution of pressure on the graft. At first this suture was untied; later, tied.

Castroviejo[3] has also experimented a great deal with round grafts. In the days when he believed in the importance of a bevel he devised a number of ingenious devices for cutting a perfectly beveled round graft. They were never completely perfected because the idea of beveling the sides of the graft was discarded.

Various techniques

The various techniques of keratoplasty which must be considered are total keratoplasty, rotating autokeratoplasty, superficial lamellar keratoplasty, and partial penetrating keratoplasty. For general use the last is by far the most practical and has the widest application.

Total keratoplasty[10,17] has had sufficient trial in animal experiments and human cases to be discarded. It is not successful in practical application and not feasible on theoretical grounds.

Rotating autokeratoplasty,[9,11] while theoretically sound, does not work well in practice. It consists of the rotation of a large circular disk, or end-for-end transfer of a larger rectangle of cornea in the involved eye to replace cloudy central cornea by clear peripheral cornea of the same eye.

Superficial lamellar keratoplasty[12] is theoretically feasible but very little used in this country. Since it is a form of nonpenetrating keratoplasty, there must be an area of wound union all the way across the base of the graft with some attendant scarring. For most surface scars, superficial keratectomy is simpler and just as effective. However, in certain cases of deeper scarring where any form of penetrating keratoplasty seems to introduce excess risk, it must be considered.

An example of this would be a case of aphakia with bulging vitreous. Here the risk of vitreous loss and vitreous incarceration at the edges of the graft might outweigh the better visual prospects of an uneventful penetrating graft and militate in favor of the safer, if visually poorer, nonpenetrating graft.

The partial penetrating corneal graft is the most successful method in ordinary cases.

Although there are individual variations in technique of these grafts, the principles are well established. The graft must be in contact, in as great an area as possible, with good corneal stroma. This does not mean that it must necessarily be in contact with clear surface cornea, but it must form union with good corneal stroma whether overlaid or not by scars on the surface. This requirement affects somewhat the size and location of the graft. If it is not fufilled the graft need not be lost but satisfactory clarity is not to be expected.

Recent trends in technique

Size of grafts. The gradual swing in re-

cent years from small grafts to larger and larger grafts has been attended by greater visual success. There is always some scarring at the edges of the graft, and if this is of significant width it may tend to encroach on the central visual area of a small graft. The same width scar will not approach the center of a larger graft. There are also outside limitations to the size of the graft. It must not be large enough to interfere with the angle of the anterior chamber nor to allow iris incarceration or prolapse at the edges.

It is now known that beveling of the edges of the graft or recipient cornea is not necessary although in former years much attention has been given to this feature.

Sutures. Some means of holding the graft in place is important and the present methods are all variations of the overlying suture. For more secure closure it is obvious that the sutures should be placed in recipient cornea as close to the graft edges as possible.

It probably makes little difference whether a single continuous suture is used or multiple sutures. As long as adequate and even, but not excessive, pressure is attained, this requirement is fufilled. Although I personally prefer the continuous, single, tied suture because of its ease of even adjustment, I can find no fault with multiple sutures if they are properly adjusted.

Direct suturing of graft to recipient cornea introduces unnecessary additional trauma to the graft and is to be avoided in the ordinary case. Certain special situations where it must be used will be discussed in the section dealing with complications. Omission of sutures and use of other devices for securing the graft are generally unsatisfactory.

Shape of graft. The shape of the graft is not of major importance. The two popular shapes are round and square. Both are easily obtained. The arguments for a round graft on a cosmetic basis are not particularly relevant. In the first place, the primary objective is restoration of vision. Slight improvement in appearance is a very minor consideration. In the second place, the sharp corners of a square graft tend to appear rounded in due time in many instances. The important factors are not initial shape but accurate fit and smoothness of the edges.

Probably the high-speed mechanical trephine is the best means of cutting a true-edged graft. Of the various methods of cutting grafts by hand, the square technique by double-bladed knife, keratome, and straight-bladed scissors is probably easiest. The method of hand trephine and curved scissors seems somewhat harder and less likely to give a perfect fit but can be mastered. The principal objection to the high-speed trephine is its greater risk of injuring the lens. In the final analysis, the shape and method to be used are those found safest and most satisfactory in the hands of the individual surgeon.

Anesthesia. In addition to these major principles there are other factors in surgical technique which deserve mention. Anesthesia is local by choice and should consist of adequate topical anesthesia plus retrobulbar block. Complete akinesia is also important. The local anesthesia may be further supplemented, if desired, by subconjunctival injection. If for some reason general anesthesia is required, the method of choice is intravenous pentothal and the inhalation anesthetics are to be avoided because of their after-effects. It is well to supplement pentothal by deep orbital block.

Asepsis. Complete aseptic technique is, of course, of major importance but needs no detailed discussion here. Since the graft is obtained from another patient whether living or postmortem, it seems wise to use prophylactic penicillin in all cases.

Dilatation of pupil. Although some surgeons who use trephine techniques like to use miotics before operation and mydriatics at the end, a widely dilated pupil to avoid synechias and incarcerations is important.

Therefore, it seems better to dilate the pupil widely before operation with such drugs as atropine and strong neosynephrin, to reinforce the mydriasis with subconjunctival injection such as cocaine and adrenalin, and even to place a drop of adrenalin, or adrenalin and atropine, directly into the anterior chamber during the operation.

Postoperative care. At the end of the operation binocular dressings with moderate pressure should be applied and the patient treated much as a detached retina patient is managed. However, moderate elevation of the head of the bed is in order. The surgeon should hold his curiosity in check and avoid early and frequent dressing which may serve more to interfere with healing than to promote it. After the sutures are removed, further pressure dressings are advisable.

The operation is easy enough so that it can be mastered by any competent intraocular surgeon, but it is different enough from other ocular surgery that it should not be entrusted to or attempted by a surgeon who has not had considerable experience in developing his technique through many animal grafts.

Donor material

The final portion of this part of the symposium deals with donor material. Years of experiment and experience have determined certain facts which can be stated rather arbitrarily. The material must be corneal tissue. Attempts to use buttons of glass, plastics, and other tissues have all been unsuccessful.

Donor cornea. The donor cornea may be from a fresh eye which has just been enucleated or from one which has been satisfactorily preserved. Most of the latter are postmortem eyes. In either event the cornea must be in good condition, free from local disease; uncontaminated, and from a patient who is free from communicable disease, including syphilis. Whether late latent syphilis or adequately treated syphilis can be transmitted by a corneal graft is a moot question. However, this question is one which surgeons do not care to risk answering by human experiment.

It has been found out by experience that race, age, sex, and blood grouping are not important factors and do not influence the result of the operation. But the donor cornea must be human. Other species cannot be substituted. If they are, the graft may take but will not stay clear.

Preservation of materials. Prior to 1944, there had been a few isolated attempts to preserve donor eyes for short periods of time. Filatov was organizing an "eye bank" in Russia but very little had been done in this country. In that year Dr. Paton and I set up an experimental "eye bank" at the New York Hospital.

Postmortem eyes were obtained from the general wards of the hospital and a few nearby coöperating hospitals. The eyes were enucleated under aseptic operating room conditions, placed in suitable physiologic solutions, and kept in a portion of the blood-bank refrigerator until used.

This pilot experiment proved the practicality of such an "eye bank" and the advisability of starting such a bank which would be available to surgeons in all hospitals but independent of any one hospital. In early 1945, The Eye Bank for Sight Restoration was incorporated. Everyone in this audience is familiar with its history. It has proved to be most useful in providing material for corneal grafting.

For the eye departments of large general hospitals, it is helpful in providing donor material at the time it is needed, if there is none locally available at the time.

For the smaller hospitals and the isolated specialty hospitals it has proved an indispensable boon in supplying material that might otherwise never be obtained. As a clearing house, it serves to prevent waste of donor material not needed at the time at its hospital of origin.

Postmortem eyes should be obtained as soon as possible after death, preferably within 4 to 6 hours. They are then stored at the temperature used for preserving blood (about 4° C.). At present the best method of storage is in a tightly sealed container in a saturated atmosphere of water vapor. The allowable time of storage has not yet been well worked out. It is best to use the donor eyes as soon as possible.

The best index of suitability is not the elapsed time but the condition of the cornea on close inspection. At first it was arbitrarily thought that the fresher the cornea, the better donor material it would be. Subsequently, Filatov, the advocate of preserved tissue therapy, felt that storage improved the condition of the cornea. In practice, it seems to make little difference whether the cornea be stored or not, as long as its condition is good at the time of operation.

Conclusion

In conclusion, then, the operation of corneal transplantation has become an accepted, useful procedure, the general principles of which are well established. So long as they are adhered to, many minor variations in technique can be introduced to suit the individual surgeon. The institution of "eye banks" materially aids in the securing and distribution of donor material.

525 East 68th Street (21).

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III. COMPLICATIONS

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Only the complications taking place in cases which have been classified as favorable for keratoplasty will be discussed in this presentation.

This study is based on the observation of about 1,000 keratoplasties including the operations performed by me and those done under my supervision in the United States and elsewhere during the past 17 years. I have purposely included in this study all the complications that I have observed in my cases and those of others in order to be able to mention in this presentation the complications encountered by surgeons with both extensive and limited experience in corneal transplantation.

Some of the complications occur during the operation, others during the first few days or weeks of the postoperative recovery, still others several weeks or months after the operation. Only the treatments that have been found to be most effective in the handling of these complications will be described.

The two types of keratoplasty, square and circular, that I have advocated and on which this study is based are illustrated in Figure 1, A and B. Figure 2 shows the double-bladed knife (A), keratome (B), and special scissors (C) used in the square-graft technique, the trephine (D and E), and special scissors (F) used in the circular-graft procedure.

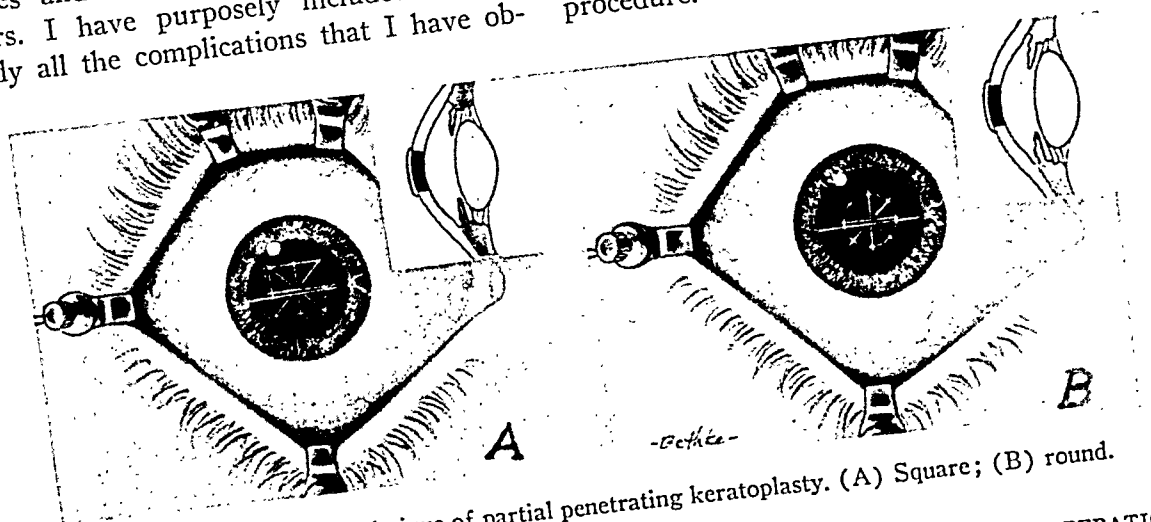


Fig. 1 (Castroviejo). Technique of partial penetrating keratoplasty. (A) Square; (B) round.

COMPLICATIONS DURING THE OPERATION

While preparing the operative field, irritating solutions such as iodine or alcohol may enter the recipient's eye and destroy part or all the corneal epithelium. This complication will not necessitate the postponement of the operation. The surgical procedure will of course be more difficult since the outlining of the incisions with fluorescein or other solutions will not be as effective.

Even though the operation may be somewhat more complicated than with an intact epithelium, the final outcome, as far as visual

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purposes are concerned, will not be affected and the epithelium will regenerate completely. Without epithelium, however, there is more opportunity for infection and possible subsequent opacification of the graft.

The same accident mentioned in the case keratectomies. This complication makes it difficult to continue the operation.

Two choices are suggested, either to postpone the operation for about a week to give time for the anterior chamber to reform and for the cornea to close the opening firmly, or

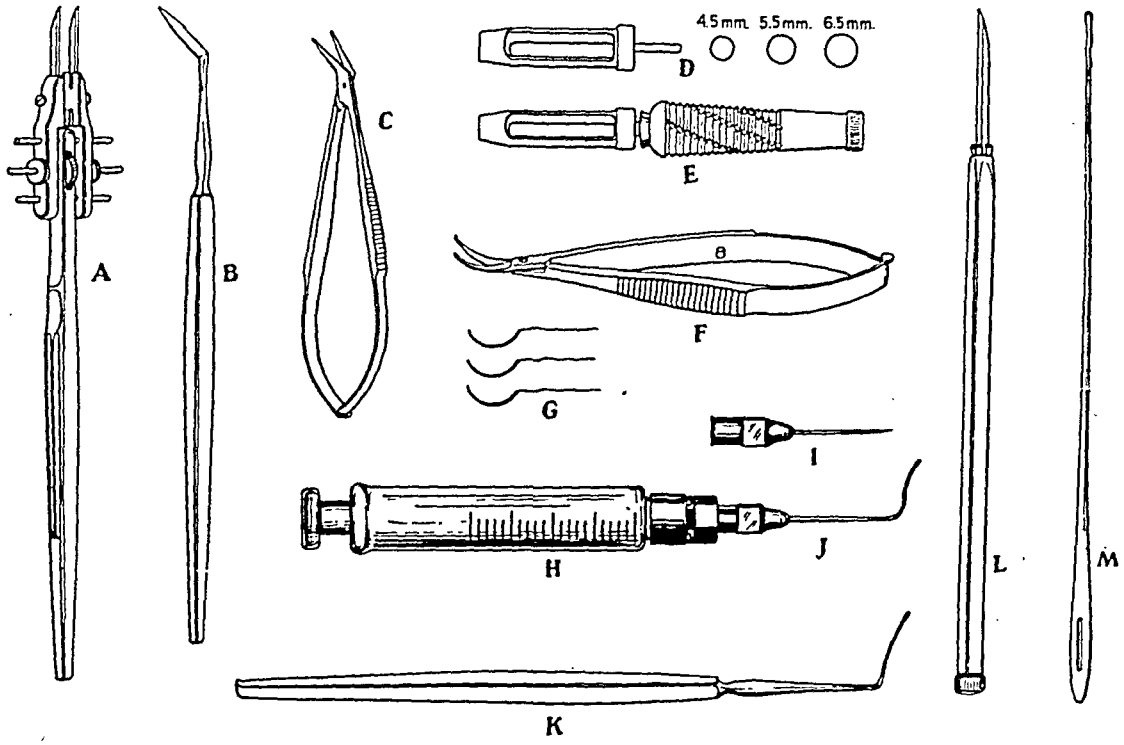


Fig. 2 (Castroviejo). Instruments required for described methods of square and circular partial penetrating keratoplasty and for the treatment of anterior synechia. (A) Double-bladed knife; (B) keratome; (C) special scissors for the square graft; (D) and (E) trephines; (F) special scissors for the circular graft; (G) atraumatic needles with 6-0 silk; (I) fine hypodermic needle for air injection in the anterior chamber; (J) Randolph cannula with syringe (H); (K) Cyclodialysis spatula, 15-mm. long; (L) utility knife; (M) probe.

of the recipient's eye may take place in the donor's.The donor's eye should, of course, be used undamaged if possible. The graft may be transplanted without epithelium and remain transparent with complete regeneration of the epithelial covering.

If the incisions have been placed off center in the cornea, new incisions can be made in a better position without interfering with the subsequent steps in the operation.

While outlining the incisions, the cornea may be perforated. This is particularly prone to happen in very thin corneas, such as in cases with advanced keratoconus, or in those eyes which have undergone preliminary

to proceed with the operation.

Although with more difficulty, the surgeon well trained in keratoplasty will be able to place the sutures even after the cornea has been perforated, particularly if the suture material is good. Of course, in this eventuality, the remaining uncut portion of the incision has to be completed, in the square as well as the circular-graft technique, with the aid of scissors.

While inserting the sutures, in thin corneas particularly, the needle may enter the anterior chamber. In this complication the aqueous humor will drain slowly rendering the eye hypotonic. This complication may

be taken care of by withdrawing the needle and passing it through more superficial layers of the cornea. Otherwise, a fistula may form during the postoperative recovery with drainage of the aqueous humor and flattening of the anterior chamber and likelihood of subsequent development of anterior synechias and intraocular infection. If there is any doubt about the location of the suture on the second attempt, it would be preferable to postpone the surgical procedure rather than risk the success of the operation.

While inserting the sutures, particularly if a continuous one is employed with an atraumatic needle, the needle may break. This can be remedied either by threading the silk on a regular needle and proceeding in this way until the suture has been completed, or by recommencing the suture, inserting a new one through the channels already made.

While manipulating the instruments after the suture has been inserted the thread may be cut. This complication can be handled by tying a knot where the silk was cut. At the completion of the operation, the knot should be drawn away from the graft to prevent its opacification at the site of pressure from the knot on the graft. This cloudiness no matter how slight, if it occurs in the center of the graft, may reduce vision considerably.

The lens may be injured by the keratome in the square-graft technique or, more likely, by the trephine or by the scissors while completing the incision. In any event, this is one of the most serious complications. The most satisfactory way of dealing with this situation is to complete the dissection of the recipient's cornea and the graft, remove as much as possible of the injured lens including the capsule, and place the transplant in position tying the suture which was previously inserted.

In this complication, the vitreous has a tendency to prolapse during the operation and to dislocate the graft with subsequent opacification of the graft, secondary glaucoma, or panophthalmitis. Therefore, it is advisable in these cases, in order to maintain the graft firmly in position, to suture the four corners in position in the square graft or to place four sutures at opposite ends of perpendicular diameters in the circular graft. The patients in whom this accident takes place rarely recover with useful vision.

When, after perforation of the anterior chamber, the pupil is found to be contracted, smaller than the opening made in the cornea of the host, a direct instillation of cocaine (4 percent) and adrenalin (1:1,000, or even 1:100), into the corneal opening, may dilate the pupil wider than the corneal window. If, in spite of the instillations, the iris shows within the opening, it is advisable to excise the involved portion of iris rather than to risk the development of an anterior synechia.

The performance of an iridectomy in these cases will, of course, be questioned by those who perform keratoplasties with contracted pupils. Statistics will show in the future which method gives the greater number of anterior synechias, the one of the contracted or the one of the dilated pupil.

In my experimental work in animals, the method of contracted pupil was discarded because it had a much greater tendency to develop anterior synechias. My experience in human beings has verified the findings of the experimental work.

Inexperience, particularly with the square-graft technique may lead to irregularities in the shape of the corneal window or the graft. This complication can be avoided by mastering the operation through training with animals' eyes. If it should occur, it can only be corrected if the cornea of the host is dissected before the graft. In this case the graft can be shaped to conform with the asymmetry of the corneal opening in order to obtain a better coaptation of the borders. If the graft or its bed is made with excessive beveling or an irregular inner edge, the condition can be adjusted by careful dissection with scissors.

In cases of very large grafts, particularly in advanced keratoconus where the cornea is

thin and collapses as soon as the anterior chamber is opened, it is sometimes very difficult to hold the graft in position. In these cases, direct suturing of the border of the cornea of the host with that of the donor is to be recommended. At least four sutures placed in the corners of the square graft or at the ends of two perpendicular diameters in the circular graft are advisable.

Complications during the postoperative recovery

The dislocation of the transplant within the eye is a complication which I have not encountered. I have observed the complete displacement of the graft outside the recipient's corneal opening. This complication is very serious and should be treated by reimplanting the same graft, if this is available, by suturing its borders with those of the host's cornea. If the graft has been lost, a new one must be prepared and sutured in place.

If neither the original transplant nor a second graft can be obtained, the use of a conjunctival flap is the only method of closing the opening and protecting the eye. I have not observed any case in which useful vision has been preserved after this very serious complication. This condition is generally observed at the first dressing. It is more likely to occur in the uncoöperative, high-strung type of patient.

If the transplant is only partly detached, the postoperative course may be stormy with the formation of a fistula and anterior synechias. Conservative treatment may sometimes result in complete cicatrization of the dehiscence with preservation of fairly good or complete transparency of the graft. If, however, this partial prolapse should be extensive, it is advisable to coapt the borders of the graft and the border of the host by direct suturing.

Occasionally, in corneas which are very thin, such as keratoconus, at the time when the corneal sutures are removed, there may be a collapse of the anterior chamber with loss of aqueous humor. Very seldom, however, is this opening extensive and almost always the transplant cicatrizes well, without complications such as development of anterior synechias.

If hernia of the iris develops, it is advisable to wait until the third postoperative week and then, when the rest of the transplant has become solidly attached to the cornea of the host, the hernia should be excised and the edges of the graft and cornea of the host coapted by direct suturing.

All cases in which the transplant has been partly or totally displaced are likely to develop endophthalmitis. Therefore, in addition to the treatment of the eye, prophylactic treatment by intramuscular injections of penicillin should be carried out; also foreign-protein therapy, preferably intravenous injections of typhoid, should be administered as soon as intraocular inflammation is apparent.

The development of anterior synechias is one of the most frequent complications in keratoplasty, particularly in cases with large grafts where the cornea is thin, such as advanced keratoconus or in eyes where the cornea has been thinned by ulceration or preliminary keratectomy.

If the synechia is smaller than 2 mm., occasionally the use of atropine or eserine loosens it. If the synechia is more extensive it will necessitate surgery in order to prevent opacity, vascularization of the graft, and secondary glaucoma.

The surgical treatment of the synechia must not be carried out before the 14th day postoperatively because until then the union of the graft with the cornea of the host is not very firm, and premature surgery might lead to dislocation of the graft. The operation, however, should not be delayed beyond three weeks, otherwise the graft may already have become opaque on account of the synechia. Therefore, the best time to carry out this surgery is in the third postoperative

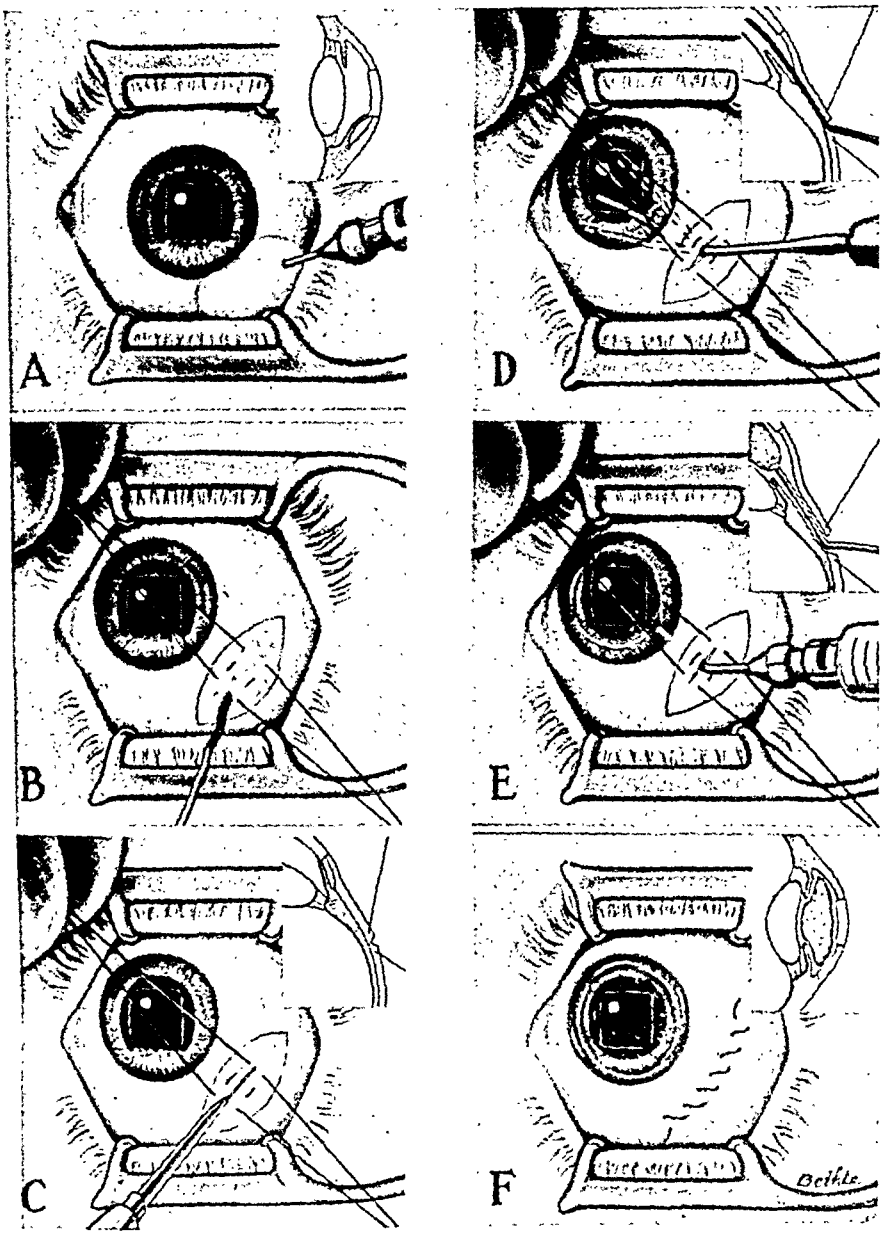


Fig. 3 (Castroviejo). Successive steps in the technique for the treatment of moderate anterior synechias.

week and preferably under general anesthesia.

Surgical techniques for the treatment of anterior synechias

If the synechia extends from one fifth to one half of the circumference of the graft, the operation of choice is as follows.

Depending upon the location of the synechia, the incision in the sclera is made in the quadrant nearest the synechia; the lower temporal for synechias in the lower half, and the upper temporal for synechias in the upper half of the transplant.

A routine preparation of the eye, about one hour before the operation, is made with instillations of atropine (1 percent) and neosynephrin (10 percent) in order to obtain as wide a dilatation of the pupil as possible. At the time of the operation, after routine preparation of the eye, argyrol (25 percent), a 4-percent solution of cocaine, and a solution of adrenalin (1:1,000) are instilled into the eye. A few drops of cocaine and adrenalin

(1:1,000) are injected under the bulbar conjunctiva (fig. 3A) with the purpose of obtaining ischemia, wider dilatation of the pupil, and to counteract a tendency to contraction after the anterior chamber has been opened.

An incision is made through the conjunctiva and Tenon's capsule about 7 mm. from the limbus and parallel to it (fig. 3B). Two 2-0 silk sutures are inserted in the sclera, 4 and 6 mm. from the limbus and parallel to it. These sutures are used for fixation; one of them is held by the assistant and the other by the surgeon. The area of the sclera between the two sutures is treated by superficial electrocoagulation or by a hot probe to obtain a bloodless operative field (fig. 3B).

With the knife an incision is made in the sclera similar to that performed for cyclodialysis (fig. 3C). When the sclera has been perforated and the choroid is reached, a

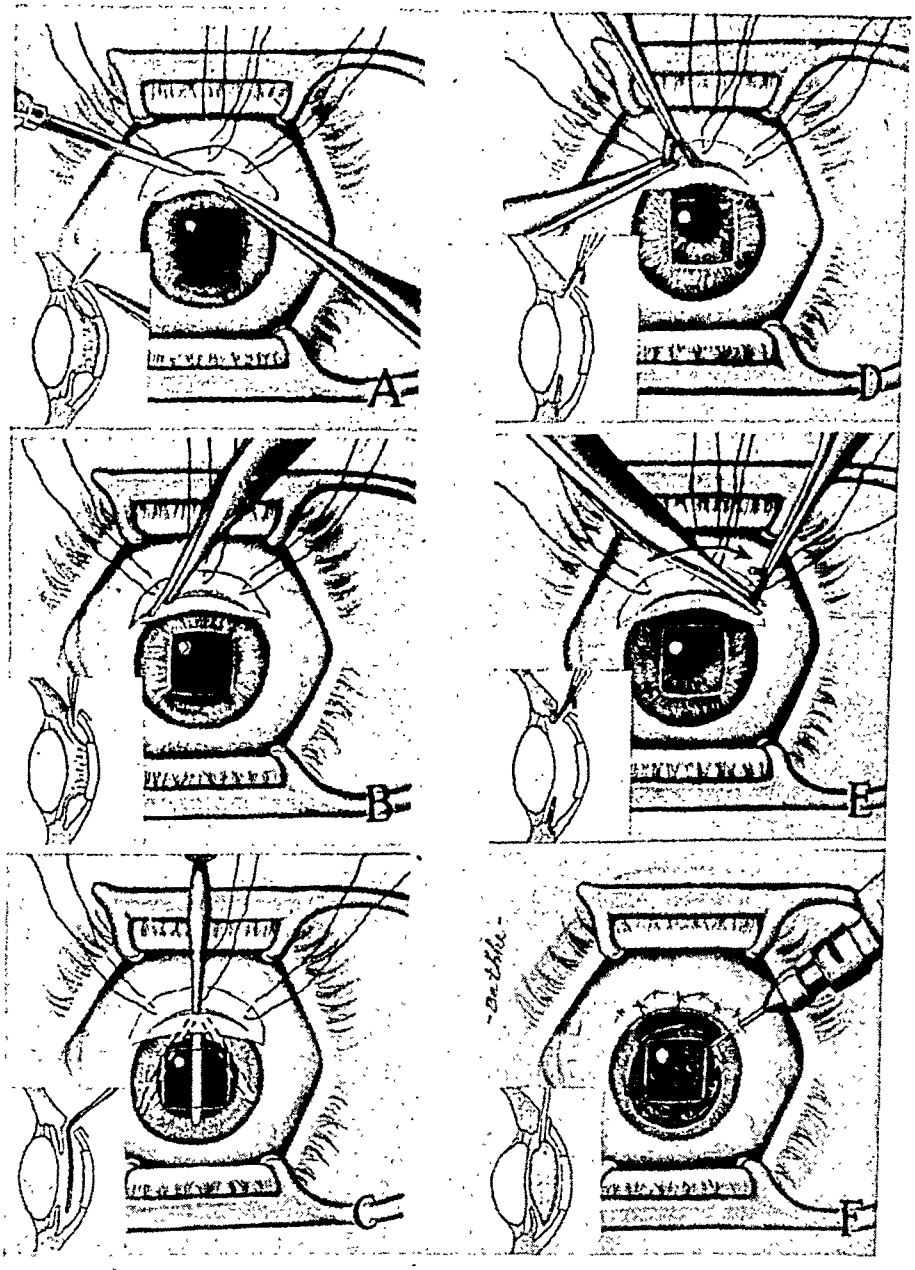


Fig. 4 (Castroviejo). Method of treating extensive anterior synechias.

long spatula similar to that used for cyclodialysis, but 15 mm. in length (fig. 2K), is introduced through the scleral opening and then between the sclera and choroid, into the anterior chamber. The adherent iris is separated from the cornea with the aid of the spatula (fig. 3D). The spatula is then withdrawn and the tip of a Randolph perforated cannula (fig. 2J) with the shape of a cyclodialysis spatula attached to a syringe (fig. 2H and 2J) is introduced in the same manner as the spatula into the anterior chamber and air is injected to push the iris away from the cornea (fig. 3E). The cannula is then withdrawn and the conjunctival incision closed with a continuous 6-0 silk suture. This cyclodialysis incision several mm. from the limbus is preferable to incisions in the limbus because with the latter it is not always possible to keep the air within the anterior chamber long enough to prevent the recurrence of the synechia.

When the synechia is very extensive, the operation which I found satisfactory is as follows.

The operation should be carried out preferably under general anesthesia. With the aid of scissors and conjunctival forceps, a conjunctival and episcleral flap of 2 to 3 mm. between the 10- and 2-o'clock positions is made around the limbus (fig. 4A). The conjunctival flap is reflected down over the cornea and three 6-0 silk sutures mounted in atraumatic needles are inserted, one at the 12-o'clock position and the other two equidistant between the central one and the ends of the conjunctival incision. The sutures are passed first through the conjunctiva and then through the sclera entering the sclera about 2 mm. from the limbus and taking a bite of about 1 mm. (fig. 4A). The sutures are now drawn out of the way in order to make the incision with a minimum of interference.

With the knife an ab-externo incision is made at the limbus around the 12-o'clock position (fig. 4A). When the anterior chamber is entered the incision is enlarged temporally and nasally with the aid of scissors (fig. 4B). With the cyclodialysis spatula the iris is then separated from the cornea (fig. 4C). A large iridectomy from the 10- to 2-o'clock positions is then performed (fig. 4D and 4E). The sutures are then passed through the corneoconjunctival junction, including a small bite of corneal tissue, and tied. Additional conjunctival sutures are inserted and air is injected into the anterior chamber (fig. 4F) in an effort to push the iris away from the cornea, thus preventing the recurrence of the synechia.

If, after this procedure, an anterior synechia develops in the lower half of the graft, the first operation described can be carried out. I have had several cases thus treated successively with the two operations in which the eye remained without synechias, with clear transplant and good vision.

In these two operations, bacteria leading to endophthalmitis or panophthalmitis are often introduced into the eye. I have had several such instances, therefore the need for very aseptic technique and great care in performing these operations should be stressed. Prophylactic treatment with systemic application of penicillin should be carried out, beginning the day previous to the operation and continuing until all the signs of inflammation in the eye have disappeared. In addition, intravenous injections of typhoid vaccine should be instituted.

Infections

Conservative treatment may bring about successful cicatrization of ulcers of the graft when infection is not advanced. If the infection is more intense, more strenuous treatment, such as subconjunctival injection of penicillin (1 cc. of solution containing 10,000 units), is carried out. If the eye does not respond to penicillin therapy, subconjunctival injection of 1 cc. containing approximately 1 mgm. of streptomycin may be tried.

In these cases, in addition to the local treatment suggested, plus atropine and hot

applications, systemic treatment with penicillin or streptomycin should be carried out. Also, in order not to miss any possible way of improving the general condition of the patient, foreign-protein therapy by means of intravenous typhoid injections should be immediately started.

Penicillin combined with sulfadiazine, 4 gm. a day to maintain a blood level of 10 mgm. per cc., has been used with success when the penicillin alone did not seem to be effective. Iontophoresis with penicillin is apparently less effective than the subconjunctival injection of the same medication.

Cultures of the secretion or scrapings may be taken to decide which form of medication will be preferable, but treatment should be started without waiting for the result of the cultures.

In two cases, abscesses of the lens have been observed, both requiring removal of the lens when the abscesses were found to progress in spite of conservative treatment. In both cases the transplant became cloudy with extensive anterior synechias. In one the transplant cleared up with vision limited to fingers at three feet; in the other phthisis bulbi developed.

Glaucoma

Secondary glaucoma is another frequent complication following keratoplasy. In some cases, conservative treatment with miotics and hot applications will be successful. Others will require surgical treatment. If the glaucoma is of the congestive type, a very large iridectomy from the 10- to 2-o'clock positions is advisable. If the eye is not congested, it is preferable to perform a sclerectomy of the fistularizing type, such as an Elliot or Lagrange. If the glaucoma is associated with an anterior synechia, the glaucoma may be controlled by the excision of a large portion of the iris, including the synechia.

Vascularization

If at the 3rd or 4th week postoperatively, the transplant should begin to vascularize, the cornea adjacent to the vascularized area in the graft should be treated by radiation (about 1,500R), concentrating the treatments on the vascularized area alone, protecting the rest of the cornea with a lead filter. If the vascularization is permitted to develop over the whole graft, the transplant will most likely become very cloudy or opaque. However, I have observed some cases in which after vascularization the graft cleared up sufficiently to restore useful vision.

Inflammation

There are some cases in which the transplant has remained clear for 3 or 4 weeks and suddenly a mild uveitis develops which in a few days leads to cloudiness of the graft.

In some of these patients, careful examination will reveal a focus of infection and upon its removal the eye will immediately become quiet. Others will not show any improvement upon removal of the focus of infection. In these cases local treatment should immediately be started with atropine and hot applications as well as general treatment with penicillin and intravenous typhoid vaccine.

The general treatment must be instituted immediately, even before the possible cause of the uveitis is found. Some patients developing uveitis without an apparent focus of infection, but showing a low systemic resistance, respond well to intravenous injections of amino acids. Many of these patients are benefited by a high-vitamin diet or vitamin medication.

Corneal transplants, which after uveitis have become cloudy to the point where the patient could only see hand motion at one foot, have been improved in some cases to such an extent that it was impossible to tell at the end of a year that they had been nebulous, vision in some instances improving up to 20/30 and even 20/20.

Edema

After uveitis, epithelial edema and bullous degeneration of the epithelium are fre-

quently observed in the graft. This corneal edema is generally improved by applications from 3 to 6 times daily of sodium chloride hypertonic (15 percent) jelly. Occasionally after failure to clear up the edema, the scraping of the epithelium followed by very light superficial electrodesiccation has resulted in the disappearance of the edema but in permanent nebulosity of the graft, requiring further surgery. When the transplant remains nebulous or opaque without other intraocular complications, a 2nd, and sometimes a 3rd, transplant has been successful.

A corneal edema is frequently associated with endothelial edema, an entity that greatly resembles Fuchs's corneal dystrophy. In some cases, in spite of all treatment, the edema persists and the graft remains cloudy.

If the transplant cicatrizes with marked protrusion and opacity and if there is a synechia, the anterior synechia must be dealt with first, and when the cornea is free from the iris, a second corneal transplantation will be necessary.

Deformity

In cases of keratoconus, the transplant has often a tendency to protrude during the postoperative course. This must not be considered a complication but almost the normal cicatrization of the grafts in keratoconus. In order to obtain a more normal curvature, it is necessary to maintain a pressure dressing which is started approximately 14 days after the operation and is continued until the 5th or 6th postoperative week. Even in spite of the pressure dressing, the transplant, though transparent, sometimes cicatrizes with protrusion or uneven curvature, resulting in pronounced myopia and astigmatism, thus defeating the success of the operation. Contact lenses may help the situation occasionally; if not, a second transplantation will be necessary.

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IV. PHYSIOPATHOLOGY

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The fundamental problem in keratoplasty is the fate of the corneal graft. Do the donor cells in a homogenous graft continue to live after transplantation (as in autografts of the skin), or does the graft merely act as a framework for the ingrowth of the recipient cells? Until this basic problem is solved, the various factors which influence the final transparency of the graft cannot be properly evaluated. This report is based on an extensive experimental study which is still in progress, but has already yielded partial answers to these problems.

A number of studies have been made in the past to determine whether a corneal graft continues to live as autonomous tissue or if it merely acts as a reticulum for the ingrowth of cells from the recipient cornea. The conclusions reached in these investigations have been based on routine histologic studies of grafts at varying intervals following operation.

In most of the reported studies it is not mentioned whether the transplants were autogenous or homogenous grafts and, when the type of graft is specified, no distinction is made between the two. In general, most workers agree that Bowman's membrane, the corneal stromal fibers, and Descemet's membrane of the graft are not replacd.

There is, however, a wide difference of opinion on the fate of the corneal stromal cells. Salzer,[11] Bonnefon and Lacoste,[2]Loehlein[8] and others believe that the grafted corneal cells of the stroma die and are gradually replaced by similar cells from the recipient. Fuchs,[6] Imre,[7] Castroviejo[3] and others, on the other hand, think that the grafted corneal cells live and are not replaced by cells from the recipient, that is, the donor graft survives as a viable entity.

It may be pointed out that if the cells in homografts of cornea continue to live after grafting they are unique in this respect. Numerous studies of homografts of skin, bone, nerve, muscle, fat, and other tissue[1,2] have shown that the grafts are invariably replaced by cells from the recipient.

Exceptions to this are grafts from identical twins or mother to child which will occasionally live as autonomous tissue. Cartilage grafts at one time were also thought to be an exception to this rule. However, there is no definite proof that the donor cells of this tissue actually survive.

Medawar[9] has recently done some excellent studies on skin grafts in rabbits and has shown that the disintegration of the cells in homografts is the result of a hypersensitive reaction produced by the grafted cells of the donor animal. He has also shown that the rapidity of destruction of the cells in the homografts is proportional to the amount of tissue grafted. That is, if a large amount of skin is grafted, the cells will die in about 10 to 12 days; if one small graft is used, the cells will live for about 20 days.

In spite of the conclusive work done on skin grafts and other body tissues showing that homografts do not continue to live as autonomous tissues it is theoretically possible that corneal grafts may be an exception to this finding. The number of corneal stromal cells in a graft is small as compared to the number of cells in a skin graft, and the avascular cornea has been shown by

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Chesney, Woods, and Campbell[4] and also Rich and Follis[10] not to develop the same immunologic reactions as do other tissues of the body in systemic infections of syphilis and Arthus phenomenon. It is, therefore, conceivable that corneal grafts may not produce a sensitivity reaction similar to that produced by skin grafts, and the cells may continue to live as they do in a tissue culture.

The Fate of the Grafted Cornea (Experimental)

In our experimental approach to this problem, it was necessary to have a clear understanding of the histologic pictures of a clear (successful) corneal graft and of an opaque (unsuccessful) graft. To determine this, we made histologic studies at almost daily intervals of autografts and homografts to clear corneas up to 2 weeks and at weekly and biweekly intervals up to 4 months. Rabbits were used as the experimental animal. A total of 38 autografts and 24 homografts have thus been examined histologically.

During the first week after operation, it is frequently difficult to predict accurately which grafts will eventually become opaque and which will clear. All grafts are cloudy to some degree during this time due to edema of the tissue. If there is no postoperative infection, if the edges of the graft are in good apposition with the recipient cornea, and if the edema of the graft subsides within a week to 10 days, the graft will usually clear. All grafts which were clear at 2 weeks after operation have remained clear for as long as they have been followed. In this study autografts and homografts of the cornea have given identical results in both clinical and histologic material. The following are the usual histologic patterns of clear and cloudy grafts.

Experiment 1

Clear grafts. During the first 48 hours after operation, the graft is loosely adherent to the recipient cornea by a fibrin clot. The epithelium from the recipient cornea grows into the cleft where it is not filled by a fibrin clot between the donor and recipient cornea (fig. 1). The epithelium is missing from the graft, the stroma is edematous and is invaded by a few polymorphonuclear cells. The endothelium is probably damaged physiologically in all cases and in some cases is actually denuded in areas.

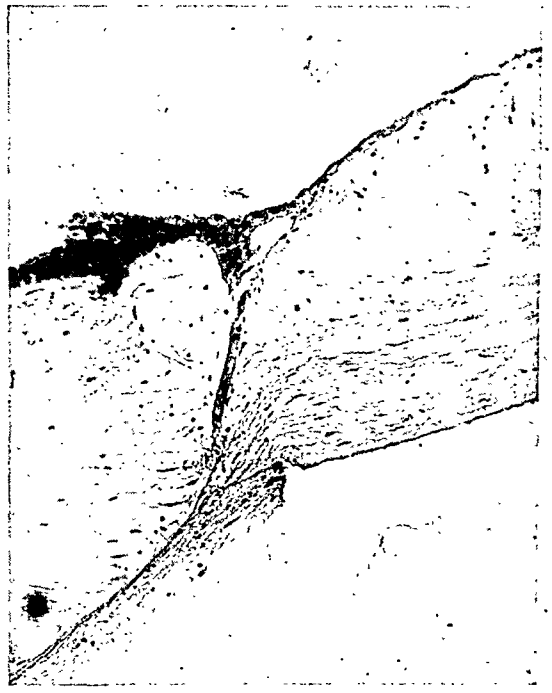


Fig. 1 (Maumenee and Kornblueth). Section of autogenous corneal graft (2 days after operation) showing ingrowth of epithelium and fibrin clot at site of operative wound. Migration of newly formed epithelium over wound and graft on right side. (H. & E. stain. ×100.)

During the next three days the epithelium is regenerated over the graft by migration from the recipient cornea. The edema of the stroma shows little change. A few wandering macrophages appear between the lamellae of the stroma. During this time the endothelial cells are usually replaced on the graft. It cannot be stated with certainty whether these cells are replaced by a proliferation of the remaining cells on the graft or by a migration of cells from the recipient cornea.

At 5 days after operation, a proliferation of cells that look like fibroblasts can be seen



Fig. 2 (Maumenee and Kornblueth). Section of autogenous corneal graft (5 days after operation) showing fibroblasts in wound. Graft on left. (H. & E. stain. ×100.)

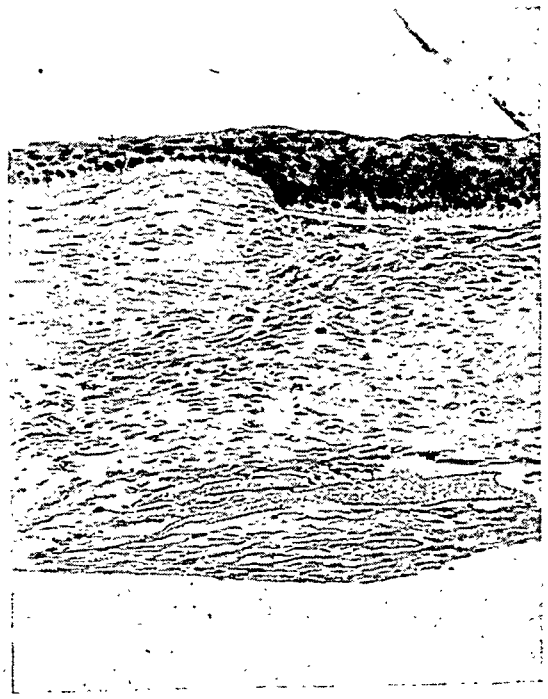


Fig. 3 (Maumenee and Kornblueth). Section of autogenous corneal graft (15 days after operation) showing ridge of fibroblasts on posterior surface of cornea. (H. & E. stain. ×100.)

in the wound and in the region of the endothelium on both the donor and recipient corneas (fig. 2). As these cells fill in the wound, the epithelial cells, which at first grew into the cleft, are destroyed. During the next 5 days, the edema of the stroma sub-

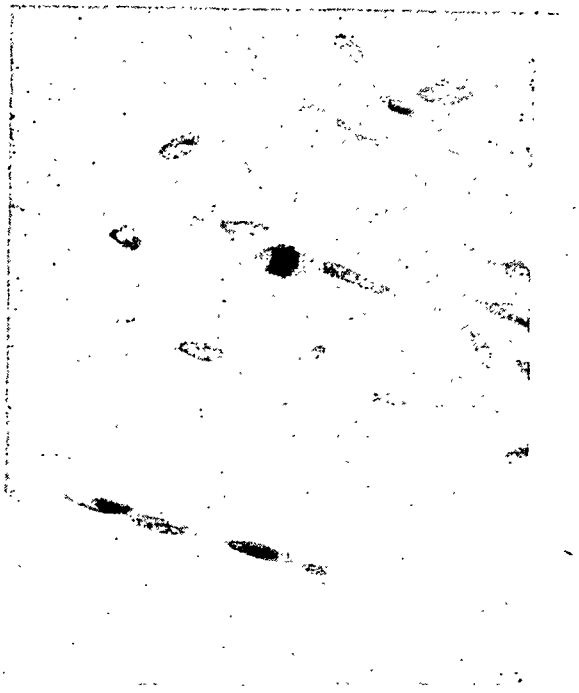


Fig. 4 (Maumenee and Kornblueth). Section of autogenous corneal graft (5 days after operation) showing mitosing keratoblast in metaphase in the corneal graft. (H. & E. stain. ×500.)

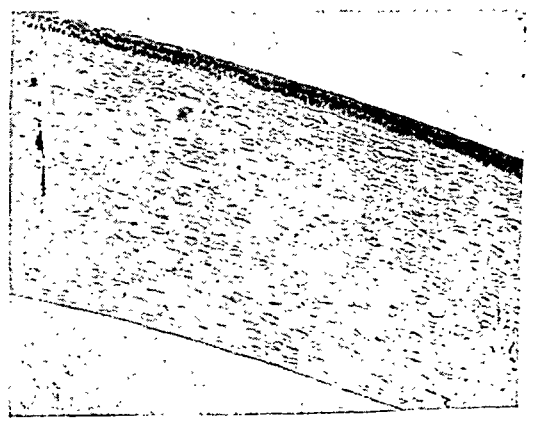


Fig. 5 (Maumenee and Kornblueth). Section of autogenous corneal graft (15 days after operation) showing normal corneal structure of graft. (H. & E. stain. ×100.)

sides, the epithelium on the transplant assumes its normal structure, the fibroblasts increase in the wound and form a ridge of tissue on the posterior surface of the wound (fig. 3). During the first 2 weeks after operation, mitotic figures are occasionally observed in the stromal cells of the graft and in the stromal cells of the recipient cornea immediately adjacent to the graft (fig. 4). An exact explanation of this finding cannot be given at the present time but it does indicate that some reparative action is taking place in the graft as well as in the recipient cornea. During the 2nd and 3rd weeks fibrils appear in the scar and in the ridge on the posterior surface of the cornea. The graft assumes the normal corneal structure and cannot be differentiated from the normal recipient cornea (fig. 5). During the 2nd and 3rd months, the fibrils in the scar gradually assume the normal corneal pattern, and it is sometimes difficult to tell where the graft ends and the recipient cornea begins except for the slight irregularity of the lamellae and the break in Descemet's membrane (fig. 6).

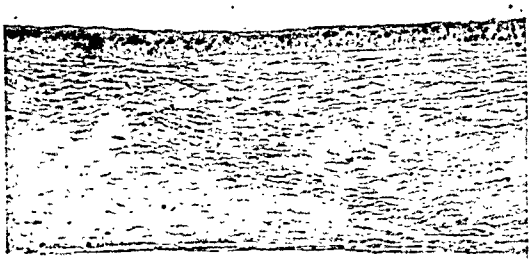


Fig. 6 (Maumenee and Kornblueth). Section of homogenous corneal graft (5 weeks after operation) showing healed wound between graft and recipient cornea. (H. & E. stain. ×100.)

Cloudy grafts. It is frequently impossible to predict which grafts will clear and which will become opaque, on either clinical or histologic examination during the first week after operation. However, wide gaps between the wound edges (fig. 7), massive anterior synechias (fig. 8), and infections of the suture tracts in the recipient corneas cause prolonged edema of the grafts. Grafts which remain edematous for 3 to 4 weeks frequently become partially opaque and, on histologic examination, are found to have several layers of fibroblasts with newly formed fibrils under the epithelium or endothelium (figs. 9 and 10).



Fig. 7 (Maumenee and Kornblueth). Section of autogenous corneal graft (15 days after operation) showing wide wound filled in with fibroblasts. (H. & E. stain. ×100.)

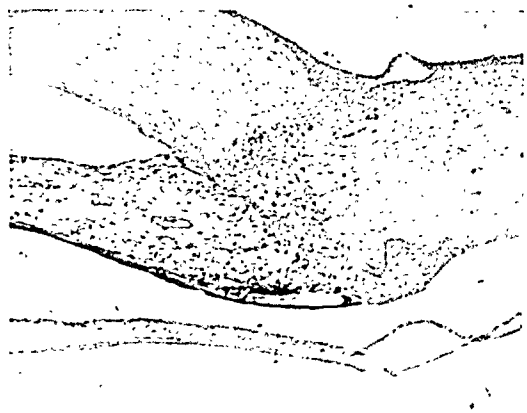


Fig. 8 (Maumenee and Kornblueth). Section of autogenous corneal graft (9 days after operation) showing massive anterior synechia with pigment-bearing cells in wound. (H. & E. stain. ×25.)

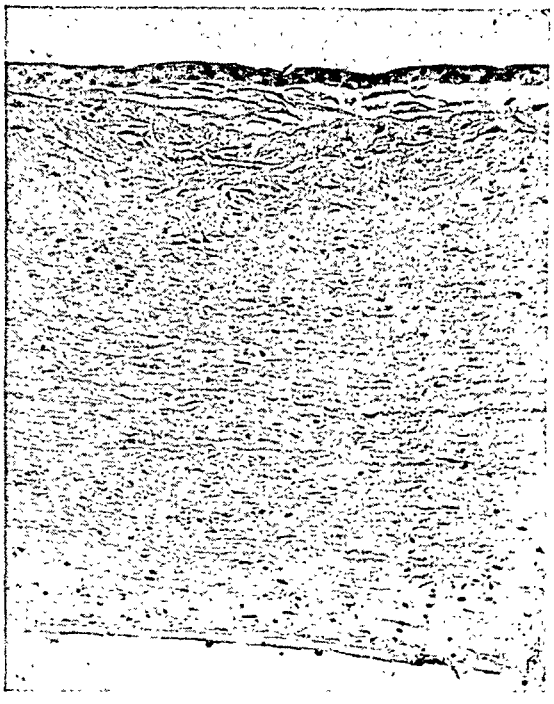


Fig. 9 (Maumenee and Kornblueth). Section of autogenous corneal graft (15 days after operation) showing early newly formed fibrous tissue beneath the epithelium. (H. & E. stain. ×100.)

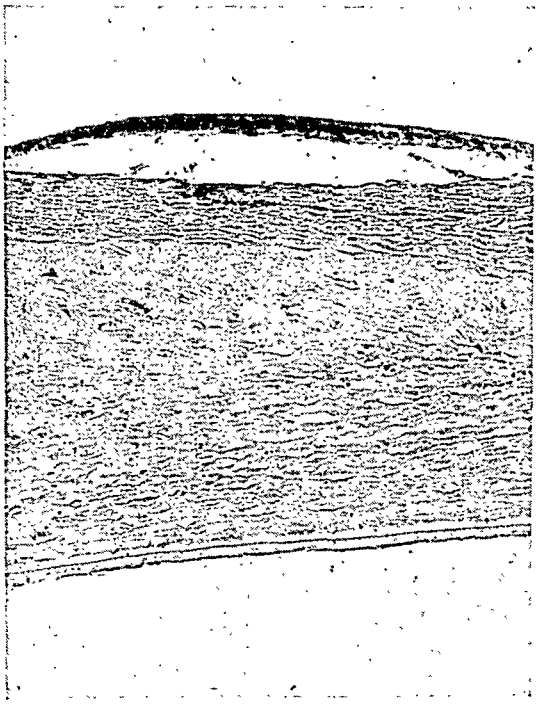


Fig. 10 (Maumenee and Kornblueth). Section of autogenous corneal graft (2 months after operation) showing newly formed fibrous tissue beneath the epithelium. (H. & E. stain. ×100.)

In grafts with greater edema the normal arrangement of the donor lamellae is destroyed in places with resultant opacities in these areas (fig. 11). In more severe reactions, from either unknown causes or low-grade infection, polymorphonuclear cells invade the stroma in greater numbers. There is a destruction of the lamellae of the graft and later an invasion of the graft by blood vessels, macrophages, and fibroblasts from the recipient animal. This latter type of re-

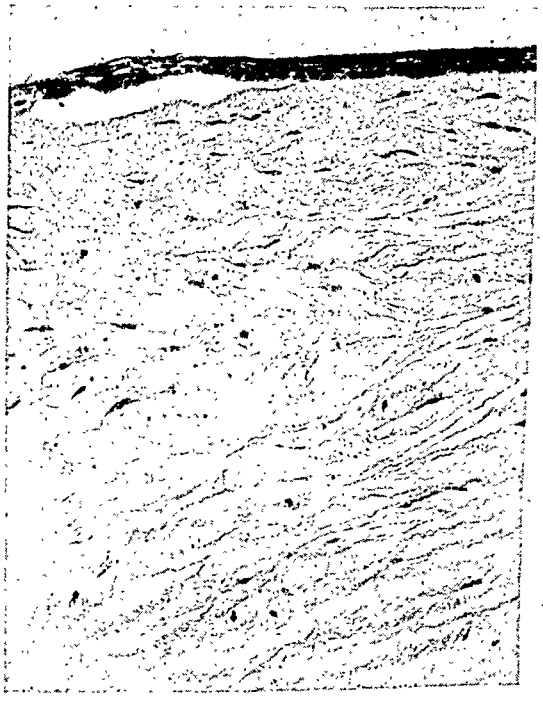


Fig. 11 (Maumenee and Kornblueth). Section of autogenous corneal graft (10 days after operation) showing massive edema of graft and irregular arrangements of lamellae. (H. & E. stain. ×100.)

action usually causes a dense opacification of the graft. During the early stages, these grafts look like granulation tissue and in the end stages resemble any dense scar of the cornea (fig. 12).

Routine histologic study did not show whether the stromal cells of either the autografts or homografts of the cornea were replaced by cells from the recipinet corneas or whether the grafts remained as viable entities. Against the supposition that the stromal cells were replaced by cells from the

recipient corneas was the fact that at no time were abnormal acellular areas seen or were any large number of dying or newly formed cells observed in the stroma of the autografts or homografts. It is possible, however, that a gradual replacement of the donor cells could have taken place and escaped detection on routine histologic examination.

Experiment 2

With this latter possibility in mind, studies were performed on regeneration of normal corneal stromal cells, in nongrafted corneas, to determine the origin of these newly formed stromal cells. These studies will be reported in detail elsewhere. In brief, the first group of experiments consisted in destroying the corneal cells by freezing various areas of the cornea to $-78°C.$ and studying the replacement of the cells in these areas.

It was found that the cells were replaced from uninjured keratocytes and wandering macrophages, but it could not be determined which of the newly formed cells arose from which precursor. We, therefore, sought some method of tagging the wandering macrophages so such precursors of the stromal cells could be identified in a regenerated corneal lesion.

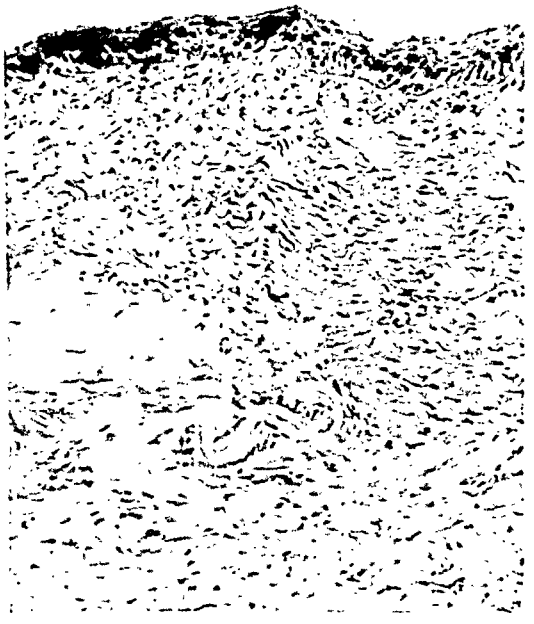


Fig. 12 (Maumenee and Kornblueth). Section of homogenous corneal graft (7 weeks after operation) showing replacement of stroma by fibrous tissue. (H. & E. stain. ×100.)

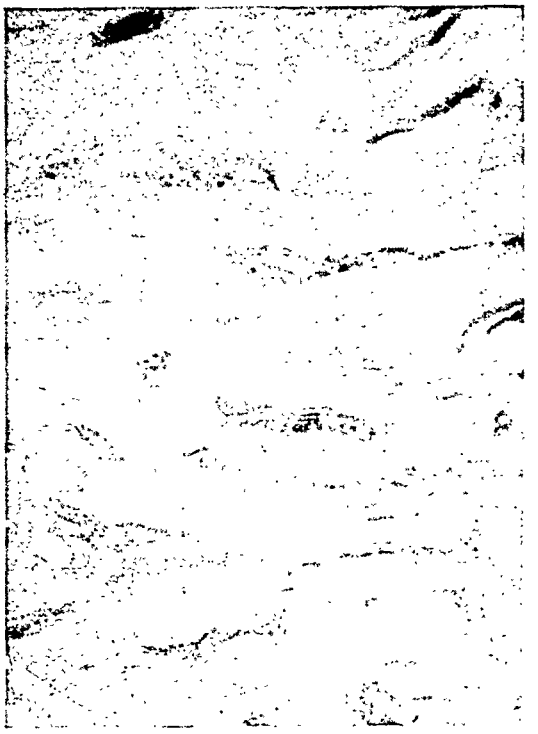


Fig. 13 (Maumenee and Kornblueth). Section of homogenous corneal graft to a rabbit saturated with trypan blue (15 days after operation) showing trypan blue in corneal corpuscles. (Lithium-carmine stain. ×750.)

To this end, animals were saturated with trypan blue systemically and areas of their corneas were frozen. In such animals the macrophages can be identified by the presence of trypan blue granules in their cytoplasm. These "tagged" cells were found in great numbers in the regenerating cornea.

With the fact established that wandering macrophages participate in the regeneration of dead corneal tissue, the following experiment was performed.

Grafts were done on animals saturated with trypan blue. When these grafts were examined histologically, trypan blue could be found in a few of the stromal cells in the autogenous and homogenous grafts. The

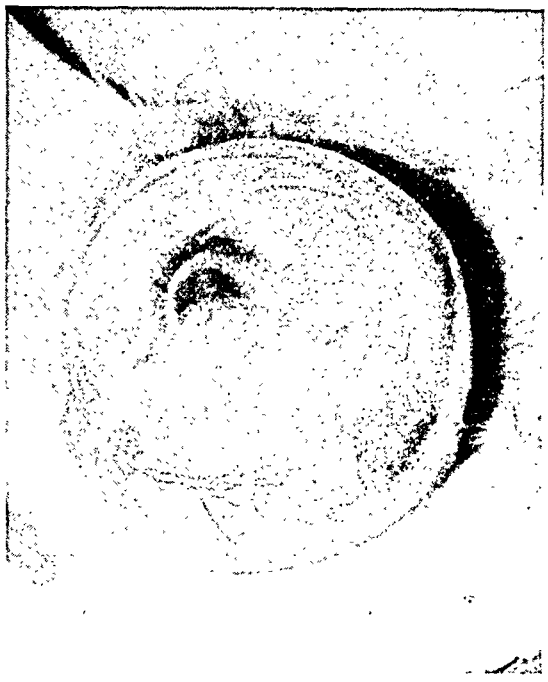


Fig. 14 (Maumenee and Kornblueth). Partially clear formalin corneal graft 7 months after operation.

number of stromal cells containing trypan blue were much greater in cloudy than in clear grafts (fig. 13). This clearly indicated that at least to some extent the wandering macrophages of the recipient corneas participate in the regeneration of the cells in the donor grafts.

EXPERIMENT 3

The question of the replacement of the corneal stromal cells were studied by another method. Scherschewskaya[13] has stated that clear corneal grafts can be obtained from formalized donor corneas. If this is true, all of the cells in an ultimately clear graft of this type must be derived from the recipient animal because the cells in the donor graft are killed when this tissue is placed in formalin. We have been unable to confirm Scherschewskaya's reported finding that clear transplants can be obtained with formalized corneas. Fifteen such grafts have been performed and in only one instance was a partially clear graft obtained (fig. 14).

A somewhat similar experiment on this same line was likewise unsuccessful. In this experiment the cells of the donor cornea were killed by freezing the tissue. In 13 attempts no clear grafts were obtained. Many of these grafts of frozen tissue looked as promising as did fresh grafts for 5 to 7 days after operation. However, all became progressively more edematous after removing sutures and frequently the anterior lamellae sloughed off during the first 2 weeks after operation.

In short, all efforts to obtain a clear graft by the use of nonviable corneas in which the cells have been killed either by formalin or by freezing have been completely unsuccessful. These experiments would indicate that viable corneal tissue is essential for a successful graft. It is possible, however, that the denaturization of the corneal protein by the formalin, or disturbance of the cohesion of the stromal lamellae by freezing may have influenced these results.

These experiments do not entirely contradict Filatov's[5] recent statement that he obtained 66.6 percent successful grafts when he used corneas preserved for 1 to 3 days at + 2° to + 4°C. and only 24.1 percent successful grafts when he used fresh corneas. Bajenova[1] demonstrated that corneas preserved in moist chambers at +2°C. for 10 days contained viable stromal cells which would grow in tissue culture. We can offer no explanation, however, why Filatov should obtain better results with preserved but viable tissue than with fresh tissue.

These three experiments just reported in brief indicate that living donor stromal cells are essential at least during the first stages of a graft for its final clarity.

EXPERIMENT 4

A fourth experiment was done with the idea of determining at what time the viable donor stromal cells were no longer essential for the continued clarity of the graft. To this end, a series of autografts and homografts were made in experimental rabbits, and at varying times after the operation. The cells of the donor graft were killed by the freezing

technique. It was found that the donor cells could be completely destroyed as early as 11 days after operation and the graft would regain its normal clarity after the edema following the injury subsided (fig. 15).

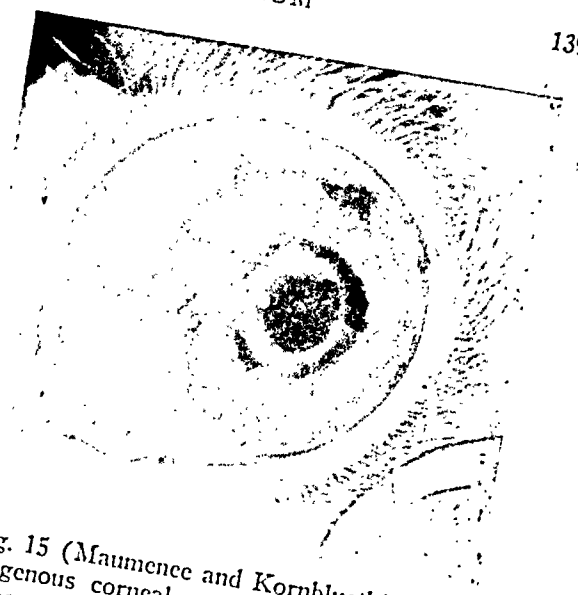


Fig. 15 (Maumenee and Kornblueth). Clear homogenous corneal graft in which all cells had been destroyed in the graft by freezing 11 days after operation. Picture taken 4 weeks after freezing.

These four experiments do not give a conclusive answer to the fate of the stromal cells in a corneal graft. They do, however, give us a clear indication of the general picture. First, there is no massive replacement of the cells in an autogenous or homogenous graft at any one time. Second, the wandering macrophages of the recipient animal probably contribute from the beginning in a limited degree to the replacement of the donor cells in a corneal graft.Third, viable donor cells are essential for a successful take of a transplant, at least for the first 2 weeks after operation, until the dependence of the donor graft on the recipient cornea is fully established. The donor cells are not essential to the clarity of the graft once the tissue has become firmly attached to the recipient cornea.

This is the apparent picture as well as it can be visualized from the information so far at hand. It is quite possible that further investigation may alter this concept of the process. The final answer of the fate of the donor stromal cells cannot be decided until a method is obtained to tag the donor corneal cells or both the corneal cells and the wander macrophages of the recipient.

Factors which influence the result of keratoplasty

Most of the factors which determine the final clarity or cloudiness of a corneal transplant have been observed clinically. These factors may be divided into three groups: the condition of the grafted tissue, the status of the recipient cornea, and the operative complications. From the experimental standpoint we can add the following observations.

1. Fresh living corneal tissue is the most favorable material for grafting. Nonviable grafts are completely unsatisfactory.
2. Excessive trauma either in removing or handling the graft is detrimental to the final clarity of the tissue.
3. Numerous small vessels in the recipient cornea do not appear to influence the result of keratoplasty to any marked extent. This is illustrated by the following experiment. A group of animals with vascularized corneas and small central corneal leukomas have been subjected to autografts and homografts. The recipient animals had been previously grafted and the transplants had become opaque and vascularized (fig. 16). The reaction following the initial graftings was allowed to subside before regrafting. In this group the percentage of clear grafts obtained on the second attempt was the same as when animals with normal corneas were used. This indicates that numerous small blood vessels in the cornea without other damage to the tissue are not detrimental to the final clarity of the graft.
4. Dense and diffuse corneal opacities influence the results of operation unfavorably. This is shown by the following experiment.

A group of animals in which dense corneal opacities had been produced by the injection of 20th-normal sodium hydroxide into the lamellae of the corneas were subjected to keratoplasty. If the grafts on these animals



Fig. 16 (Maumenee and Kornblueth). Opaque autogenous corneal graft with vascularization (2 months after operation). This eye used for regrafting.



Fig. 17 (Maumenee and Kornblueth). Clear homogenous corneal graft 5½ weeks after operation. The cells in the recipient cornea had been destroyed by freezing 3 weeks before operation.

were surrounded by the opacities the transplants always become opaque. However, if the opacity in the recipient cornea was present on only one or two sides of the graft, the transplant would occasionally remain clear.

The reason why corneal grafts fail to remain clear in completely opaque corneas is not fully understood. One explanation which has been given for the poor results in this type of cornea has been that there are not enough normal corneal cells surrounding the graft. This explanation is probably not correct, however, for clear transplants can be obtained in corneas in which all of the original cells have been destroyed by freezing if sufficient time is given for the edema of the cornea to subside and new cells to grow in (fig. 17).

While we do not have a satisfactory explanation for the poor results in opaque corneas, it is interesting that the grafts are frequently edematous for several weeks before they finally become scarred and vascularized when they are inserted into corneas damaged by sodium hydroxide.

5. The operative complications such as poor apposition of the wound edges, anterior displacement of the graft, and secondary infection are essentially the same in experimental animals as in clinical cases. Small anterior synechias are unfavorable but do not always cause an opacification of graft.

SUMMARY

Finally, how can one visualize the course of events in a successful graft? The donor cornea should be viable tissue and as untraumatized as possible. The continued viability of the graft is not essential after the second postoperative week. The recipient cornea should not be completely opaque and should not be edematous.

Small blood vessels in the recipient cornea are not detrimental to the final clarity of the transplant. Good apposition of the graft should be obtained at operation. After the graft has been inserted, it becomes edematous during the first 24 hours and the epithelium is lost. The endothelium is always

damaged to some extent but part of it may remain on the graft.

The majority of the stromal cells continue to live in the graft and do not show a massive degeneration or replacement at any time during the postoperative course. They are supplemented, at least to a limited extent, by the newly formed keratoblasts from the recipients macrophages.

The epithelium is replaced by a migration of epithelium from the recipient cornea. The endothelium may be repaired from the uninjured cells of the graft or a migration of cells from the recipient cornea. The wound is closed at first by a fibrin clot and later by fibroblasts which form fibrous tissue between the graft and adjacent cornea.

Johns Hopkins Hospital (5).

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V. RESULTS*

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The literature on corneal transplant operations contains few statistical facts on the final results of this well-publicized surgical procedure. One of the chief difficulties in obtaining such data has been the lack of a sufficiently large number of cases in any one clinic to permit statistical analysis.

To overcome this difficulty the American Academy of Ophthalmology and Otolaryngology made arrangements for a group of clinics to pool their material, for it was thought that the combined data would be sufficiently large to analyze statistically.

Clinics in closely neighboring cities were chosen for the study so that the doctors from each of the participating clinics could easily meet from time to time for discussions. The Massachusetts Eye and Ear Infirmary, the Institute of Ophthalmology of the Presbyterian Hospital, the Manhattan Eye, Ear, and Throat Hospital, the New York Eye and Ear Infirmary, the New York Hospital, the Hospital of the University of Pennsylvania, and the Wilmer Institute of The Johns Hopkins Hospital were chosen to participate.

A standardized tally sheet for the analysis of the cases was drawn up by the group of doctors. Each of the representatives from the coöperating institutions studied the histories from his own hospital, and recorded the pertinent data on the standardized tally sheets. The sheets from all the hospitals were collected. The data were transcribed to punch cards and analyzed with the aid of automatic sorting and counting machines. After the data were gathered, the representatives from the participating hospitals met to discuss the results and to draft plans for this report.

This plan for statistical study of the corneal transplant operation has worked very well. The pooling of opinions has been beneficial, but the greatest advantage is that the plan provides a standardized method of analysis for a large number of cases from many separate clinics.

Without it, each clinic would have reported its individual experience. The analysis of the data probably would have been different in each report and comparison of the results of one clinic with those of another would have been difficult. We feel that the American Academy should continue to sponsor and guide similar coöperative clinical studies on other subjects.

We were able to gather data on 417 corneal transplant operations performed at the various coöperating hospitals. The analysis of this material forms the basis of the following report.

RESULTS ACCORDING TO CLARITY OF GRAFT

In 16 of the 417 cases, there was no statement in the history as to the final clarity of the graft. In addition, 20 of the cases had

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been followed for only 3 months or less. In 242 or 63.5 percent of the 381 remaining cases, the graft became cloudy, and in 139 or 36.5 percent, the graft remained clear. Therefore, in the group as a whole without selection of cases, there was approximately one chance in three that the graft would remain clear.

Selection of cases

In order to determine whether it is possible to increase the chances of obtaining a clear graft by proper selection of the cases, we analyzed the effect of various factors on the final clarity of the graft. The cases were divided into groups and the percentage of grafts remaining clear was compared in each of the groups.

TABLE 1

Relationship of diagnosis to percentage of clear grafts

Diagnosis	No. of Cases	Clear Grafts Followed 4 Mos. or more
Conical cornea	63	65.2%
Hereditary dystrophy	17	58.8%
Scar luetic interstitial keratitis	49	49.0%
Scar nonspecific inflammatory	141	46.9%
Active keratitis or ulcer	13	23.1%
Scar chemical	24	20.8%
Scar traumatic	22	18.2%
Scar gonococcal	23	8.7%
Fuchs' dystrophy	10	0
Total	362	36.5%

Age of patient. The youngest patient in our series was 3 years of age and the oldest was 80 years. However, no correlation was found between the percentage of grafts remaining clear and the age of the patient.

Diagnosis. Table 1 shows the classification of the cases according to diagnosis. The cases with conical cornea obtained the highest percentage of clear grafts. In about 2 out of 3 cases of conical cornea the graft remained clear. The results in the cases with hereditary corneal dystrophies (Groenouw, Haab-Dimmer, and Fleischer types) were almost as good, 58.8 percent of the transplants remaining clear. In the cases with corneal scars from luetic interstitial keratitis or from other nonspecific corneal inflammations, about half of the transplants remained clear. In contrast, the results in cases with corneal scars from chemical burns, trauma, or gonococcal ulcers were poor, only about one transplant in 5 or 10 remaining clear. Total failure resulted in every instance in cases with Fuchs's dystrophy of the cornea. The 13 cases in which a corneal transplant operation had been performed in the presence of an active keratitis or an active ulcer are interesting. In these, it was surprising to find that the transplant remained clear in 23.1 percent of the cases, a result that would not have been expected.

Previous operations. In 30 of the cases, the corneal transplant operation had been performed on eyes that had previously had one unsuccessful corneal grafting. In 8 or 21.2 percent of these the second graft remained clear. In an additional 11 cases, two previous corneal transplant operations had resulted in failure and a third graft was performed. In only 1 of these cases did the third graft remain clear.

There is general agreement that corneal grafting is technically more difficult in aphakic eyes than in eyes with the lens in place. In our series corneal transplant operations were done in 7 cases with aphakia. The results were good; in 3 cases (42.8 percent) the graft remained clear.

The chances for obtaining a clear graft were reduced in all the cases in which previous operations such as iridectomies, filtering operations, superficial keratectomies, or cauterization of the cornea had been performed. Eight cases had previously had a conjunctival flap drawn over the cornea, and in none of them did the transplanted cornea remain clear. Undoubtedly the eyes requiring other operations before the corneal

grafting had severe defects, and a poor prognosis was to be expected.

Size of corneal opacity. The cases were divided into four groups according to the extent of the corneal opacity. Table 2 shows

TABLE 2

RELATIONSHIP OF SIZE OF CORNEAL OPACITY TO PERCENTAGE OF CLEAR GRAFTS

Size of Opacity	No. of Cases	Clear Grafts Followed 4 Mos. or More
None	16	50.0%
Central	104	52.8%
One half or less	74	29.8%
Over one half	173	27.7%

that the cases with no corneal opacity or those with only a central corneal opacity had the best prognosis. In approximately half of these cases the grafts remained clear, while only about 1 case in 3 or 4 with more extensive opacities obtained a clear graft. It is often difficult to estimate the depth of the opacity, especially in cases with extensive corneal scarring. Therefore, in classifying our cases according to the size of the opacity, we did not include a consideration of the depth of the opacity.

TABLE 3

RELATIONSHIP OF CORNEAL VASCULARIZATION TO PERCENTAGE OF CLEAR GRAFTS

Vascularization of Cornea	No. of Cases	Clear Grafts Followed 4 Mos. or More
None	170	50.5%
Slight	52	50.0%
Moderate	71	25.4%
Extensive	64	10.8%

Vascularization of the cornea. Table 3 shows the percentage of clear grafts obtained in our series when the cases were grouped according to the extent of the preoperative corneal vascularization. About one half of the cases with no vascularization or with only "slight" vascularization obtained clear grafts. On the other hand, only a fourth of those cases with "moderate" vascularization obtained a clear graft. When the corneal vascularization had been estimated as being "extensive," only about 1 case in 10 obtained a clear graft.

Anterior synechias. The presence of anterior synechias is one of the most difficult problems in handling a case for corneal grafting. In some of our cases, attempts had been made to eliminate the anterior synechias before the corneal transplant operation was undertaken. In many cases, these attempts were unsuccessful. Thirty-nine cases in our series had corneal grafting in the presence of anterior synechias. In only 6 or 15.4 percent of these did the corneal graft remain clear.

General prognosis. In most of the cases, the factors we have just considered separately were not isolated. For example, patients with keratoconus often had no corneal opacity or only a central one. In addition they usually had no vascularization of the cornea, no anterior synechias, and had had no previous surgery. On the other hand, patients with opacities due to burns or gonococcal ulcers usually had extensive corneal opacities and vascularization, broad anterior synechias, and frequently numerous operations had been performed on the cornea before the transplant operation had been undertaken.

TABLE 4

RELATIONSHIP OF PROGNOSIS TO PERCENTAGE OF CLEAR GRAFTS

Prognosis	No. of Cases	Clear Grafts Followed 4 Mos. or More
Very good	79	68.3%
Less good	115	50.5%
Unfavorable	99	12.1%
Contraindicated	38	10.5%

However, in order to arrive at a decision as to the results of corneal grafting in specific types of cases, we divided our cases into four categories using the criteria for

prognosis described by Castroviejo.* (See table 4.)

Group 1. The first group of very favorable cases comprised cases of keratoconus, cases with only a central corneal opacity, and cases of mild interstitial keratitis. Of the 79 cases in this group, 54 or 68.3 percent obtained clear grafts.

Group 2. The second group of less favorable cases comprised cases of hereditary corneal dystrophy (Fleischer, Haab-Dimmer, Groenouw, and Salzmann types), cases with extensive superficial corneal opacities without vascularization, cases with superficial tear-gas burns without pannus, cases with adherent leukomas, cases with central descemetocele, and cases with extensive interstitial keratitis. Of the 115 cases in this group, 58 or 50.5 percent obtained clear grafts.

Group 3. The third group of unfavorable cases included cases of corneal scarring involving the limbal and pupillary area, extensive deep leukomas, band-shaped degeneration of the cornea, dystrophia adiposa, aphakic cases, and cases of extensive opacities with vascularized pannus. Of the 99 cases in this group, 12 or 12.1 percent obtained clear grafts.

Group 4. The fourth group of cases in which corneal transplantation was considered contraindicated included cases with Fuchs's dystrophy, cases with extensive corneal opacities with calcareous degenerations, cases with corneal opacities of pemphigus, and those of corneal opacities with extensive anterior synechias. Of the 38 cases in this group, 4, or 10.5 percent, obtained clear grafts. Statistically there was no difference in the results between the cases in Group 3 and those in Group 4.

In summary, in the first small group of selected cases, with the best prognosis, about two thirds of the grafts remained clear. In the second large group of less favorable cases, one half of the grafts remained clear, while in the last two groups of unfavorable cases, there was only one chance in eight of obtaining a clear graft.

* Csatroviejo, R.: Indications and contraindications for keratoplasty and keratectomies. Am. J. Ophth., 29:1081-1093, 1946.

Visual results

Ideally, the most important consideration in evaluating the corneal transplant operation would be the improvement in vision that results from the operation. However, mere comparison of the preoperative and postoperative vision is inadequate, for some cases with clear grafts must be eliminated from consideration because of extraneous causes for poor vision. For example, cases with preoperative cataract, glaucoma, nystagmus, or amblyopia ex anopsia must be discarded even though the grafts remain clear. The significance of minor improvements in vision must also be carefully evaluated. In some of the cases a small improvement in vision may be recorded and the case classified as having improved vision postoperatively. For example the preoperative vision might have been recorded as 5/200, and the postoperative vision as 15/200.

This may not represent a true improvement in vision. Certainly the examiner spends a good deal more time and effort coaxing the patient to read the chart after operation than he does before the operation was performed.

In addition, by repeated examination, the patient often becomes familiar with the blurred form of the 20/200 letter. He learns to interpret the blurred image more readily by experience and may therefore show an apparent improvement in vision, not as a result of the operation, but only as a result of frequent testing.

Although ideally the improvement in vision should be the best criterion for the success of the operation, practically it is difficult to assess statistically since it must be qualified so carefully. For these reasons, we have correlated most of our data with the

final anatomic result, that is, the presence or absence of a clear graft. However, it is important for a complete picture to include some of the data we found on the visual acuity, if we remember the limitations of such a study.

Table 5 shows the relationship between the preoperative and postoperative vision in 253 of the cases. As mentioned before, we had to exclude cases with preoperative cataracts, glaucoma, nystagmus, or amblyopia ex anopsia, and those in which some disease was found in the posterior segment of the eye.

TABLE 5

RELATIONSHIP OF PREOPERATIVE VISION TO POSTOPERATIVE VISION

Postoperative Vision \ *Preoperative Vision*	LP	HM	1–10/200	11–20/200	20/100	20/70	20/50	20/40	Total
No LP	6	6	10		1				23
LP	10	10	14	2	2		1		39
HM	2	20	18	2	1				43
1–10/200	2	6	21	4	1	3			37
11–20/200	2	2	5	4	3			1	17
20/100		1	9	4					14
20/70	2	3	8	2		3			18
20/50	1	6	6	3					16
20/40		3	8	4	1	1			17
20/30		1	14		1	1	1		18
20/20		1	7		1	2			11
Total	25	59	120	25	11	10	2	1	253

In Table 5, the numbers in the heavy squares refer to cases that had the same category of vision postoperatively and preoperatively. The numbers above the heavy squares refer to cases that fell into a category of poorer postoperative vision, and the numbers below the heavy squares refer to cases that fell into a category of better vision postoperatively than preoperatively.

A final visual acuity of 20/30 to 20/20 was obtained in only 29 or 11.4 percent of the cases, and in 23 or 9.1 percent of the cases all light perception was lost as a result of the corneal transplant operation.

The visual result in the cases grouped according to general prognosis was interesting. In the cases with the best prognosis (group 1), limited to cases of keratoconus, cases with only a central corneal opacity, and cases of mild interstitial keratitis, 58 cases had preoperative vision of 20/200 or less, Of these, 32 cases or 55.2 percent attained a final vision of 20/100 or better.

Of the cases with a less favorable prognosis (group 2) 74 had preoperative vision of 20/200 or less, and 39 or 52.7 percent of these obtained a final vision of 20/100 or better. Of the cases with an unfavorable prognosis or those in which the operation seemed contraindicated (groups 3 and 4) 7 out of a total of 64 or 10.9 percent were raised from a preoperative vision of 20/200 or less to a postoperative vision of 20/100 or better. Of the 229 cases with a preoperative vision of 20/200 or less, 83 or 36.2 percent obtained a postoperative vision of

20/100 or better, approximately 1 case in 3.

The final visual results in the 24 cases with initial vision of 20/100 or better deserve careful consideration. Only 6 of these cases obtained a final vision of 20/30 or better, while in 13 of these cases the final vision was reduced to 20/200 or less. Therefore, while only a fourth of these patients with relatively good preoperative vision obtained a vision of 20/30 or better, over half of them had their vision reduced to 20/200 or less as a result of the operation.

Although the number of cases is small, these figures indicate that it is probably unwise to perform a corneal transplant operation on an eye with a corrected visual acuity of 20/100 or better.

Conclusions

1. A statistical study has been made of the results of 417 corneal transplant operations.

2. The graft remained clear in 36.5 percent of the cases.

3. The percentage of clear grafts varied greatly with the cause of the corneal opacity. The best results were obtained in cases of keratoconus (65.2 percent), hereditary dystrophy (58.8 percent), interstitial keratitis (49.0 percent), and nonspecific inflammatory scars (46.9 percent). Poor results were obtained in cases with active keratitis or corneal ulcer (23.1 percent), scars from chemical burns (20.8 percent), trauma (18.2 percent), or gonococcal ulcers (8.7 percent). No clear grafts were obtained in cases with Fuchs's dystrophy.

4. The larger the size of the corneal opacity and the greater the extent of corneal vascularization, the less were the chances of obtaining a clear graft.

5. In a group of 79 cases selected as having the most favorable prognosis, 68.3 percent of the grafts remained clear.

6. Of 229 cases with preoperative vision of 20/200 or less, 36.2 percent obtained a postoperative vision of 20/100 or better. A group of 58 cases with preoperative vision of 20/200 or less was selected as having the most favorable prognosis. Of these cases, 55.2 percent obtained a postoperative vision of 20/100 or better.

7. The visual results after corneal transplantations in patients with preoperative vision of 20/100 or better do not warrant the risk of the operation.

THE RESPIRATION OF THE STORED CORNEA*

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INTRODUCTION

A better understanding of certain physiologic processes that take place in corneas which are "stored" under various conditions may be gained by measurements of the respiration of the tissue. This method may aid in determining the optimum conditions for preservation of the donor cornea. A number of methods for preservation have been described but most reliable and thorough reports are based on four different techniques for storage, namely: (1) over Ringer's solution in air at 4°C.;[1,2] (2) under oil;[3,4] (3) in formalin;[5,6] (4) at subzero centigrade temperatures.[8,9] A study of the respiratory metabolism changes under these conditions is obviously important.

METHODS

Bovine eyes were used exclusively in this experiment since they were readily available.† The QO_2 of the beef cornea is approximately the same as the human cornea[10] and other mammalian corneas.[11]

On enucleation at the packing plant entire eyes were stored as follows: (1) at 4°C. suspended over Ringer's solution contained in a large sealed thermos jug; (2) under mineral oil at 15°C. The corneas from these eyes were removed at the time of the metabolism studies.

Isolated corneas from freshly enucleated eyes were stored as follows: (1) in commercial formalin (5 percent and 35 percent); (2) in the deep freeze at −40°C.; (3) at −40°C. after quick freezing on the expansion chamber of the carbon dioxide frozen section apparatus. The latter two groups were permitted to thaw immediately prior to being placed in the Warburg flasks.

All investigations of respiratory metabolism were made according to the standard Barcroft-Warburg technique. Each cornea was divided into four segments of approximately equal size before being placed in the Warburg flask containing a Ringer-phosphate buffer with 0- to 2-percent glucose.[12] Manometric readings were made at frequent intervals during 2- to 6-hour periods. The oxygen consumption for each interval was computed in terms of dry tissue weights. From this data a curve was plotted to show the oxygen consumption of each cornea and individual QO_2 values were determined. From these values the average QO_2 for an experimental group was calculated.

RESULTS

1. + 4°C. storage. Over 100 intact eyes were stored by this method. It was found

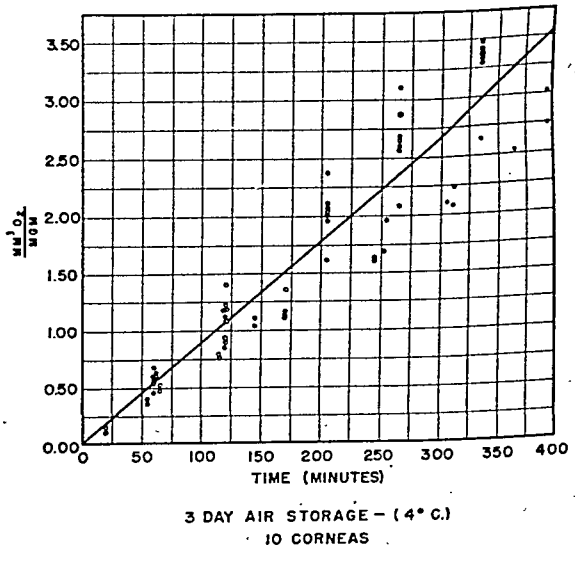


Fig. 1 (Duane). Respiration of 10 corneas from intact eyes stored for three days over Ringer's solution at +4°C. Ordinate: mm.³ O_2 per mgm. dry weight. Abscissa: minutes.

* From the Departments of Physiology and Ophthalmology, Medical Laboratories, State University of Iowa.

† Eyes obtained through courtesy of Gay's Locker, Iowa City, Iowa, and Wilson Company, Cedar Rapids, Iowa.

that if they were removed from the low temperature during the first seven days of storage the corneas respired normally. Figure 1 is a sample curve which shows the data obtained from corneas stored for three days demonstrating that the normal rate of respiration is still present. After seven days the respiration began to fall off (fig. 2). By the tenth day bacterial contamination precluded further investigations.

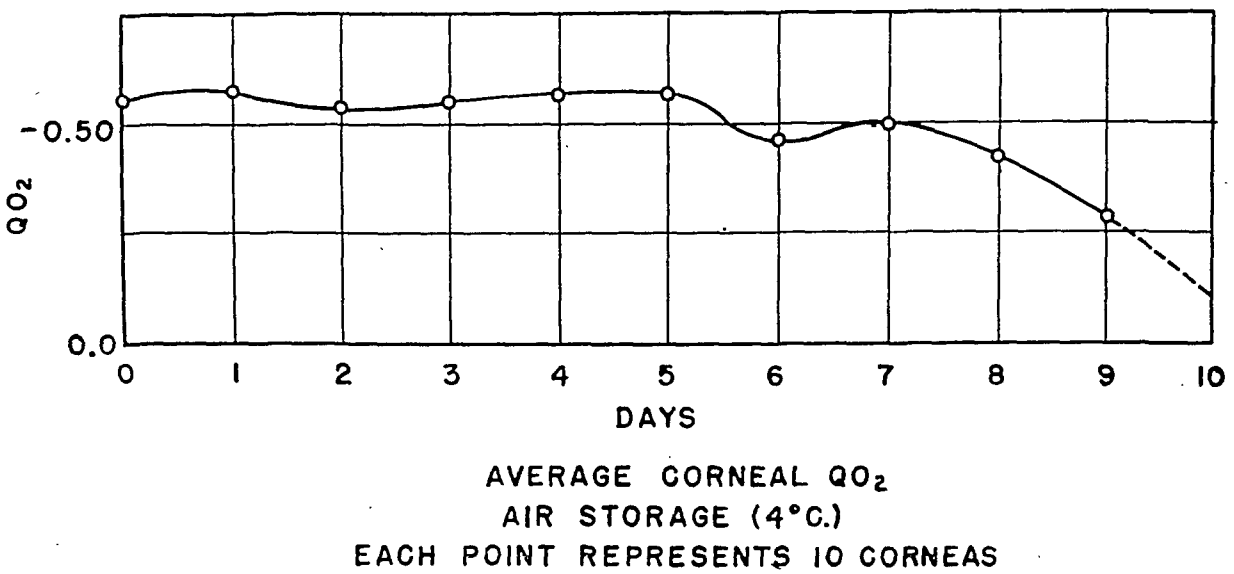


Fig. 2 (Duane). Average QO_2 of corneas from intact eyes stored over Ringer's solution at +4°C. Each point represents 10 corneas.

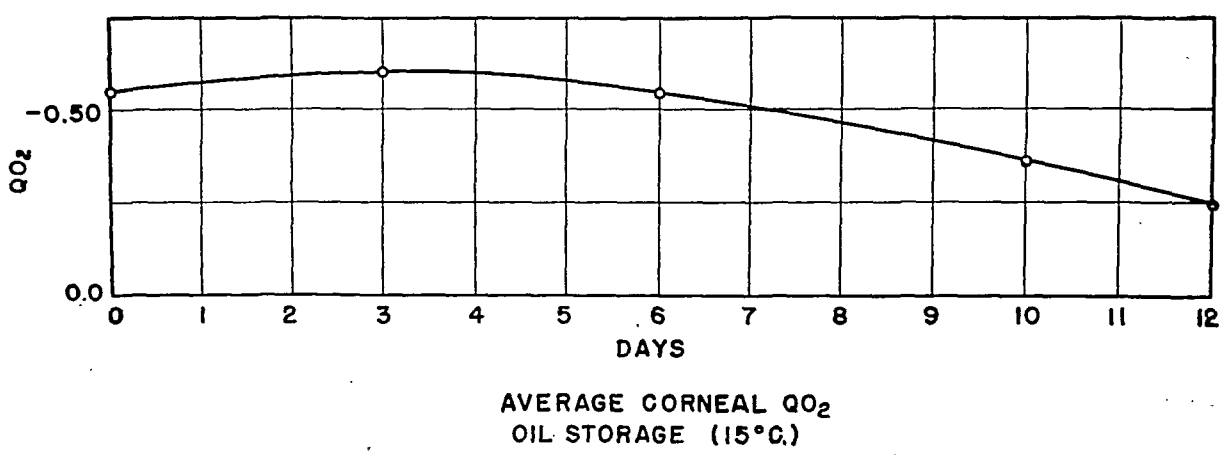


Fig. 3 (Duane). Average QO_2 of corneas from intact eyes stored under oil at +15°C.

2. Storage under oil. Sixteen corneas were studied after a storage period from 3 to 12 days. The results shown in Figure 3 are similar to those found for corneas stored at +4°C. In these experiments also bacterial contamination prevented longer storage periods.

3. Formalin storage. The 11 corneas included in this group did not respire when placed in the manometric flasks. Merely dipping the cornea in either 5-percent or 35-percent formalin completely inhibited the respiration. No respiration appeared after longer storage in these fluids when followed up to four days.

4. Deep freeze, —40°C. Results ob-

tained from 22 corneas in this group are plotted in Figure 4. The QO_2 dropped to one-half normal in 24 hours and within four days had fallen to one-fifth normal where the cornea. However, the reproducibility of the curves presented in this report is evidence of their reliability. Even when the corneal respiration is depressed by low temperatures, readings are obtained which can be plotted upon a straight line. A typical curve, Figure 6, is offered as evidence of the feasibility of this technique in these studies.

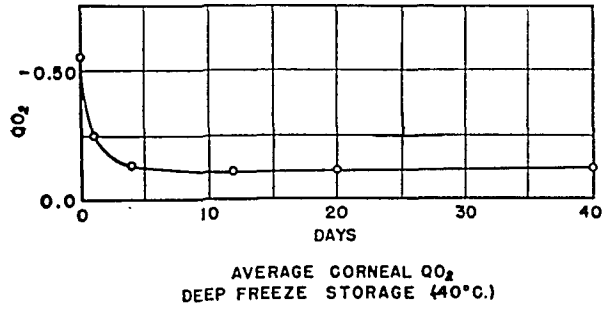


Fig. 4 (Duane). Average corneal QO_2 of isolated corneas stored in the deep freeze at —40°C.

Clinical experience has demonstrated that the storage of donor corneas at low nonfreezing temperatures is only satisfactory for periods of 48 to 72 hours. Longer storage periods almost invariably result in opaque transplants. However, the QO_2 of these corneas remains normal for a considerably longer time than 72 hours.

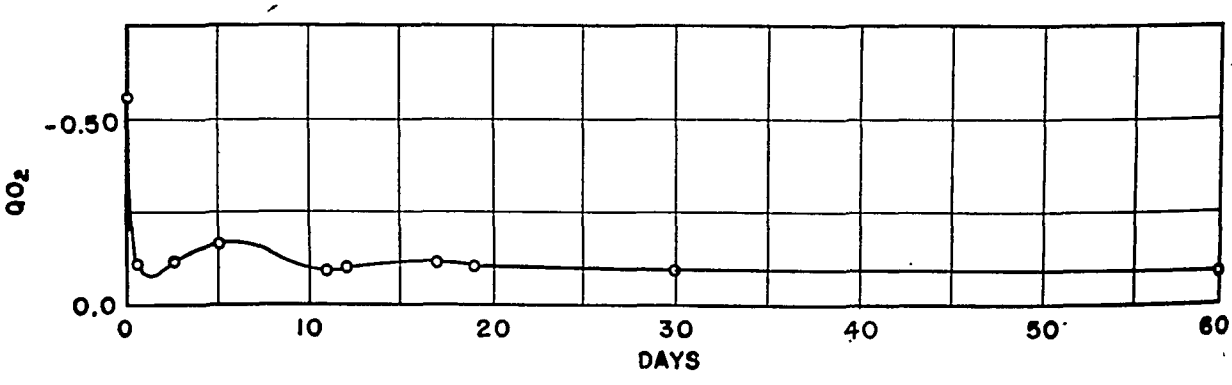


Fig. 5 (Duane). Average corneal QO_2 of isolated corneas stored at —40°C. after quick freezing.

it remained. The absence of bacterial contamination permitted study over a much longer period. At 40 days the QO_2 was still one-fifth normal.

5. At —40°C. after quick freeze. The results obtained on 40 eyes which were included in this group are plotted in Figure 5. Quick freezing reduced the respiration to one-fifth normal and at 60 days it was still at this level.

Discussion

Most mammalian tissues studied with the Barcroft-Warburg technique demonstrate a respiratory rate many times greater than

It was hoped that these experiments might explain the unsatisfactory surgical results on the basis of a change in the activities of respiratory enzyme systems. There appears to be little correlation between the maintenance of a normal QO_2 by a cornea and its suitability for corneal transplantation. However, one should be cautious in transferring the results from bovine corneas to the conditions which exist in human eyes. Furthermore, the present studies do not include measurements of glycolytic activities which may be important for the survival of tissues.

There are certain reports in the literature

that corneas treated with formalin are suitable as donor material for corneal transplants.[5,7] There are many reasons to question these reports[13,14] and the results of the studies reported in this paper cast further doubt on the use of formalin as a storage medium.

The literature on cold death of tissues is well summarized by Heilbrunn,[15] but the actual effect of low temperatures on respiratory enzyme systems is unknown. It is hoped that further investigations may provide answers to some of these questions.

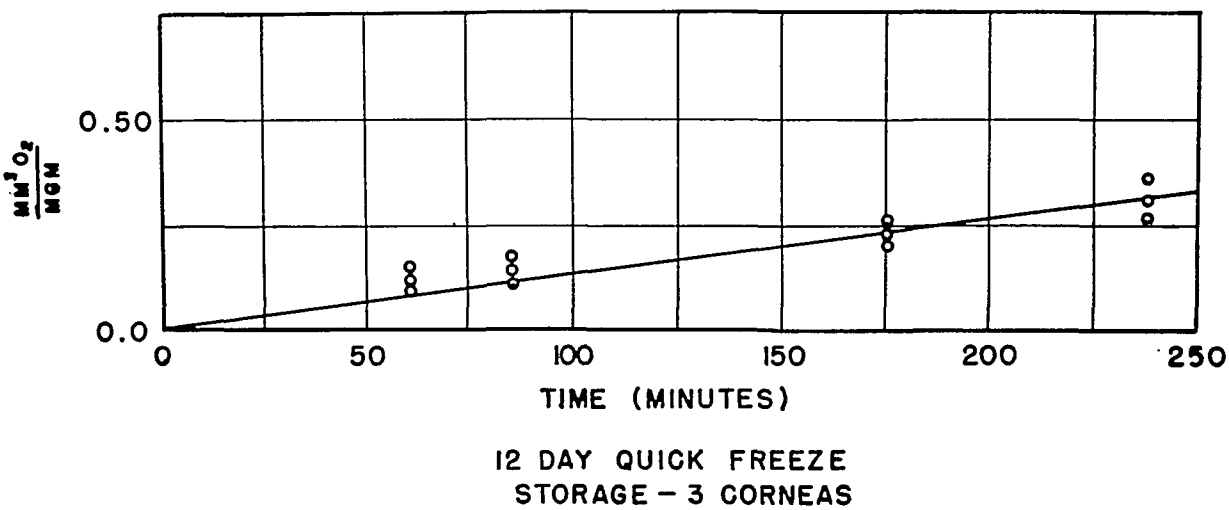


Fig. 6 (Duane). Respiration of three corneas stored for 12 days at —40°C. after quick freezing.

Summary and Conclusions

1. Respiration studies have been made on bovine corneas stored from 1½ hours to 60 days under five different conditions: (1) intact eyes stored above Ringer's solution at 4°C., (2) under oil at 15°C., (3) isolated corneas stored in 5-percent and 35-percent formalin, (4) in the deep freeze at —40°C., and (5) in the deep freeze after quick freezing.

2. The QO_2 of the cornea remains normal when stored over Ringer's solution or under oil at low nonfreezing temperatures for 7 days. The respiratory rate falls to one-fifth normal in 10 to 12 days under these conditions.

3. Formalin inhibits respiration of the cornea immediately and this is apparently irreversible.

4. The corneal QO_2 is reduced immediately to one-fifth normal by quick freezing and drops to this level within 4 days when kept at —40°C. There is no further respiratory depression up to 60 days storage.

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SOME FACTORS IN THE SURGICAL TREATMENT OF VERTICAL DEVIATIONS*

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The uncertainty of postoperative results has deterred many ophthalmologists from attempting the surgical correction of vertical deviations. It is true that such muscle surgery has its disappointments and that there is still much to learn about it, but by taking full advantage of certain known facts, the number of failures can be reduced and more uniform results obtained.

For example, knowledge that most vertical deviations are noncomitant was the first step toward the solution of this problem. Then we began to appreciate the importance of preoperative information on the behavior of the eyes in the six cardinal directions of gaze. The value of accurate measurement of the amount of deviation in the different fields was drilled into us by Duane,[1] White,[2] and others who also showed us that the screen and parallax test was the test par excellence for obtaining such information.

We became increasingly aware of the futility of the old teaching of "tenotomy of the superior rectus is the operation of choice in hyperphoria," for we began to diagnose vertical deviations not as hyperphorias, but as paralyses with or without secondary overactions. The proper surgical treatment is therefore based not only upon the correct preoperative diagnosis of the muscle or muscles involved, but also upon which eye is used for fixation in the different directions of gaze. Failure to consider the presence or absence of a shifting fixation in the preoperative study has done much to increase the variability of the surgical results.

Since most operations upon the vertically acting muscles are designed to give a functional result, they must be more exact. The preoperative studies to be complete should include information on the eye used for fixation in the primary position and in the various directions of gaze. Accepting the general principle that most vertical deviations are of paralytic nature, we can now

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consider the exact procedures available for use in specific paralyses* and show the importance of the fixing eye in determining which operation should be selected.

Paralysis of the superior rectus

The frequency of involvement of this muscle has long been a controversial subject. Duane,[3] White,[4] and others have considered a weakness of the superior rectus to be the most frequent congenital ocular muscle anomaly, and list it high as a cause of ocular torticollis; while Bielschowsky,[5] Adler,[6] and others believe that it is much more frequently due to involvement of one of the oblique muscles. Be that as it may, when the diagnosis of paralysis of the superior rectus is made, the following operative possibilities have to be considered.

Operative choices	Indications
1. Strengthening affected muscle	a. Genuine paresis of superior rectus b. Secondary overaction of inferior rectus of same eye c. Fixation with sound eye
2. Weakening of inferior oblique of opposite eye	a. Slight paresis of superior rectus b. Fixation with paretic eye
3. Weakening of inferior rectus of same eye	a. Secondary procedure b. Fixation with the sound eye.

1. Strengthening of affected muscle

To my mind surgery of this type should be employed when these conditions prevail: (a) Genuine limitation of motility in the field of action of the superior rectus. (b) Secondary overaction of the ipsilateral inferior rectus. (c) Fixation is maintained with the sound eye.

The reasons for selecting a strengthening procedure under these conditions are: (a) To improve the elevating power of the paretic muscle. (b) A shortening of the superior rectus mechanically limits the action of the opposing inferior rectus, hence if the inferior rectus is not spastic, serious interference with the downward movement of the eye may follow. (c) When fixation is maintained with the sound eye, no secondary deviation occurs.

Our operative aim, therefore, should be to strengthen the affected muscle rather than to weaken the normal inferior oblique of the opposite eye. It is well to remember that a shortening of the superior rectus is sometimes followed by a slight ptosis which does not always clear up. For this reason, the muscle should not be resected more than about 6 mm.

2. Weakening of the inferior oblique of the opposite eye

Such a weakening can be effected either by myectomy at the origin of the muscle or by a recession at its scleral insertion. Recent studies have shown that recession is the more exact method and in time will probably supplant the older procedure of removing a portion of the muscle near its origin.

This operation is indicated when (a) The limitation of motility of the affected eye is minimal. In these cases, there is no need for increasing the upward motility of the paretic eye. (b) When fixation is maintained by the paretic eye—thus causing a secondary overaction of the contralateral inferior oblique.

For some unexplained reason, in most cases with a slight weakness of the superior rectus, the paretic eye is used for fixation; hence, the widespread belief that a weakening of the inferior oblique of the opposite eye is the operation of choice in all such cases.

Failure to consider which eye is used for fixation accounts for the variable results reported from the use of this procedure. If it is employed when the heretofore mentioned conditions prevail, the results will be remarkably uniform. In rare instances, a

*The term paralysis is loosely used to denote any degree of weakness.

marked paralysis of the superior rectus and secondary spasm of the opposite inferior oblique coexist, requiring the use of both of these procedures.

3. Weakening of the inferior rectus of the same eye

This operation is the procedure of choice when the primary condition is a fibrosis of the inferior rectus which simulates a paralysis of the superior rectus. Such a condition is a common finding in fracture of the floor of the orbit. In these cases, upward motility is impossible because of the adhesions present along the floor of the orbit. Marked improvement in upward rotation follows a recession of the inferior rectus. In all cases of true paralysis of the superior rectus, weakening of the inferior rectus of the same eye is used only as a secondary procedure when the initial strengthening of the paretic muscle has failed to inhibit to a sufficient degree the overactivity of the spastic inferior rectus.

Paralysis of the inferior rectus

A similar analysis of these cases shows the operative choices to be:

Operative choices	Indications
1. Strengthening affected muscle	a. Genuine paresis of inferior rectus b. Fixation with sound eye
2. Weakening of superior oblique of opposite eye	a. Slight paresis of inferior rectus b. Fixation with paretic eye

1. Strengthening of affected muscle

This type of surgery is indicated in those cases showing (a) Genuine limitation of motility in the field of action of the inferior rectus. (b) Fixation with the sound eye. Such an operation may be followed by a slight overcorrection in upward gaze. It is well, therefore, to proceed cautiously unless the deviation is pronounced above as well as below the horizontal plane.

2. Weakening of the superior oblique of the opposite eye

The superior oblique has long been regarded as "noli me tangere;" yet, in carefully selected instances, the surgical weakening of this muscle has produced satisfactory results. The methods for weakening this muscle are: (a) Dislocating the pulley and allowing it to recede into the orbit. The technique of this operation as described by Hughes and Bogart[7] consists of making a small skin incision over the trochlea and displacing it with a periosteal elevator. It produces an effect similar to that caused by an external sinusotomy. (b) Tenectomy of the reflected portion of the tendon within its capsule. This operation recently described by Berke[8] is simple in its execution and effective in reducing the action of the superior oblique without causing a complete paralysis.

Sufficient time has not elapsed to allow a final appraisal of these operations, but at present the latter one bids fair to become an established procedure. Weakening of the superior oblique is indicated in those cases of paralysis of the inferior rectus where fixation is maintained by the paretic eye, thereby producing a marked overaction of the contralateral superior oblique. Such a condition usually exists when the paresis is slight and no great limitation of motility exists in the field of the affected inferior rectus, and fixation is maintained with the paretic eye.

Paralysis of the superior oblique

This muscle is frequently involved and many of these cases require surgery for relief from distressing diplopia. The operative measures to be considered are:

Operative choices	Indications
1. Strengthening affected muscle	a. Genuine paresis of superior oblique b. Marked torsion of image c. Fixation with scund eye

2. Weakening of inferior rectus of opposite eye	a. Slight paresis of superior oblique b. Fixation with paretic eye
3. Weakening of inferior oblique of same eye	a. Secondary spasm of this muscle

1. STRENGTHENING OF AFFECTED MUSCLE

Using the same diagnostic criteria this is the method of choice when there is (a) Genuine limitation of motility in the field of action of the superior oblique. (b) Fixation with the sound eye. Such a strengthening operation is an elaborate surgical procedure first described by Wheeler,[9] in 1934, and more recently modified by McGuire[10] and others. It involves reflecting the superior rectus and either shortening or advancing the superior oblique. Although its usefulness is limited, in cases of paralysis of the superior oblique with marked torsional disturbance, it does much to rid the patient of the annoying tilting of the object.

2. WEAKENING OF THE INFERIOR RECTUS OF THE OPPOSITE EYE

Paralyses of the superior oblique such as result from radical sinus surgery are rarely complete, yet they are sufficient to cause most distressing symptoms. In such instances where (a) The limitation of motility is slight and (b) fixation is maintained with the paretic eye, a recession of the inferior rectus of the opposite eye often produces a most gratifying result.

Such an operation must be guarded to avoid overcorrection. Rarely is it advisable to do more than 2 to 3 mm. Another distressing complication that follows too generous a recession of the inferior rectus is a dropping down of the lower lid with the resultant exposure of bulbar conjunctiva between the lower limbus and lid margin.

3. WEAKENING OF THE INFERIOR OBLIQUE OF THE SAME EYE

This is the operation of choice when the inferior oblique of the same eye manifests a definite overaction which is not an uncommon finding in long-standing cases of paresis of the superior oblique. The spasmodic upshoot can be satisfactorily corrected by a recession of this muscle, but it will have little or no effect on the deviation in the lower field. Its use is therefore recommended only in those cases with secondary spasm of the inferior oblique.

PARALYSIS OF THE INFERIOR OBLIQUE

Isolated paralysis of this muscle occurs not too infrequently as a congenital anomaly. It is most often a unilateral affair, but in rare instances both eyes are similarly affected. They rarely cause discomfort and, in my judgment, are usually best left alone. If one contemplates surgery, the following possibilities have to be considered.

OPERATIVE CHOICES	INDICATIONS
1. Strengthening affected muscle	a. Genuine paresis of inferior oblique b. Fixation with sound eye
2. Weakening of superior rectus of opposite eye	a. Slight paresis of inferior oblique b. Fixation with paretic eye

1. STRENGTHENING OF AFFECTED MUSCLE

This can be accomplished by a tucking or a shortening at or near its scleral insertion, or by advancing the muscle over the orbital margin as described by Wheeler.[9] Neither of these procedures has proven very satisfactory in my hands, but in rare instances when the paralysis is more or less complete and fixation is maintained with the sound eye, one of these surgical measures should be used.

In the cases in which there is a paralysis of both the superior rectus and the inferior oblique of the same eye, fixation is usually maintained with the sound eye. Under these conditions, the proper operative procedure consists of strengthening both of the paretic muscles.

2. Weakening of the superior rectus of the opposite eye

Recession of the contralateral superior rectus is used in those cases where the paralysis is incomplete and fixation is maintained with the paretic eye.

Summary

Recent knowledge has shown that most vertical deviations are of paralytic origin. Selection of the proper operative procedure in a given paralysis depends not only upon the amount of deviation present in the different directions of gaze, but also upon the eye used for fixation. The surgical treatment of each type of paralysis is reviewed, showing the importance of the "fixing eye" in the selection of the proper surgical approach.

635 West 165th Street (32).

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ANTISTINE IN OCULAR ALLERGY*

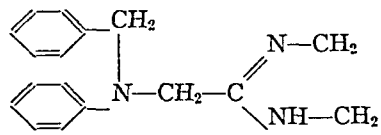
PAUL HURWITZ, M.D.
Chicago, Illinois

The treatment of the ocular symptoms of itching, lacrimation, photophobia, and secretion in hay fever and allergic conjunctivitis has thus far proved largely unsatisfactory. Little sustained relief for these irritating symptoms is derived from the countless drugs in our medical armamentarium. The drugs include the astringents, vasoconstrictors, soothing agents, local antiseptics, anesthetics, and combinations of several of these medications. More recently the use of vitamins in ointments, locally and orally, has been recommended. All these have been supplemented by the administration of calcium.

Desensitization with pollens and other specific allergens has had less effect on the ocular symptoms than on other symptomatology. Moreover, patients suffering from ocular symptoms alone are reluctant to submit to the prolonged desensitization therapy. Measures directed toward hygienic surroundings and the removal of foci of infections are ineffective in the treatment of allergic episcleritis, phlyctenular keratitis, iritis, uveitis, and endophthalmitis. Air-conditioned surroundings, ocean voyages, trips to seaside resorts and pollen free areas are not available to all, nor is the search for relief always rewarded.

The recent development of the chemical antihistaminic agents shows promise in relieving the symptoms of occular allergy. However, the oral use of benadryl and pyribenzamine has been more effective in relieving the symptoms of allergic bronchitis, rhinitis, and urticaria than the ocular symptoms. The itching, lacrimation, photophobia, blepharospasm, and secretion in many cases of hay fever, allergic conjunctivitis, blepharitis, keratitis, and dermatitis have not been adequately alleviated. To determine the extent of symptomatic relief in the ocular allergies, Antistine, prepared as a solution, was used in a series of cases.

Antistine† is the trade name for a new antihistaminic preparation. The chemical formula is phenyl-benzyl-aminomethylimidazoline. Its structural formula is:



Solutions for ocular topical application contain the sulphate salt in 0.5-percent concentration with a pH of 6.9 in an isotonic buffered solution of the following formula:

Antistine sulphate	18.75 gm.
Sodium carbonate anhydrous	2.66 gm.
Boric acid U.S.P.	46.50 gm.
Potassium chloride	27.75 gm.
Distilled water	3,750.00 cc.

The only previous report of its ophthalmic use is by Bourquin,[1] who reported on it in 37 cases, including conjunctivitis, keratoconjunctivitis, scleritis, iridocyclitis, and ocular trauma. However, there were only a few cases of ocular allergy.

OCULAR ALLERGY

Allergy may affect any portion of the eye or adnexa as has been frequently reported. Bothman,[2] in a comprehensive monograph on ophthalmic manifestations of allergy, cites numerous cases to this effect. Local reactions may attack the lids, conjunctivas, and cornea. General reactions may attack these structures as well as the episclera, sclera, iris, choroid, optic nerve, retina, and

* Presented before the Chicago Ophthalmological Society, February 16, 1948.

† Manufactured by Ciba Pharmaceutical Products, Inc.

extraocular muscles or nerve pathways of the eye.

Allergic reactions of the eye are usually associated with allergic conditions elsewhere in the body, especially with allergic rhinitis and gastrointestinal disorders. Many of my patients had an allergic rhinitis and several were taking atropine by mouth for "spastic" intestinal disorders. A familial history of allergy is common.

Common causes

The most common causes of ocular allergy are found in the categories of inhalants, ingestants, and contactants. Among the inhalants, frequent offenders are the pollens of trees, weeds, and grasses; animal danders, house dust; the seed of cotton, flax, and kapok; and the molds of alternaria and penicillium.

Heading the food list (ingestants) are the cereals, egg, milk, nuts, fish, chocolate, meats, fruits, vegetables, and spices. Among the contactants are poison ivy, silkworm, wool, perfumes, cosmetics, lacquers, orris root, and various drugs applied locally.

Allergic reaction

The allergic reaction is characterized by a spasm of smooth muscle (in the eye: the iris, ciliary body, arteries, and arterioles), capillary dilatation, and increased permeability. Capillary permeability results in tissue edema with serum and fibrin, leukostasis, and erythrostasis.

Duggan,[3] citing Ricker, explains this reaction as follows: Various stimuli cause constriction of all terminal vascular elements (arterioles). The capillaries become fatigued and relax. There is a subsequent slowing of the blood stream in the capillary bed and a resultant terminal anoxemia. The lack of oxygen causes an increased permeability of the capillary walls. The perivascular exudate presumably contains irritating and toxic H products (histamine) or the end results of antigen-antibody reaction. Duggan aptly states that the "pathologic changes of allergy are due to vascular reactions which are physiologic in nature but pathologic in degree."

Immunologic explanation

The accepted immunologic explanation of allergy assumes that allergic symptoms do not occur in individuals inherently capable of developing allergic manifestations on first contact with the allergen. This is explained on the basis that normal cells contain no antibody (reagin). Antibody production is stimulated by the initial contact. After a suitable contact and incubation period, reagin will be present in the cells. Upon second exposure to the antigen, the antigen combines with the reagin in the cells and H substances or histamine are released. This is in effect anaphylaxis. In individuals being treated with desensitization, a new antibody is formed which neutralizes the antigen and prevents the antigen from reaching the reagin in the cells. This prevents the production of H substances. No allergic reaction occurs if there is sufficient neutralizing antibody to inactivate all of the antigen.

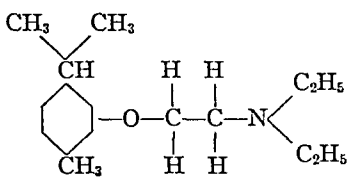
Antihistaminic agents are presumed to be effective through neutralization of the H substance or through replacement of the space in the cell that might be occupied by histamine. There is experimental evidence to support this contention. Parenthetically, it may be mentioned that the action of the sympathomimetic drugs, epinephrine, ephedrine, and propadrine hydrochloride, do not have a specific immunologic or chemical action in the allergies. They exert their antiallergic action on the basis of their vasoconstrictor properties. In structure all antihistaminics are basically alike in that they contain the ethylenediamine group. The attached number and structure of radicals differ.

Chemical antihistaminic agents

The development of the chemical antihistaminic agents has been summarized by

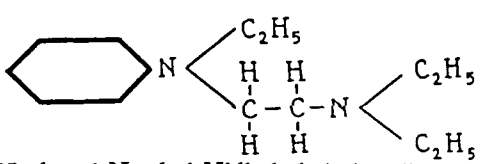
Feinberg.[4] However, since there is little disquisition of the antihistaminic agents in ophthalmic literature, it may be well to devote some space to their history. The awareness of the association of the anaphylaxis and allergic reactions, and the recognition of histamine as an important factor in both conditions, stimulated scientific effort toward neutralizing and rendering ineffective the H factor. In 1933, certain phenolic ethers were found to be effective in counteracting the action of histamine and its anaphylactic properties. Subsequent efforts to discover more effective and less toxic agents resulted in a series of drugs.

The evolvement of the antihistaminic drugs commenced with Fourneau's[5] study of one of the phenolic ethers. This was found to be antianaphylactic and antihistaminic in vivo and in vitro. It is protective against two lethal doses of histamine in the guinea pig, is locally anesthetic, but too toxic. The formula is:



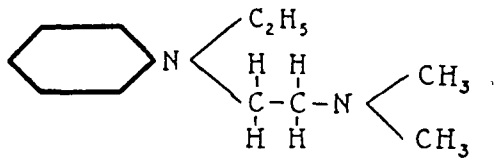
2-isopropyl-5-methylphenoxyethyldiethylamine (Fourneau).

Another chemical agent, in which the ethylenediamine radical was substituted, was explored by Staub[6] and found to be antianaphylactic, protecting the guinea pig against 2 to 6 lethal doses of histamine. It is also antihistaminic but likewise too toxic. The formula is:



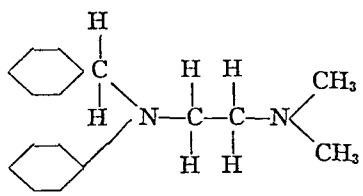
N-phenyl-N-ethyl-N'diethylethylenediamine.

Halpern[7] substituted the dimethyl for the diethyl group. This resulted in a drug of higher antianaphylactic action, protective against 8 to 10 lethal doses of histamine administered to the guinea pig. The chemical formula is:



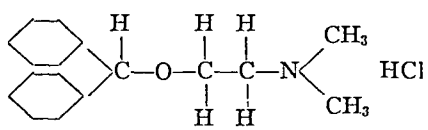
N'phenyl-N'ethyl-N-dimethylethylenediamine.

Antergan was also studied by Halpern. This compound is formed by substituting a benzyl-group for the ethyl group. This chemical agent, in addition to being antianaphylactic and antihistaminic, is also antiallergic, less toxic than the other products and affords protection against 40 lethal doses of histamine. The structural formula is:



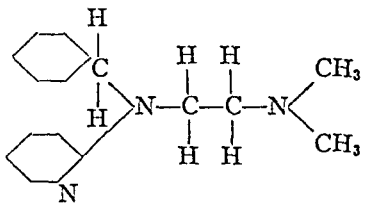
N'phenyl-N'benzyl-N-dimethylethylenediamine.

Benadryl hydrochloride made its appearance in this country as an antiallergic agent. It is effective in urticaria, dermatitis, and asthma. Frequent side reactions are dizziness and drowsiness. The structural formula is:



Beta-dimethylaminoethyl benzohydryl ether hydrochloride.

Pyribenzamine differs from antergan in the substitution of the pyridil for the phenyl ring. It is antiallergic, effective in urticarial dermatoses, hay fever and vasomotor rhinitis, and asthma. The side reactions are not serious and consist primarily of drowsiness and lassitude. The structural formula is:



N'pyridil-N'benzyl-N-dimethylethylenediamine.

Pharmacologically, it has been determined[8] that Antistine has a very low toxicity, does not accumulate rapidly, and has strong antihistaminic activity. This latter activity has been demonstrated by its ability to negate the stimulating effect of histamine phosphate on the isolated ileac strip of the guinea pig.

Antistine also prevents bronchial spasm, produced by histamine in the isolated perfused lung of the guinea pig and in the living animal, and it decreases appreciably the hypotensive action of histamine in dogs. This holds true in local as well as general application. Antistine does not inhibit antibody production. The protection afforded by the antihistaminic property of Antistine permits a greater antibody production by allowing the animal to tolerate a larger amount of the injectable antigen.

Clinically, Schindler[9] found Antistine, used orally, subcutaneously, and intravenously, an effective antiallergic agent in 39 patients. This group included bronchial asthma, urticaria, pruritis, and erythema nodosum.

Brach[10] reports that Antistine counteracts the itching of urticaria, eczema, neurodermatitis, prurigo, lichen ruber planus, psoriasis, and nervous pruritus. In urticaria the skin changes are counteracted or prevented. Brach states, too, "Antistine seems to suppress the itching regardless of whether it is elicited by sympathicotonic or parasympathicotonic factors, which seems to indicate that the itching is always produced by H substances."

Antistine also achieves some effect through its peripheral influences on the vasomotor action that evokes the itching. Liberated histamine thus is prevented from exerting its effect. In addition to this action there is a slight local anesthetic action. Antistine orally is well tolerated. No serious side effects have been observed. Occasional complaints are nausea, epigastric distress, vertigo, palpitation, flushing, and drowsiness.

Case reports

Presented are 50 cases of ocular allergy. For the purposes of this study, the cases are divided into the following groups:

1. Hay fever with simple allergic conjunctivitis.
2. Hay fever complicated by other allergens and by pathologic conditions other than conjunctivitis.
3. Allergic conditions other than hay fever.
4. Vernal catarrhal conjunctivitis.
5. Palpebral urticaria, dermatitis (eczematoid and atopic), and angioneurotic edema.

No effort is made to justify this classification, except that the cases seem to be best suited to this division. In none of the cases were blood studies or conjunctival smears for eosinophilia made. In each case there was adequate clinical evidence to warrant the diagnosis. In most instances, skin tests were made. Cases which did not meet standard criteria to establish the diagnosis of ocular allergy were not included in this series.

Group 1. Hay fever with allergic conjunctivitis

In this group are 15 cases of typically characteristic hay fever with allergic palpebral conjunctivitis. The ragweed pollen was the dominant factor in the production of the symptoms. Although skin tests in many of these cases revealed hypersensitivity to other antigens, this hypersensitivity was subclinical.

Mrs. N. H. had complained for 5 years of seasonal sneezing, coughing, nasal discharge with

ocular itching, tearing, and redness. These symptoms coincided with the hay-fever season and were unusually severe this past year. There were present a typical allergic conjunctivitis with edematous palpebral conjunctivas and an allergic rhinitis with pale and boggy nasal mucosa. Skin tests were strongly positive to ragweed, cockle burr, wormwood, and many foods. Previous local treatment with many ophthalmic preparations were without value. Benadryl and pyribenzamine, orally, relieved mildly the sneezing and coughing but did not alleviate the ocular symptoms. One drop of Antistine ophthalmic solution completely relieved the ocular itching and tearing for periods of 4 to 6 hours. Three drops in each eye daily gave total relief from all ocular symptoms. The Antistine solution was used for a period of 6 weeks with constant relief. A momentary smarting sensation followed the instillation of the solution.

Fourteen additional cases of typical hay fever with allergic conjunctivitis are presented. For the sake of brevity, comment is made solely on differing aspects of symptomatology or response to treatment.

Mrs. E. E. had typical hay fever and allergic conjunctivitis and was taking atropine orally for a "spastic colon." She complained of blurring of vision and itching of both eyes. She was hypersensitive to ragweed. One drop of Antistine solution, instilled locally twice daily, completely relieved the itching and the blurring of vision.

C. G., aged 10 years, had hay fever with follicular conjunctivitis, itching, and secretion of both eyes. Complete relief from the itching and secretion was obtained with one drop of Antistine ophthalmic solution instilled every morning. The size of the conjunctival follicles was visibly reduced following the instillation of the solution. Constant ocular rubbing was obviated.

Mrs. E. C., with typical hay fever of many years' duration, complained of blurring of vision, ocular itching, nasal stuffiness, and a tickling sensation of the throat. One drop of Antistine solution daily completely eliminated the blurring and itching.

Mrs. E. H. had typical hay fever. She complained of a distressing ocular heaviness, epiphora, and itching. Adrenalin, neosynephrine, and boric-acid irrigations gave no relief. One drop of Antistine solution completely relieved all symptoms for 6-hour periods for the first 3 days. After the third day, only one drop a day was necessary to give total symptomatic relief.

J. C., aged 9 years, had hay fever with allergic conjunctivitis, rhinitis, and bronchitis. He suffered sneezing and wheezing and complained of ocular itching, secretion, a burning sensation, and the intense desire to rub his eyes. One drop of Antistine solution instilled in both eyes, morning and night, gave complete relief from all ocular symptoms. After the first week, one drop each night relieved all symptoms and the patient no longer rubbed his eyes (to the mother's great relief). The side reaction to the Antistine consisted of a momentary burning and a "watery sensation."

C. R., aged 8 years, had typical hay fever with sneezing and ocular irritability. She could not tolerate Antistine solution because of the intense smarting sensation following instillation.

Miss P. H. had typical hay fever with rhinitis and conjunctivitis each summer for several years. The palpebral conjunctivas were hyperemic and thickened. She obtained complete relief from ocular itching and epiphora by using one drop of Antistine solution, daily, in both eyes for two days and then one drop every second day. After one week the solution was stopped. For 12 days she was symptom free. She then used one drop in each eye for several days, and discontinued the solution 3 weeks before the termination of the hay-fever season. She continued asymptomatic for the remainder of the pollen season, despite a high pollen count.

Mrs. T. F. had typical hay fever with severe itching and tearing for many summers. (Her son had a vernal conjunctivitis.) Her symptoms were completely relieved by one drop of Antistine solution 3 times a day. Neosynephrin and estevin were prescribed as control measures during the hay-fever season. She stated that these drugs did not compare favorably with Antistine in the degree of relief obtained. She experienced severe momentary burning upon instilling Antistine.

Mrs. M. S. is a typical hay-fever patient with distressing ocular lacrimation and photophobia. She had subjected herself to every known therapy, including the antihistaminics orally, but without relief. Even air-conditioned surroundings gave only mild comfort. Antistine ophthalmic solution gave immediate and prolonged relief from the lacrimation, photophobia, and itching and even relieved her rhinorrhea and sneezing.

Mrs. E. B. developed hay fever with typical ocular symptoms during the course of an attack of endophthalmitis and keratitis, which complicated a cataract extraction performed elsewhere. Treatment with atropine produced an atropine dermatitis. Antistine solution relieved the symptoms of the eczematoid dermatitis. One drop a day, for 6 days, controlled the ocular symptoms of the hay fever and, thereafter, treatment was not necessary. This improvement occurred before the end of the hay-fever season. Surprisingly, intensive antihistaminic therapy resulted in an accelerated improvement in the endophthalmitis. It is likely that the pathologic conditions in this case may have had an allergic basis.

Mrs. E. H. had characteristic hay fever with rhinitis and conjunctivitis. She complained of itching and tearing of both eyes. She was sensitive to ragweed, silk, and wool. One drop of Antistine solution, 3 times daily, relieved completely the symptoms. An unexplained skin lesion of both cubital spaces disappeared after the institution of an antiallergenic regimen.

Mr. G. C. had typical hay fever with ocular

itching and tearing. Skin tests were positive to ragweed. On September 15th he was given Antistine solution. He used two drops, 3 times daily, in both eyes for 3 days. At this time, prior to the end of the hay-fever season, he became symptom free and discontinued the use of the Antistine solution.

M. I., aged 10 years, had hay fever with ocular tearing for several years. Desensitization was without effect. The tearing ceased with the use of Antistine solution.

H. S., aged 6 years, had seasonal allergic conjunctivitis with itching, redness, and secretion of both eyes. (The patient's mother was allergic to foods and pollens.) Antistine solution completely eliminated the symptoms.

Comment

Several observations can be made from this group of cases. All patients, except one, obtained immediate and dramatic relief from all ocular symptoms with the use of Antistine ophthalmic solution. The amount of solution necessary to allay the itching, tearing, and lacrimation varied from one drop 3 times a day to one drop every second day. Several patients experienced extended periods in which ocular therapy was unnecessary. Other patients were able to discontinue the Antistine solution prior to the termination of the hay-fever season. This indicates a cumulative therapeutic effect of the action of the antihistaminic agent when applied locally. It is apparent that the antihistaminic agent successfully combats the histamine for space in the cell when applied locally, as well as systemically.

In most instances the local application of Antistine ophthalmic solution causes temporary smarting of varying degree. No other significant side reactions were noted in this series.

In two instances, where blurring of vision was present (one case where the patient was taking atropine by mouth), the use of Antistine solution relieved the blurring.

In most patients, Antistine did not alter the pathologic status of the conjunctivas, except to contract the superficial vessels slightly. In one case of follicular conjunctivitis, the size of the follicles was noticeably reduced following instillation of Antistine.

A comparison of the value of Antistine ophthalmic solution with other ocular medications in relieving the ocular symptoms of hay fever, was greatly in favor of Antistine. This pertains to degree and duration of relief. Use of the solution also proved superior to air-conditioned surroundings.

Group 2. Hay fever associated with other allergens and pathologic conditions

In this group are cases in which the ragweed pollen was a major, but not the sole, antigenic factor. Other ocular pathologic conditions besides allergic conjunctivitis existed.

H. G., aged 13 years, complained of ocular itching, photophobia, redness, and intense blepharospasm. The symptoms were perennially present but were exaggerated during August and September. The palpebral conjunctivas were injected, boggy, and hypertrophic. Skin tests revealed a hypersensitivity to ragweed, molds, dust, and many foods. Previous treatment, consisting of desensitization, and of adrenalin, neosynephrin, estevin, and many collyria locally, failed to give even moderate symptomatic relief. During the summer months, photophobia and blepharospasm were intense in the presence of sunlight. Antistine ophthalmic solution, instilled locally 4 to 5 times a day, gave complete ocular relief. After prolonged use of the Antistine, the palpebral conjunctivas assumed a normal appearance.

Mrs. D. R. complained of itching, burning, and photophobia all year round. She was hypersensitive to the glare of snow and sun. During the hay-fever season there was a typical allergic conjunctivitis. One drop of Antistine solution, every second day, relieved all symptoms.

Mrs. E. B. had hay fever, perennial conjunctivitis, rhinitis with sneezing, and itching, burning, and redness of both eyes. In addition, she had frequent recurrent hordeola. One drop of Antistine, daily, relieved all symptoms. Oral antihistaminics had no effect on the ocular symptoms. The occurrence of bacterial infection and hordeola on a fertile allergic soil is noted. For the past 6 months, with the use of the solution, there have been no styes nor injection of the lid margins.

A. C., aged 20 years, has had typical hay fever for the past two summers. He complained of severe itching, redness, and discomfort of both eyes. The palpebral conjunctivas of both eyes were injected, succulent, and presented the characteristic

picture of an acute catarrhal conjunctivitis. Five-percent sodium sulfathiazole solution was prescribed. Its use for 10 days resulted in an improvement of the conjunctival injection and succulence, but the itching and ocular discomfort did not abate. Antistine ophthalmic solution was then used and the symptoms were immediately mitigated. For the first week, three drops daily were required, but thereafter only one drop per day was necessary to obtain complete symptomatic relief. The palpebral conjunctivas reverted to normal one week after treatment with the Antistine solution was instituted. Skin tests were strongly positive to ragweed, house dust, many foods, and vitamin C. Represented here is an acute conjunctivitis superimposed upon an allergic base. The use of Antistine solution prior to the sulfathiazole solution was not effective. A combination of the two might have proved successful.

Miss C. W. suffered from typical hay fever with ocular itching for several years. Prior to the onset of the hay-fever season, she had two attacks of acute iritis, and was seen by me during the second. In addition to other therapy, 30-percent sodium sulfacetimide solution, locally, was prescribed. This resulted in an allergic palpebral dermatitis and conjunctivitis. The patient was treated with Antistine ophthalmic solution and Antistine tablets (400 mg.) daily. The iritis, dermatitis, and conjunctivitis rapidly improved. Thereafter, during the hay-fever season, one drop of Antistine ophthalmic solution, every 2 or 3 days, controlled the ocular itching. The boggy conjunctivas became normal in appearance. Skin tests were positive to grasses, molds, trees, house dust, sulfathiazole, and many foods. In this case, the allergic etiology of the iritis was unsuspected until the reaction to the sulfacetimide developed. The prompt response to antihistaminics was further verification of the allergic etiology.

D. D., aged 9 years, with a familial history of allergy, suffered from perennial itching, epiphora, and recurrent redness of the eyes. During the hay-fever season, the condition was aggravated. Previous therapy, with zinc, adrenalin, boric acid, estevin, and various ophthalmic ointments, resulted in only mild relief. When the patient was seen in the spring of the year, there were present characteristic boggy palpebral conjunctivas, a limbal injection, and punctate areas of corneal tumefaction in each eye. Antistine ophthalmic solution, instilled 3 to 4 times a day, relieved all ocular symptoms. The pathologic conditions subsided during the hay-fever season, while on Antistine solution treatment, and the ocular symptoms were so mild that medication was felt unnecessary for periods of weeks. This is a case of typical hay fever with perennial allergic manifestations of limbic keratoconjunctivitis.

Miss M. Z. suffered with recurrent corneal ulcerations for 13 years. For the first 10 years, these occurred only in the summer, but more recently have occurred several times a year. The duration of the attacks varied from a few weeks to several months. Severe photophobia, blepharospasm, lacrimation, and redness of the eyes were present. There was a hypersensitivity to many antigens including pollens and dust. With the slitlamp, numerous diffuse areas of corneal infiltration, ulceration, and extensive superficial vascularity were noted. Every known therapy was applied without appreciable effect. Antistine tablets (400 mg. daily) orally, and Antistine solution, 3 times daily in both eyes, were administered. After therapy for one week, the patient stated she had experienced "100-percent relief." Antistine solution markedly decreased the corneal vascularity.

B. H., aged 15 years, complained of ocular itching throughout the year. Skin tests revealed hypersensitivity to ragweed, wool dust, and tree pollens. One drop of Antistine solution every morning in both eyes gave complete relief from the itching.

Comment

In this group are cases of hay fever, associated with other allergens and pathologic conditions besides allergic conjunctivitis. Included are bacterial complications. Presented are cases of allergic iritis, limbic keratoconjunctivitis, infiltrative and ulcerative keratitis, and allergic conditions, complicated by acute catarrhal conjunctivitis and recurrent hordeola. The two patients, who had intense hypersensitivity to the glare of sun and snow, disproportionate to the pathologic conditions present, may be considered cases of physical allergy. All patients in this group showed a remarkable response to Antistine ophthalmic solution.

Group 3. Ocular allergy without hay fever

Mr. N. Z. was undergoing desensitization treatment for a perennial allergic asthma at a Veterans hospital. He complained of constant ocular itching and redness of the lids for 4 years. Skin tests revealed a hypersensitivity to a number of foods including beef, tea, spinach, and apples. Characteristic allergic palpebral conjunctivitis was present with a superimposed subacute catarrhal conjunctivitis. One drop of Antistine ophthalmic solution daily gave complete relief from ocular itching and the redness of the lids subsided. The palpebral conjunctivas assumed a normal appearance. Previous treatment with other medication had been unsuccessful.

R. G., aged 14 years, complained of recurrent itching and tearing of both eyes for two years.

There was a typical mild allergic conjunctivitis. Skin tests were positive to many foods, kapock, and feathers. Antistine ophthalmic solution, used twice a day, completely relieved the itching and tearing. Other medication, previously used, was to no avail.

Mr. N. M., aged 29 years, complained of a marked redness of the lid margins and ocular discomfort for many years. He gave a history of recurrent attacks of hives and sneezing. Of numerous local medications used, neosynephrin, ⅛-percent solution, and penicillin solution gave some relief. Skin tests were positive to many foods, including fish and coffee, and strongly positive to house dust. Antistine ophthalmic solution, 3 times daily, completely relieved the ocular discomfort and decreased the hyperemia of the lid margins. The patient stated that his eyes "felt fine." However, a moderate redness of the lid margins persisted even after prolonged treatment. In this case it is felt that the therapeutic response was not complete because of the hypersensitivity to dust. On a trip to New Orleans he partook of fish and coffee and developed a marked palpebral urticaria, which promptly responsed to Antistine, locally and orally.

Mrs. R. S. complained of itching and pain in both eyes. There was a mild hyperemia of the palpebral conjunctivas. Skin tests revealed a marked sensitivity to wool products. Antistine ophthalmic solution was prescribed. The patient instilled only one drop in one eye and experienced a hollow sensation in the eye and a sinking sensation in the epigastrium. This case is presented as an unusual side reaction to the Antistine solution, possibly on a basis of vagus stimulation. The patient dreaded the use of the solution and would not permit its repetition.

Mrs. F. K. had recurrent attacks of ulcerative blepharoconjunctivitis for many years. She also had recurrent attacks of hives, rhinitis, and periodic swelling, scaling, and itching of the skin of the upper lids. There was present a typical allergic conjunctivitis. When first seen the patient was using sulfathiazole ointment for the ulcerative marginal blepharitis and the condition was increasingly worse. Penicillin ointment likewise aggravated the situation. Skin tests were positive to wool products, many foods, fingernail polish (lacquer), and cat hair. Antistine ophthalmic solution was prescribed and used for one week with no apparent improvement. Penicillin, in solution, was then prescribed for use with the Antistine solution. After 10 days of combined treatment, the blepharoconjunctivitis improved. With the continued use of Antistine, the patient has been asymptomatic for many months. Illustrated, in this case, are the association of an infectious condition with allergy; the negative response to antibiotics in lanolin ointments, in patients hypersensitive to wool products; and the efficacy of the combined treatment with antibiotics and antihistaminics.

Mr. P. F., aged 39 years, for the past 3 years was subject to frequent attacks of hordeola and ulcerative blepharoconjunctivitis. He complained of itching, burning, and redness of both eyes. Many ocular medicaments, including the antibiotics, gave only mild and temporary relief. Skin tests were positive to molds, wool, grass, pollens, ragweed, many foods, and feathers. Antistine ophthalmic solution, used twice daily, relieved all ocular symptoms. After using Antistine for 2 weeks, the patient felt so improved that he was ready to forego further treatment. For 6 months, while on an allergic regimen and Antistine solution, he had only one hordeolum. This was by far the longest period in 3 years in which he was free of symptoms. (Since this was originally written the patient went to Florida, broke his diet, lost his medicine, and developed a marked blepharoconjunctivitis.)

Mr. T. G., aged 44 years, had a bilateral blepharitis squamosa with conjunctivitis. This has been present for many years. He complained of bilateral redness of the lid margins, a burning sensation, and photophobia. Skin tests were positive to yeast, coffee, garlic, onions, and markedly so to house dust. Desensitization with house dust was without benefit. Antistine solution, used 3 times a day for 3 months, gave no relief from the symptoms, although the hyperemia of the lid margins decreased somewhat. Illustrated again is the failure of Antistine solution to relieve the symptoms in the presence of a marked hypersensitivity to house dust.

Mr. N. B. had recurrent attacks of blepharoconjunctivitis and palpebral dermatitis for several years. The palpebral conjunctivas were injected and granular in appearance. Previous medication used was ineffective. Skin tests revealed hypersensitivity to ragweed, Russian thistle, alfalfa, horse hair, novocaine, and mercurials. The use of Antistine ophthalmic solution resulted in great improvement, subjectively and objectively. The granular appearance of the conjunctivas was much decreased.

Mrs. S. M. suffered with recurrent blepharoconjunctivitis. There was hyperemia of the lid margins, edema of both upper lids, and infection of the palpebral conjunctivas. Skin tests were positive to house dust, wool, yeast, many foods, and all the vitamins. Antistine solution caused smarting and tearing of both eyes, puffiness of the lids, and ocular irritability. No improvement was noted.

Mrs. F. N. had recurrent cyst formation of the bulbar conjunctivas for several months. Antistine solution caused a temporary improvement but the condition recurred and Antistine was of no value. Skin tests were positive to dust, lacquer, chlorine, vitamin C, and many foods. Excision of the cysts resulted in a cure.

S. F., aged 10 years, complained of occasional ocular itching and nasal stuffiness for the past two years. Characteristic follicular allergic conjunctivitis and allergic rhinitis were manifest. Skin tests were positive to wool, feathers, chocolate, tobacco smoke, and linseed oil. Antistine ophthalmic solution, periodically used, completely relieved the itching.

COMMENT

In this series of 11 cases, 7 were improved with the use of Antistine solution. The 4 patients in whom no improvement resulted were markedly hypersensitive to house dust.

GROUP 4. VERNAL CATARRHAL CONJUNCTIVITIS

The resistance to all forms of treatment in cases of vernal conjunctivitis is well known. Recent reports on the use of Beta irradiation holds promise of improved treatment. However, for symptomatic relief, the unceasing search is often pathetic. All four patients cited below submitted to every known type of treatment, including surgery, application of dry ice, radium and X-ray exposure, without significant relief.

R. A., aged 13 years, has had typical vernal catarrh for the past four years. There were hypertrophic granulations and the cobble-stone appearance of the upper palpebral conjunctivas. Allergy tests were not made. There were no known allergies, but the patient's father has hay fever. Estevin, adrenalin, and acetic-acid solutions were of no value in relieving the ocular itching, irritability, secretion, or photophobia. Antistine ophthalmic solution, instilled at bedtime, was effective in obtaining symptomatic relief for about four hours, after which the patient awakened because of the ocular irritability. This again was relieved by a drop of the Antistine solution. During the day one drop of the solution, instilled every 3 to 4 hours, has given complete symptomatic relief. The pathologic state remains unchanged.

J. F., aged 12 years, has had vernal conjunctivitis for a number of years. His mother has hay fever. There were exuberant granulations and excrescences of the upper palpebral conjunctivas. The lower palpebral conjunctivas were thickened and pale, and the inferior cul-de-sacs had a cobblestone appearance. There was a thick viscid secretion, also itching, tearing, photophobia, redness of both eyes, and marked ocular discomfort. Skin tests were positive to wheat, rye, corn, oats, vegetables, grasses, pollens, and dust. Antistine ophthalmic solution, instilled 3 times daily, dramatically improved all the symptoms. The secretion was greatly diminished and the itching and tearing were entirely eliminated. The pathologic picture remains unchanged, but for the first time in many years the patient feels comfortable.

R. R., aged 9 years, has had vernal catarrh since early childhood. There were palpebral conjunctival granulomas and excrescences with severe itching, photophobia, blepharospasm, secretion, and a ptosis of the left upper lid due to the weight of the excessive granulation tissue. All therapy, including radium, X-ray exposure, and climatic change, has had no favorable effect. Skin tests were essentially negative to all antigens. Antistine solution, instilled 3 times daily, greatly relieved all symptoms. The mother stated that no medication previously used (including estevin, adrenalin, and neosynephrin) approximated the efficacy of the Antistine solution.

Mr. T. K., aged 34 years, was treated since early childhood for "trachoma" and allergy of the eyes, without improvement. He had a typical vernal catarrh with superior palpebral conjunctival grape-like excrescences, ocular itching, secretion, and swelling of the lids. Marked and lasting relief from all the symptoms, including a "bloated" feeling of the eyes, was obtained by the use of Antistine solution, 3 times daily. For a short time the Antistine solution became irritating and caused a sensation of smarting and ocular dryness, but after a short rest period, the patient was able to resume the Antistine without untoward effects. Skin tests were not made.

COMMENT

This series indicates the marked symptomatic relief obtained by Antistine ophthalmic solution in vernal catarrh. Although the pathologic conditions remained unchanged during the course of many months of treatment, the relief from the distressing symptoms was highly gratifying. Instillations had to be maintained on a basis of 3 to 4 times daily. There was no evidence of a cumulative effect of the therapy. During the long continued course of the therapy, no deleterious effect from Antistine solution was observed.

GROUP 5. PALPEBRAL DERMATITIS, URTICARIA, ECZEMA, AND ANGIONEUROTIC EDEMA

Miss F. M. had an acute attack of swelling, redness, and scaling of the skin of both upper lids with ocular itching, photophobia, and sneezing. Skin tests were positive to ragweed, house dust, many foods, lacquer, tobacco, and vitamins A and D. Several months after her first appearance, the patient developed typical hay fever for the first time. Antistine solution, instilled 3 times daily, immediately and completely relieved the itching and photophobia. Removal from contact allergens resulted in a rapid cure of the palpebral dermatitis.

Mrs. E. B. suffered from recurrent attacks of palpebral dermatitis of both upper lids for 10 years. The present attack was of 3 months' duration. No previous therapy was of value. There were redness

and scaling of the upper lids with itching and burning of both eyes. Skin tests were positive to feathers, foods, pine products, and lacquer. The patient was taking atropine for a "spastic bowel." Antistine solution, locally, relieved the itching and burning sensation of the eyes, but the dermatitis was unaffected. Antistine solution, applied in the form of moist packs to the lids, was similarly not efficacious in altering the dermatitis.

Mrs. S. L. developed a palpebral contact eczematoid dermatitis, following the use of sulfathiazole ointment in the treatment of an obstinate ulcerative marginal blepharitis. With the use of Antistine ophthalmic solution, the contact dermatitis rapidly improved. Surprisingly, the blepharitis also promptly healed. Cessation of the use of Antistine was followed by a recurrence of the blepharitis. The offending allergens were lanolin and a certain type of soap. With the elimination of these agents, the condition improved without recurrence.

Miss H. S. had a typical bilateral allergic palpebral dermatitis. There were redness, thickening, and itching of the skin of both upper lids. Skin tests were positive to lacquer, foods, feathers, dust, and rayon. Antistine solution, instilled as drops, was only mildly effective in allaying the itching. Antistine solution, applied as moist packs, gave no relief. Paradoxically, it caused more itching of the skin. Antistine tablets (300 mgm.) orally, daily, relieved the redness and scaling of the skin of the upper lids. When Antistine tablets were discontinued, the condition recurred.

Mrs. M. K. had a typical acute palpebral angioneurotic edema of both upper and lower lids. She also had an allergic rhinitis and had had migraine headaches in early adult life. She experienced burning, itching, and foreign-body sensation of both eyes. Skin tests were positive to many foods and drugs. One drop of Antistine ophthalmic solution resulted in a marked and visible reduction of the palpebral edema within 20 minutes. The itching and burning were immediately alleviated. Antistine solution was used 4 times daily for 14 days with effective relief from symptoms. However, subsequently, the solution diminished rapidly in efficacy and gave relief for only 10- to 20-minute periods. Oral antihistaminics were ineffective.

Mrs. E. S. complained of continuous severe itching of the skin of the lower lids for many years. No pathologic condition of the skin was evident. Skin tests were positive to timothy, cotton seed, feathers, many foods, pine, and chlorine. Antistine solution was of no value. Antihistaminics orally were also of no value. It is felt that, although the pruritus may have been on an allergic basis, there also existed a strong psychosomatic factor.

Mrs. M. G. had, for the past 5 years, recurrent urticaria of the right upper lid, characterized by redness, scaling, edema, and itching of the skin. Scratch tests were positive to feathers and wool. Oral antihistaminics were of no value. Antistine solution, in moist packs applied to the skin of the lids, decreased the itching and resulted in ocular comfort. A moderate improvement was noted. There were less redness and scaling. Antistine, in a greaseless ointment base, gave more marked and lasting objective improvement.

Mr. P. L. had an eczematoid dermatitis of the left lower lid as a result of being treated with penicillin ointment. Antistine solution, instilled, resulted in immediate relief from the itching sensation and ocular irritability. The dermatitis subsided with unusual rapidity.

Mrs. R. M. had atopic palpebral urticaria of both upper lids for 16 months. She complained of itching, redness, and aching of both eyes. Skin tests were positive to many foods, animal hair, pollens, and molds to a mild degree. Antistine solution, in drops and moist packs to the lids, relieved the itching. The redness and edema of the lids disappeared.

Mrs. G. developed repeated attacks of Quincke's edema during therapy for glaucoma. Each of the four lids was alternately involved. The skin of the lids was tense and slightly pink, with itching. Antistine ointment, in a greaseless base, applied to the skin of the lids, and Antistine solution, instilled in both eyes, relieved the itching and facilitated rapid healing. Skin tests were positive to feathers, lanolin, cottonseed, and foods.

Mrs. E. G. developed a marked urticarial swelling of all four lids, following the ingestion of phenobarbital. There were ocular tearing, itching of both eyes, and swelling of all four lids. A year ago she had an attack of hives. Skin tests were positive to cottonseed, feathers, wheat, pork, lacquer, vitamin E, and orris root. Antistine ophthalmic solution and Antistine ointment, applied to the skin of the lids, resulted in prompt symptomatic and objective improvement of the urticaria. Application of the ointment caused a moderate burning sensation for about 10 to 15 minutes.

Mr. A. F. had bilateral atopic palpebral urticaria with smarting and tearing of both eyes and swelling of the lids. This condition existed continually for many years. Allergy tests were positive to various foods and fruits. Antistine solution gave some relief from the tearing and smarting, but the pathologic status remained unchanged. The value of the Antistine was at best questionable.

Comment

In 9 of the 12 cases presented, there were varying degrees of improvement with Antistine. In most cases the symptomatic improvement was much greater than the objective. Pathologic improvement resulted more readily in the contact dermatitis and the more acute forms of palpebral atopy. The chronic urticarias and dermatoses, although somewhat improved, did not respond in great measure. The action of Antistine in reducing the angioneurotic edema in one

case was dramatic but not enduring. Antistine solution, applied as moist packs, was mildly effective in these cases. Antistine ointment proved more efficient in relieving the itching of the skin and was also found to have some salutory effect on the skin lesions.

TABLE 1

TABULATION OF CASES TREATED WITH ANTISTINE

Group	No. of Cases	Improved	Not Improved
1	15	14	1
2	8	8	0
3	11	7	4
4	4	4	0
5	12	9	3
TOTALS	50	42	8
Percentages	100	84	16

DISCUSSION AND SUMMARY

In 50 cases of ocular allergies, Antistine ophthalmic solution, used locally, proved of definite therapeutic value. Eighty-four percent of the patients showed subjective (symptomatic) improvement. There was moderate to complete relief from itching, photophobia, lacrimation, conjunctival injection, blurring of vision, secretion, and ocular irritability. The most apparent benefit occurred in the patients of Groups 1 and 2, in which the dominant allergen was the ragweed pollen.

The dosage required to maintain symptomatic relief varied from one drop of Antistine solution, every 3 to 4 hours, to one drop daily, and in some cases only one drop every second day. A review of the cases indicates that Antistine solution, locally instilled, has a pronounced antihistaminic effect that is cumulative. It is retained locally in the tissues for a prolonged period of time. Its efficacy is much greater than that of any of the other ophthalmic medications employed in ocular allergy.

In most instances, the instillation of Antistine caused momentary smarting. In several of the described cases, the smarting was more severe, although of short duration, and in one case there was intense burning. Administered in my own eyes, the smarting sensation was fleeting. Despite the side reactions, the patients who derived relief did not feel that the burning was sufficient reason for discontinuing the use of Antistine. Only one patient experienced an untoward reaction; that is, the feeling of a "hollow sensation" in the eye.

Significant is the fact that many of these patients had not previously received ocular symptomatic relief from oral antihistaminics or from any other type of therapy, including desensitization. However, their response to the Antistine solution, locally, was notably good.

A concomitant symptomatic effect was the decrease of visual blurring in two patients who were taking atropine, orally, for "intestinal spasticity." In several cases there was also noted an improvement in the relief from associated rhinorrhea and sneezing.

The relief obtained in cases of photophobia was encouraging. Two patients were intensely sensitive to the glare of sun and snow. These cases were severe enough to merit consideration in a category of ocular physical allergy. Both patients responded favorably to Antistine solution.

The immediate visible effect of Antistine is the contraction of the superficial vessels and blanching of the conjunctivas. In a case of keratitis, with superficial and deep vascularity, it was found that only the superficial corneal vessels contracted. Vascular constriction may be partially responsible for the ocular symptomatic relief and is, no doubt, highly responsible for the diminution of the photophobia. The vascular contraction is prolonged and is not followed by a secondary vasodilatation, such as occurs after the instillation of adrenalin. A slight superficial anesthetic effect is another action of locally instilled Antistine.

Although the pathologic processes were not objectively altered in the majority of the patients treated, and although Antistine solution cannot be considered curative,

nevertheless, many cases responded with a decrease in the edema, hypertrophy, and folliculosis, and showed an improvement in the skin lesions. The benefits derived from Antistine appear to be the neutralization of the allergic end products and the symptomatic relief which facilitates healing. This was evidenced in those cases where blepharitis, atopic urticaria, and contact dermatitis were manifest.

The therapeutic response indicates that the hordeola, chalazions, ulcerative blepharitis, and acute conjunctivitis found in some of these patients, and usually classified as allergic entities, are not allergies per se, but are bacterial or mechanical complications. In effect, these conditions are the result of an infectious invasion on a fertile allergic soil. This was demonstrated by the fact that the aforementioned complications did not respond to Antistine until after the antibiotics or chemotherapy resolved the superimposed pathologic condition. In these cases, the combined use of Antistine with penicillin, sulfathiazole solution, or any of the ocular bacteriostatics would be advisable. Antistine was found to be compatible with most other ophthalmic drugs.

Analysis of the cases, in which Antistine ophthalmic solution proved of no value, revealed marked hypersensitivity to house dust. Of the 50 patients treated in the five groups, only 8 were unresponsive to the solution. Of these, two experienced side reactions and refused to continue treatment. Three patients had squamous blepharoconjunctivitis, of whom two were markedly positive to scratch tests with house dust. Of the remainder one patient had bulbar conjunctival serous cysts, another had palpebral pruritus, and the third had atopic palpebral dermatitis, with hypersensitivity to house dust.

Impressive was the favorable symptomatic response obtained in the four cases of vernal catarrh. Although no improvement in the pathologic state was noted, and despite the necessity for 4 to 5 instillations daily, these patients were grateful for the relief afforded by the Antistine.

In a number of the cases of atopic palpebral urticaria and contact dermatitis, the Antistine solution was supplemented with the application of Antistine ointment to the skin of the lids, resulting in an enhanced therapeutic effect. It is noted that relief was obtained more readily in the cases of acute urticaria and contact dermatitis than in the chronic lesions. In one case in this group, locally applied Antistine increased the itching sensation. In another, a case of angioneurotic edema, the Antistine was at first dramatically effective but the efficacy rapidly decreased. In the cases of this series (group 5), it was necessary to supplement local treatment with the oral administration of Antistine before the desired therapeutic effect was achieved.

It is stressed that all these cases were primarily extraocular allergies, that no effort was made to treat intraocular allergic conditions except as incidental or intercurrent, and that Antistine locally has great value in relieving the symptomatic manifestations of ocular allergy. The therapeutic value of Antistine is its ability to neutralize the effect of the liberated end-products of hypersensitive (allergic) states, locally as well as systemically, and to facilitate healing by diminishing the irritative phenomena of allergy.

Conclusions

1. The antihistaminic chemical drugs and their action are briefly reviewed.
2. Presented are 50 cases of ocular allergy and their response, symptomatically and therapeutically, to a new antihistaminic ophthalmic solution.
3. Antistine ophthalmic solution (Ciba) is advocated for use in the symptomatic relief of patients with extraocular allergy.

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OCCLUSION OF THE CENTRAL RETINAL ARTERY*

A Clinicopathologic Study

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The opportunity to report on a case of occlusion of the central artery of the retina that was seen clinically and studied pathologically comes but seldom. Such a case is the subject of this report.

Clinical Study

Case Report

History. The patient, M. R., a woman, aged 72 years, was seen on August 4, 1943, with the history of a sudden loss of vision in the right eye. She was an inmate of The Home for Aged and Infirm Hebrews and her eyes had been examined several times before this occurrence. The vision in each eye had been 20/30 with correction. Clinically, the patient suffered from severe essential hypertension, the blood pressure ranging from 200/110 to 260/140 mm. Hg.

The patient had been watching a moving picture when she noticed the sudden loss of vision in the right eye. Examination shortly thereafter revealed the typical picture of a complete occlusion of the central retinal artery. The arteries were markedly attenuated. There was a gray edema of the macular area and the cherry-red spot in the fovea. Vision was reduced to light perception only in the temporal area. In the left, or unaffected eye, the fundus showed hypertensive retinal arteries. They were narrowed, tortuous, had an increased central light reflex, and completely obliterated the vein at the point of crossing. No hemorrhages or exudates were present in either eye.

Treatment. All attempts to improve the condition of the right eye were unavailing. These included massage, inhalation of amyl nitrite, sodium nitrite intravenously, and nitroglycerin by mouth.

Course. The patient was observed at irregular intervals for the next few years.

* This investigation was made possible by the Research Fund of The Home for Aged and Infirm Hebrews. Presented at the New York Society for Clinical Ophthalmology, October 6, 1947.

On October 29, 1943, the vision in the right eye was still only light perception. The pupil was fixed in mid-dilatation and did not react to light. The fundus could be clearly seen. The retinal arteries were narrowed almost to the point of obliteration. Perivascular sheathing of the larger branches of the central retinal artery was the temporal region. The fundus showed optic atrophy, with shaggy, uneven disc margins, attenuation of the arteries, narrowing of veins, and more perivascular sheathing. The cystlike appearance of the right macula was unchanged.

On September 16, 1945, the patient was admitted to the infirmary and died Septem-

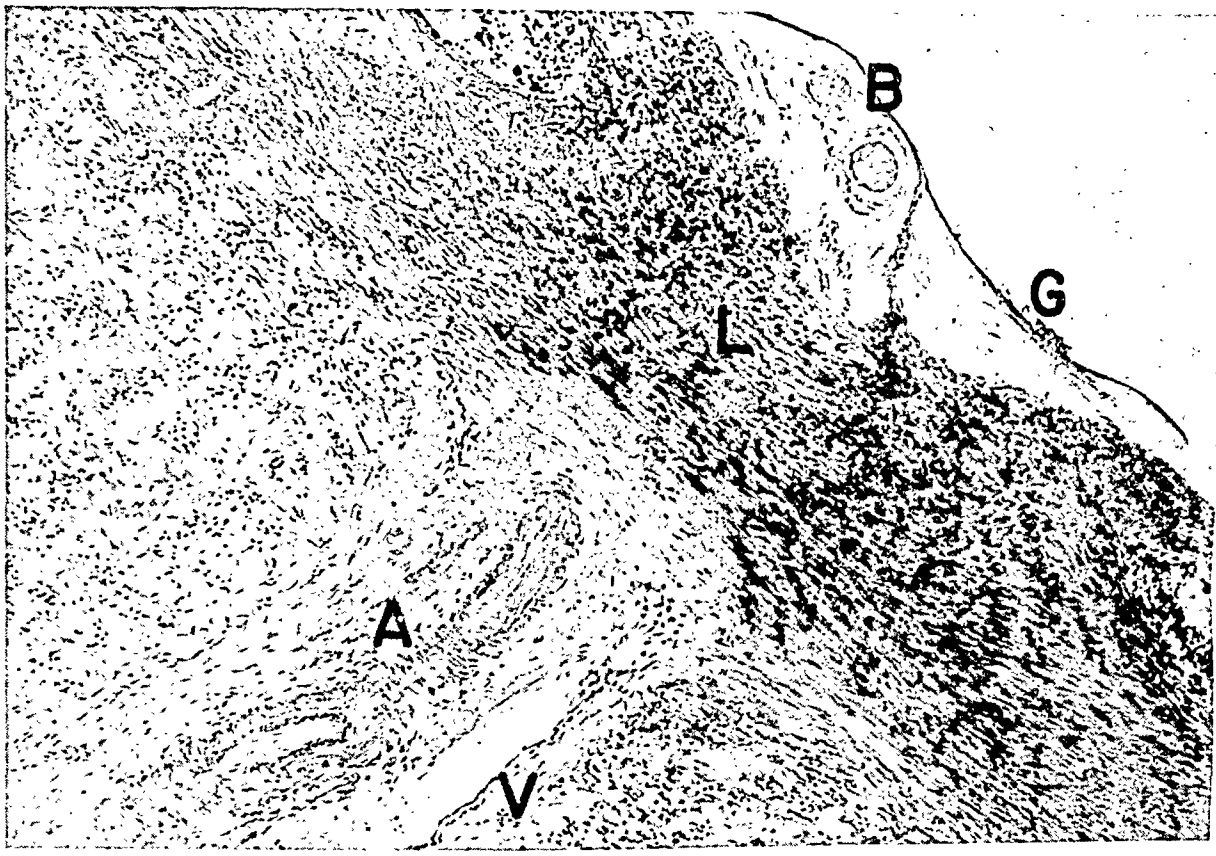


Fig. 1 (Kornzweig). Cross section of optic nerve and disc. The central retinal artery (A) and vein (V) are in the optic nerve before the lamina cribrosa (L). Branches (B) of the artery are on the disc, which is covered by glial tissue (G).

noted. Edema of the macular region was still present.

On February 19, 1944, the optic nerve of the affected eye had become pale and atrophic. The edema of the macula had disappeared and left a mottled appearance of the tissues in this region. A small, cystlike body was forming in the fovea. On August 4, 1944, the condition of the fundi was still the same.

On March 1, 1945, the vision in the right eye remained at light perception in

ber 17, 1945. This was a little more than two years after the occurrence of the occlusion of the central retinal artery in the right eye. Autopsy was performed on September 18, 1945, and both eyes were removed. Fixation of both globes was done in Bouin's solution. They were embedded in celloidin for several months. The right eye was cut horizontally in such a way that the entire nerve-head and optic nerve were completely in one half of the sectioned eye. Serial sections were made through the entire thickness of

optic nerve and disc and stained with hemotoxylin and eosin. Several slides, which showed the vessels chiefly in the optic nerve, were stained with Weigert's elastic stain.

Pathologic study

Several of the most important slides were photographed and are here presented.

Figure 1. The optic nerve and the disc can be seen in this figure. The central retinal vessels in the optic nerve and a few branches on the head of the disc are clearly seen. Between the two, the lamina cribrosa stands out as a darkly staining tissue. The artery in the nerve is definitely narrowed. In places its lumen can be seen. Near the lamina, the lumen of the artery appears to be narrowed, almost to the point of occlusion. The vein alongside of the artery is patent, but narrower than normal. On the head of the disc, and covering the physiologic cup, is a sheath of glial tissue. The two small vessels seen on the disc appear to be filled with blood. The lumen stands out fairly well and the endothelial lining is, apparently, intact.

Figure 2. This figure shows the central retinal artery in its entirety as it passes through the lamina cribrosa. The walls of the vessel are thickened, but its lumen appears to be intact. There is a constriction in the artery as it passes through the lamina cribrosa just before it arrives on the head of the disc. A small branch is given off from this vessel on the head of the disc. This small branch also is filled with blood and has a very narrow lumen. There is a possibility that this may indicate a recanalization of a closed vessel.

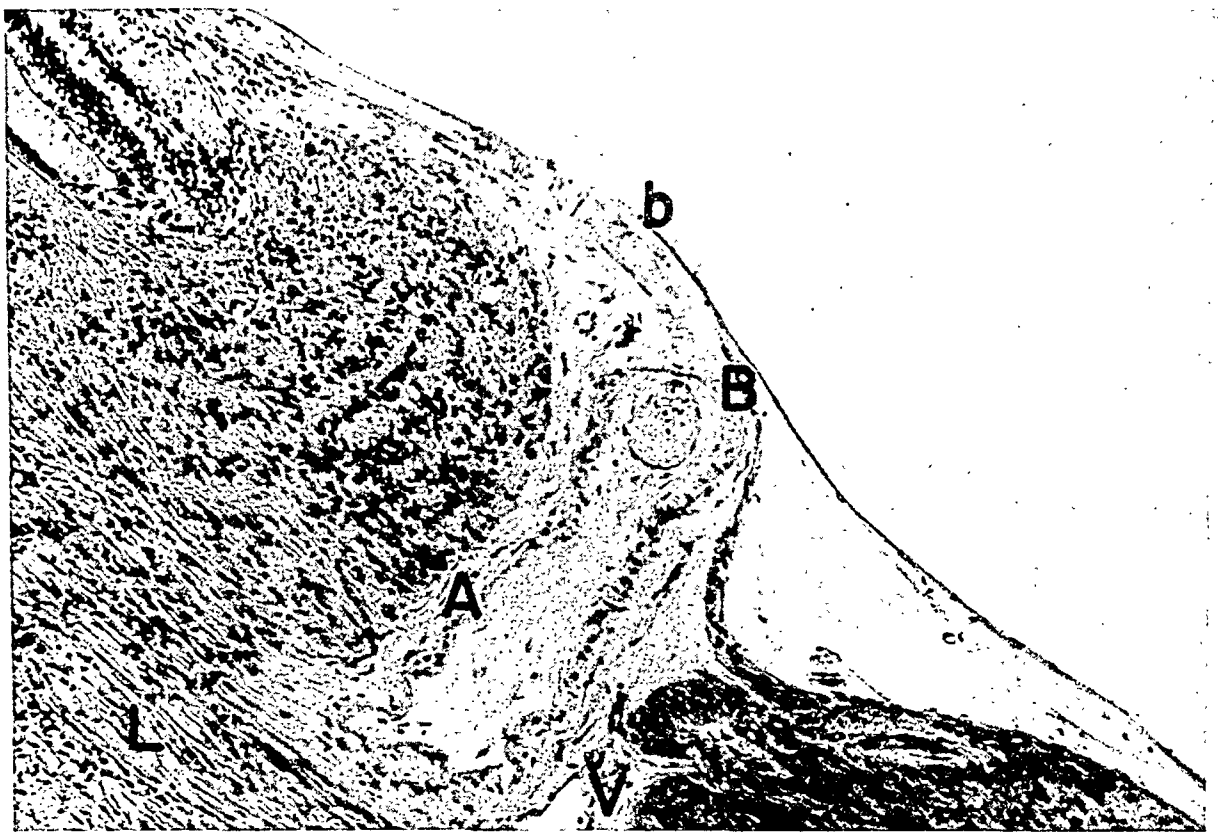


Fig. 2 (Kornzweig). Cross section of lamina cribrosa and optic disc. The central retinal artery (A) appears to be patent from the lamina (L) to the head of the disc. The media of the vessel is thickened. The endothelial lining of the branch (B) on the disc is intact. The smaller branch (b) may indicate recanalization of an occluded artery.

Figure 3. This slide is a section of the optic nerve only, which has been stained with Weigert's elastic stain. It shows the artery and the vein in their fibrous sheath. The artery stains rather heavily with the Weigert stain. Its lumen shows a moderate amount of debris and a small mass of elastic tissue to one side. This may indicate a proliferation of the elastica interna and, perhaps, the site of an occluding thrombus. The adjacent vein is widely opened and clear.

Figure 4. This slide is another section farther down, showing the same blood vessels, but in this case the lumen of the artery, although narrowed, appears to be entirely patent.

Figure 5. This slide shows the region of the macula in the affected eye. The ganglion cells in this region, and also the cells of the inner nuclear layer of the retina, are markedly reduced in number. The nerve-fiber layer is almost entirely absent. Even the cone-cell layer, directly in the foveal region, shows a thinning and a diminution in number of cone nuclei. In the subjacent choroid, several large veins and one artery can be seen. The artery has a very thickened wall and a narrowed lumen. This indicates advanced sclerosis of the choroidal arteries.

Figure 6. This shows a portion of the retina adjacent to the temporal side of the optic nerve and approaching the macula. That portion of the retina close to the optic nerve shows all the layers of the retina fairly intact. The nerve fibers are numerous and the ganglion cells are present, as well as the cells of the internal nuclear layer. There is a definite transition from normal retina to atrophic retina, which is fairly sharp. This

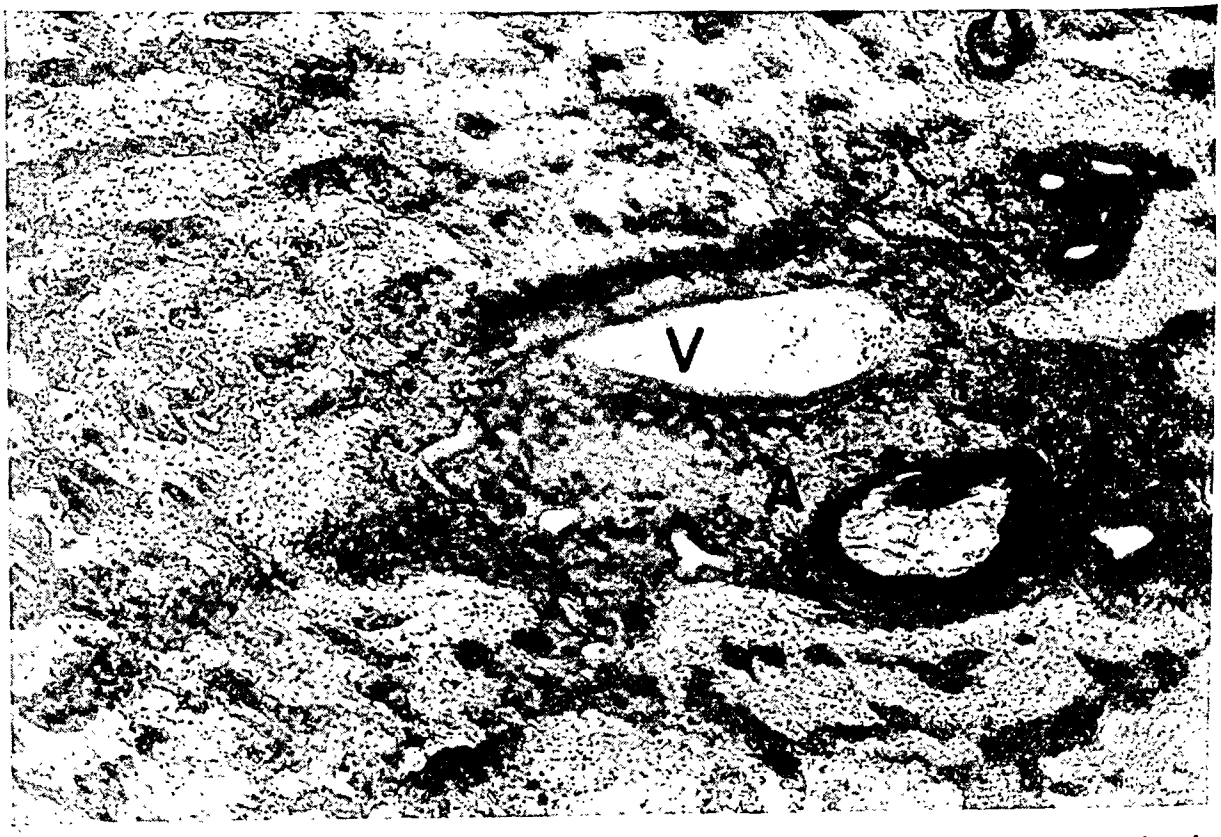


Fig. 3 (Kornzweig). Cross section of portion of optic nerve under high power, stained by Weigert's elastic tissue stain. The central retinal artery (A) shows heavy elastic tissue staining with debris in the lumen. The vein (V) is normal and patent.

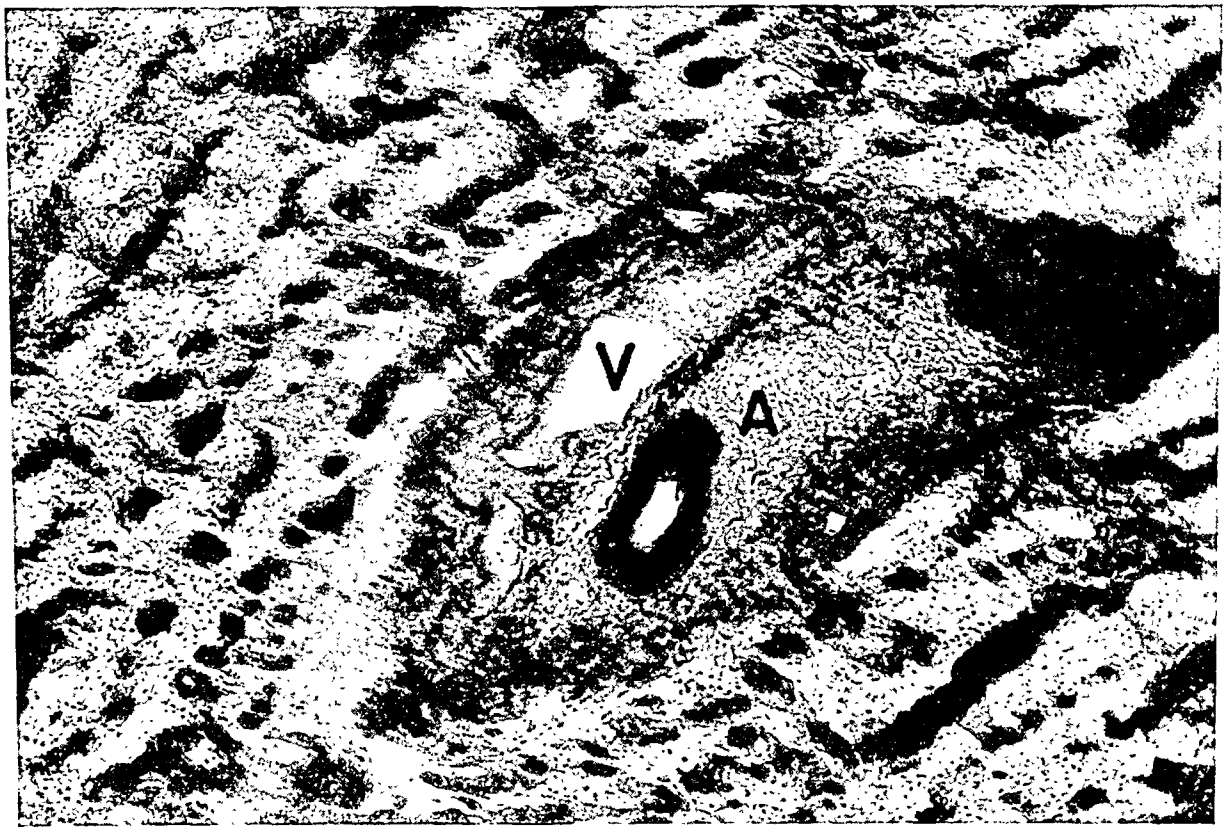


Fig. 4 (Kornzweig). Cross section of portion of optic nerve under high power, Weigert's elastic tissue stain. The central retinal artery (A) has a thickened elastica interna, but its lumen is patent.

transition shows the point of division between that portion of the retina which still has a fairly good blood supply and that portion to which the blood supply has been diminished because of the occlusion of the central retinal artery.

Figure 7. This is a cross section of the optic nerve of the unaffected eye. It gives a very clear picture of the central retinal artery in several sections, both in the nerve and on the disc. There is some thickening of the walls of the central retinal artery, but its lumen is clear and patent throughout. There is no evidence of much endothelial thickening or proliferation of the elastica interna. The vein is normal throughout. In addition, on the head of the optic nerve, the physiologic cup is seen and there is no glial proliferation as in the affected eye.

It would have been preferable to section the eye at right angles to the nerve and the central retinal artery and vein. These slides, therefore, are not conclusive. They do, however, show narrowing of the central retinal artery and an irregular, uneven lumen. A complete obliteration or occlusion of the central retinal artery is not present. Occlusion of the artery by a so-called embolus also cannot be seen. One may speculate on what the passage of time may have done to a soft thrombus in the artery. The possibility of occlusion of the vessel by spasm must also be considered.

Discussion

The earlier reports on this subject considered chiefly organic changes in the artery or embolus as the cause of the occlusion. These are reviewed fully by Parsons,[1] Duke-Elder,[2] Coats,[3] Collins and Mayou,[4] and Bridgett.[5] Von Graefe, who reported the first case of embolus of the central retinal

artery, gave, as the possible causes, endocarditis with valvular incompetence, arteriosclerosis or aneurysm of the carotid system.

Coats contributed a report reviewing 26 cases in 1905, and added several of his own. An embolus was not shown in many cases. He gave as the most common causes of occlusion, endarteritis and thrombosis of the central retinal artery. Other theoretical causes were also mentioned, for which there was no pathologic evidence. These included: (1) Retrobulbar neuritis, (2) hemorrhage within the optic nerve or its sheath; (3) tumors of the optic nerve; and (4) spasm of the arteries. Spasm was mentioned as being due, possibly, to quinine poisoning or Raynaud's disease.

More recently, spasm of the central retinal artery has been stressed as causing occlusion, which may lead to temporary or permanent loss of vision in the affected eye. Kravitz[6] cites three cases of temporary visual loss due to spasm of branches of the central retinal artery in two, and a cerebral artery in the third. One of these cases had a permanent paracentral scotoma. Duke-Elder[2] and Elwyn[7] also give considerable importance to spasm as a cause of occlusion. Sedan and Jayle[8] reviewed the subject of spasm of the central retinal artery. They mention the possible causes contributing to spasm as: (1) Migraine and vasomotor instability, (2) hypertension and arteriosclerosis, (3) Raynaud's disease, (4) severe hemorrhage, (5) poisons (quinine, tobacco, coffee, and barbituric acids), (6) glaucoma, (7) polycythemia, (8) epilepsy, and (9) papilledema.

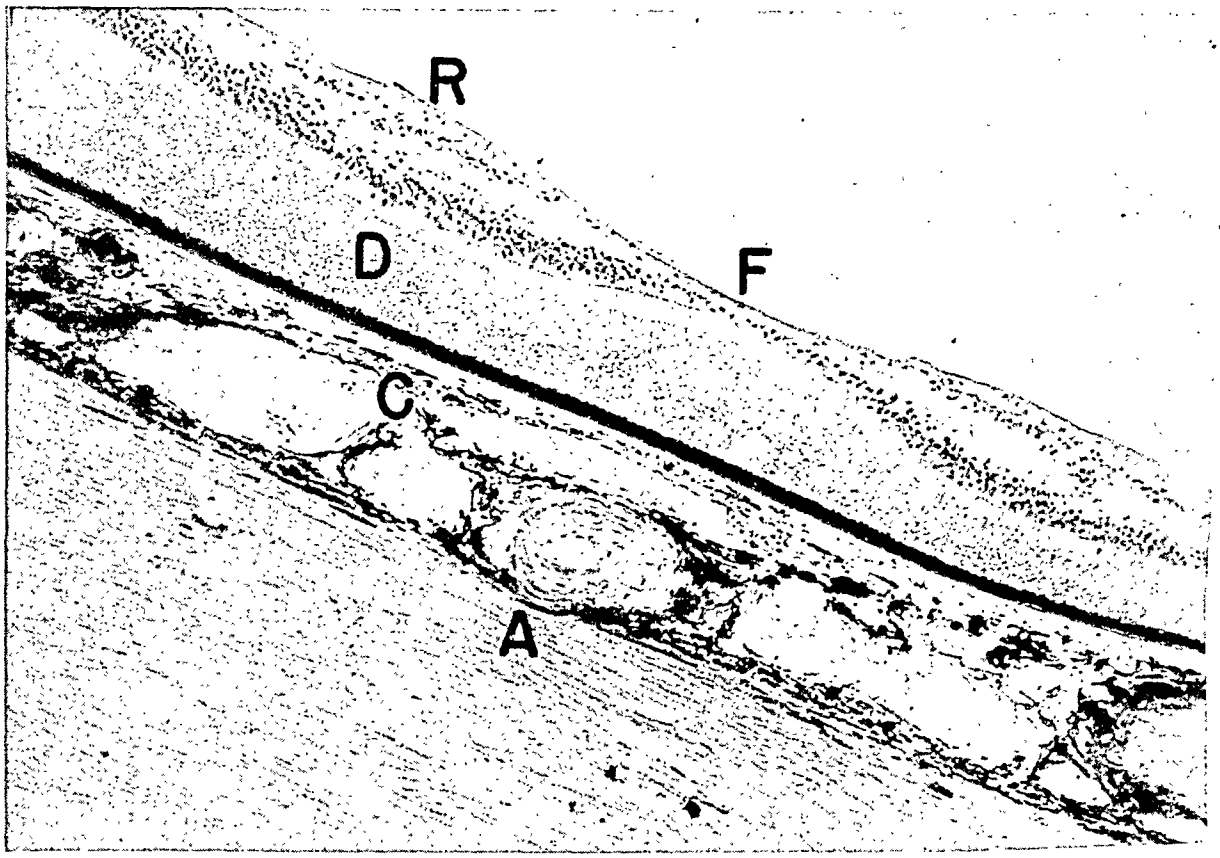


Fig. 5 (Kornzweig). Macula region of retina. Inner layers of retina (R) and fovea (F) are atrophic. There is subretinal fluid or debris (D). In choroid (C) a sclerotic artery (A) is prominent.

In the case here reported, I am inclined to believe that spasm of the central retinal artery played a large part in the blocking of the vessel. While sclerosis of the arteries in the choroid and in the central retinal artery is present, there is very little evidence of atheromatous degeneration in the blood vessels around the eye.

The postmortem examination of the heart showed normal opening of the coronary arteries. The blood vessels along their course showed a slight degree of narrowing, due to deposition of atheromatous plaques, but there was no obstruction to the flow of blood. The endothelial lining appeared to be intact throughout.

There is no evidence of complete blocking of the central retinal artery by an embolus or an occlusive thrombus. There is also no evidence of recanalization of an occluded vessel. Against the consideration of spasm as the whole cause of occlusion of the artery is the clinical evidence of the observation of the patient from the time of occurrence of the incident until her death. The artery remained narrowed throughout the entire period of observation, and was never seen to dilate or return to a normal condition.

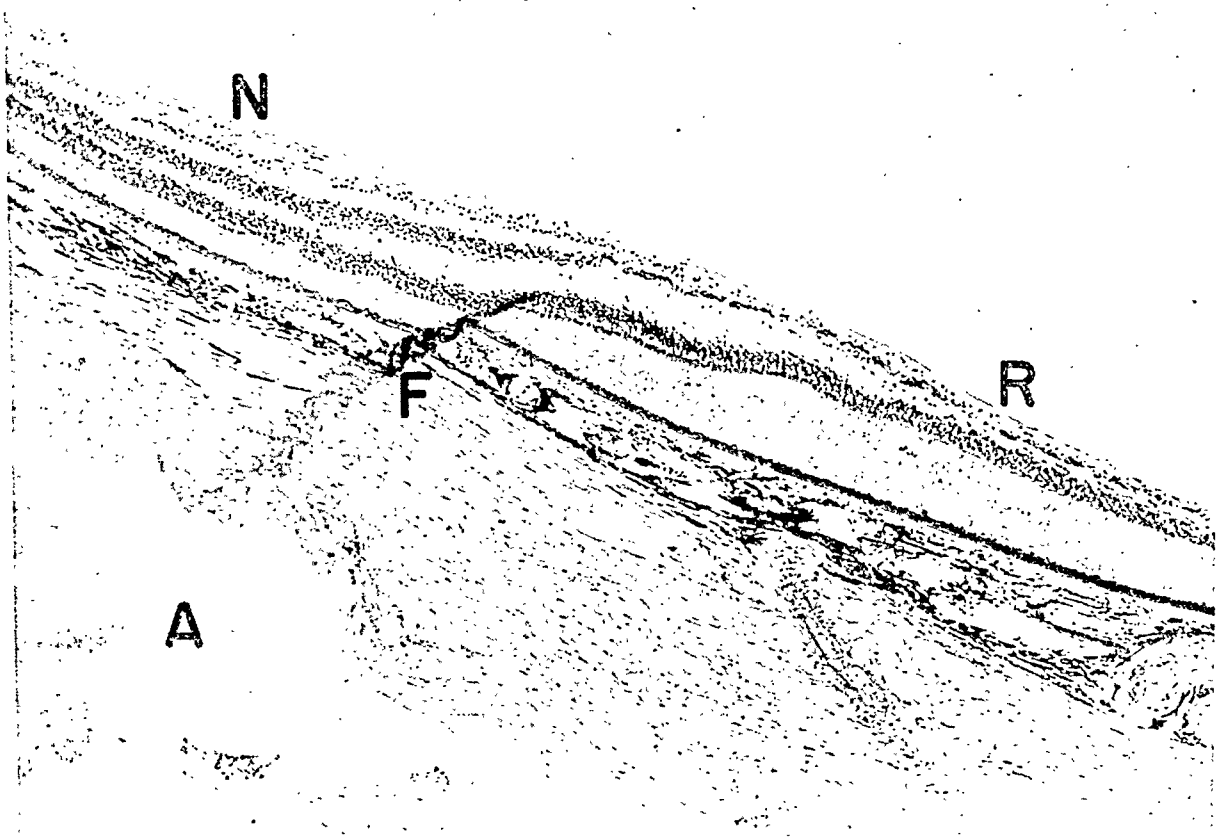


Fig. 6 (Kornzweig). Section of retina near optic disc. The normal retina (N) is near the disc. It changes to atrophic retina (R) rather sharply. (F) is a fold in the tissue, and (A) is an artifact.

Summary and Conclusions

A case of occlusion of the central retinal artery in a woman, aged 72 years, is presented. She suffered from essential hypertension of moderately severe degree. The patient was followed for over two years until

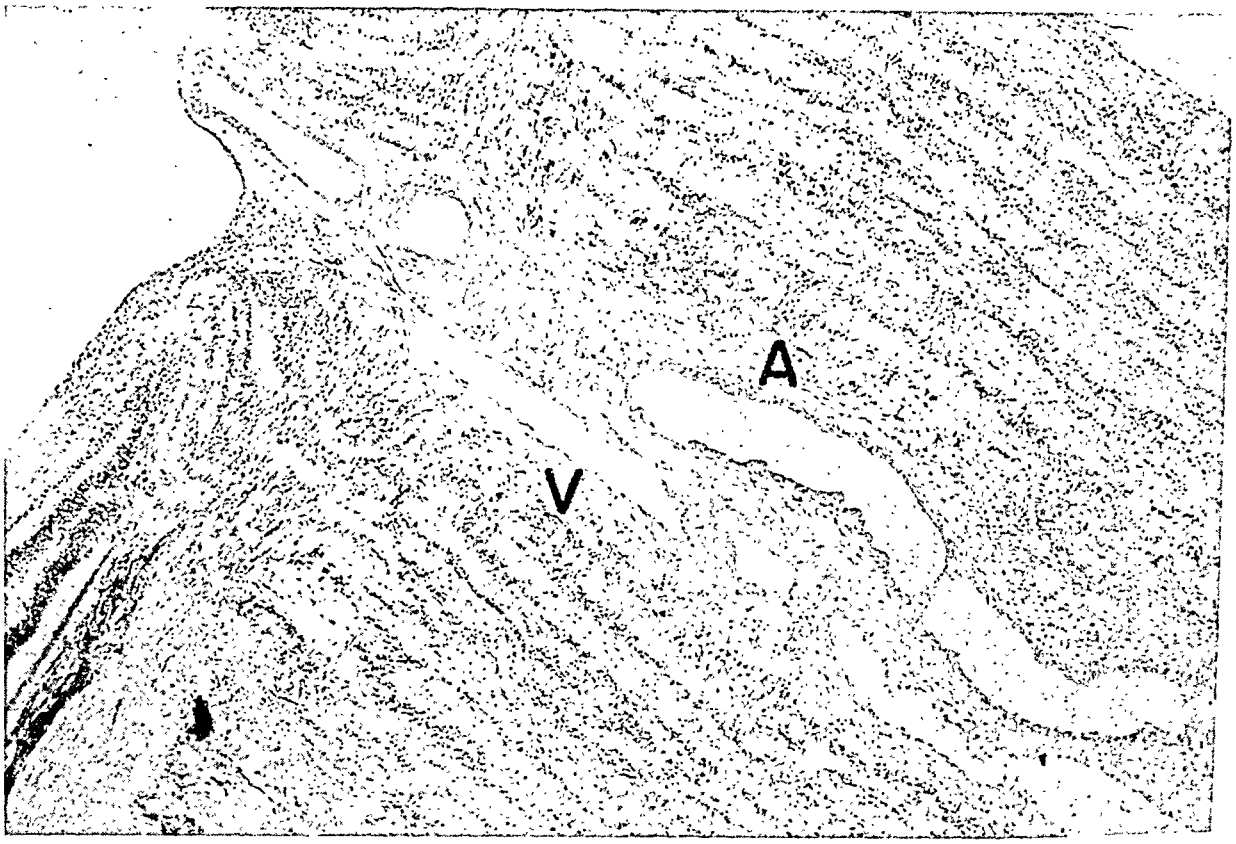


Fig. 7 (Kornzweig). Cross section of optic nerve and optic disc in the normal eye. The central retinal artery (A) and vein (V) are seen in several segments and are patent throughout.

her death, at which time the eyes were examined pathologically. No evidence of embolus, thrombus formation, or endarteritis was found. Advanced arteriosclerosis was present in the choroidal and central retinal arteries. Spasm is considered as contributing to the occlusion of the central retinal artery.

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I wish to express my appreciation to Dr. David Wexler for his help in the interpretation of the slides.

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EFFECT OF MUSCULAR EXERCISE ON DARK ADAPTATION*

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INTRODUCTION

Muscular exercise is one of the most important and most frequently encountered stress situations, and investigations of its effect on the dark-adaptation process is of considerable interest for various reasons. Muscular exercise, even of moderate intensity, produces pronounced metabolic, circulatory, and respiratory changes and thus presents a useful method of studying the effect of these changes upon one of the most fundamental visual functions. Also, in situations where muscular exercise occurs in darkness, or prior to the entrance of an individual into darkness, the problem has obvious practical applications. In addition, any effect muscular exercise has on dark adaptation would be important in the standardization of dark-adaptation tests.

In view of the large amount of research work performed during recent years on the effect of various factors influencing dark adaptation, one would expect a substantial number of publications dealing with the effects of muscular exercise. Actually, the literature is meager; only two articles could be found dealing with this subject.

Bodansky and Hendley[1] found that bicycle ergometer exercise both in normal and methemoglobinemic individuals produced a rise in the rod thresholds after 5 to 10 minutes. However, the methemoglobinemic individuals showed an improvement in sensitivity preceding the depression; whereas, the normal individuals showed no improvement at any time. There was no correlation between the amount of work done, which ranged from 20,000 to 35,000 foot pounds over a period of from 3 to 5 minutes, and the changes in threshold obtained.

Kekcheev[2] claimed that light muscular exercise reduced the duration of the dark-adaptation process from 25 to 45 minutes to 5 to 6 minutes; such a claim is surprising, as no other factor affecting dark adaptation has been noted to influence it to a comparable degree. His article is very brief, however, and does not give any details of his method.

METHOD OF INVESTIGATION

A biophotometer was used but the technique of its use modified. The test area in this instrument normally consists of a quincunx of spots, the illumination of which may be varied by means of a rheostat adjusted by the examiner. Filters are present in the instrument which make the light intensity of the two left-hand spots the highest, the central spot of medium intensity, and the two right-hand spots of least intensity. The subject reports on any given threshold when he is able to distinguish the central and two left-hand spots of the quincunx, but not the two on the right.

Considerable justified criticism[3-5] has been leveled at the results obtained with this instrument, as it has been used by various investigators. The major fault has been the lack of a fixation spot. This fault, however, is readily corrected by using the instrument according to the method first described by Sheard,[6] and this technique was followed in these experiments. All spots, except the upper-left and central spot, were covered with opaque adhesive tape. The subject fixes on the upper-left spot and reports on the appearance of the central spot as the brightness of both is increased. The change in wave length of the test light[3] as the spots are dimmed is of no consequence in these studies since the same wave-length change is present both in the controls and in the tests following exercise.

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The preadapting light incorporated in the biophotometer is of insufficient brightness to record the full extent of the visual adaptation curve. A brighter preadapting light, as mentioned below, was, therefore, used.

The left eye was used in all determinations; the test spot subtended an angle of one degree, 6 degrees temporal and superior to the fovea.

The influence of light and heavy muscular exercise on both the rate and final rod threshold of adaptation was studied. The experimental arrangement and testing procedure are summarized in Table 1. In the light-exercise experiments, in order to make the work load physiologically comparable in various subjects of unequal muscular capabilities, exercise was performed at a rate which would increase the pulse rate by 25 to 30 beats per minute.

TABLE 1

SUMMARY OF METHODS OF TESTING THE EFFECT OF EXERCISE ON DARK ADAPTATION

Type of Exercise	Duration and Rate of Exercise	Procedure of Testing	Rate of Dark Adaptation or Final Threshold	No. of Subjects; No. of Tests
Light				
Bicycle ergometer	35 min.; pulse increase of 25–30 beats per min.	Exercise started immediately after preadaptation. Readings taken at 4, 8, 12, 16, 20, 25, 30, and 35 min.	Rate	9 subjects, 13 tests
Genuflexions	2½–3 min.; pulse increase of 25–30 beats per minute	Exercise started immediately after preadaptation. Readings taken at 4, 8, 12, 16, 20, 25, 30, and 35 min.	Rate	8 subjects, 8 tests
Bicycle ergometer	10 min.; pulse increase 25–30 beats per min.	Exercise started after full dark adaptation. Readings taken after exercise from 15 sec. to 13 to 15 min.	Final threshold	5 subjects, 6 tests
Genuflexions	2½–3 min.; pulse increase of 25–30 beats per min.	Exercise started after full dark adaptation. Readings taken after exercise from 15 sec. to 13 to 15 min.	Final threshold	7 subjects, 7 tests
Heavy				
Standing running	subject ran "all out" until exhaustion which in no case was more than 2½–3 min.	Exercise - started immediately after preadaptation. Readings taken at 4, 8, 12, 16, 20, 25, 30, and 35 min.	Rate	4 subjects, 4 tests
Standing running	subject ran "all out" until exhaustion which in no case was more than 2½–3 min.	Exercise started after full dark adaptation. Readings taken after exercise from 15 sec. to 13 to 25 min.	Final threshold	19 subjects, 20 tests

The subjects were all college students between the ages of 17 and 29 years, with no ocular defects. They were well trained on the apparatus in order to eliminate learning as a possible factor in the results obtained. In the experiments on the rate of dark adaptation, successive tests were made with no exercise in between to establish controls.

In the experiments on the final rod threshold, numerous readings were taken until the subject reached a level constant except for the slight unavoidable normal variability found in repeated readings. Exercise was then performed using the preëxercise read-

ings as controls. Only values exceeding the normal preëxercise variability are considered in this paper.

Statistical analysis of the results was accomplished by means of the "t-test" (Fisher[7]). The subjects performed no exercise, other than walking to the laboratory, for several hours prior to the tests and rested in a room, illuminated with 2 foot-candles, for 15 minutes before the control tests were begun.

Tests

In the tests concerning the effect of exercise on the rate of adaptation the subject was preadapted for a period of one minute to a light of 2,400 millilamberts subtending an angle of 41 degrees at the subject's eye. For light exercise two forms of exercise (bicycle ergometer and genuflexions) performed as indicated in Table 1 were used. For heavy exercise but one form of exercise (standing running all out) was used.

In the tests concerning the effect of exercise on the final rod threshold, exercise was begun after full dark adaptation. The same forms of exercise were used as in the experiments on the rate of dark adaptation.

Results

In tabulating the effects of exercise on the rate of adaptation, the readings taken during the course of adaptation are divided into 3 intervals. Interval I includes the readings at 4, 8, and 12 minutes; Interval II, the readings at 16, 20, and 25 minutes; and Interval III, the readings at 30 and 35 minutes.

The results of light exercise are shown in Table 2. Columns 5 and 9 represent the effect on the "total dark adaptation curve" (T.D.A.). The effect on the T.D.A. was arrived at by averaging the values of individual readings taken during the entire course of dark adaptation as given in Table 1. A plus value denotes an increase in sensitivity (lowering of threshold), and a minus value a decrease in sensitivity (rise in threshold), compared to control values. It will be noted that most of the changes

TABLE 2

EFFECT OF LIGHT EXERCISE ON THE RATE OF DARK ADAPTATION

Subject	Ergometer Exercise				Genuflexions			
	Interval I	Interval II	Interval III	T.D.A.	Interval I	Interval II	Interval III	T.D.A.
D.M.	+0.05	+0.04	+0.10	+0.06	−0.05	−0.04	−0.02	−0.04
M.H.					+0.01	+0.04	+0.02	+0.02
K.J.	+0.07	+0.04	+0.06	+0.06	+0.04	−0.07	−0.06	−0.02
B.S.	−0.03	+0.05	+0.02	+0.02				
B.S.	−0.01	0	+0.08	+0.02				
B.S.	−0.07	−0.08	+0.02	−0.05	−0.03	+0.09	+0.06	+0.04
E.T.	−0.07	0	0	−0.03				
E.T.	+0.01	+0.04	0	+0.02				
L.W.	+0.05	+0.12	+0.12	+0.14				
P.W.	+0.12	+0.11	+0.22	+0.14				
P.W.	+0.07	−0.01	−0.10	−0.01				
T.G.	+0.01	+0.01	−0.02	+0.01	0	−0.01	−0.06	−0.02
M.O.	−0.05	−0.05	0	−0.04	−0.04	−0.07	0	+0.01
C.P.	−0.03	+0.07	+0.04	+0.02	−0.05	+0.07	+0.10	+0.04
J.A.					−0.07	+0.07	−0.02	+0.01
Mean	+0.01	+0.03	+0.04	+0.03	−0.02	+0.01	+0.002	+0.005

* Values are expressed in log units. Plus (+) denotes a lowering of threshold, minus (−) denotes a rise compared to the control. T.D.A. = total dark-adaptation curve.

TABLE 3

EFFECT OF HEAVY EXERCISE ON THE RATE OF DARK ADAPTATION*

Subject	Heavy Exercise			
	Interval I	Interval II	Interval III	T.D.A.
D.M.	+0.04	+0.01	−0.10	−0.02
L.C.	−0.07	+0.03	+0.02	−0.01
M.H.	0	−0.08	−0.16	−0.02
J.A.	−0.50	−0.07	−0.06	−0.06
Mean	−0.01	−0.02	−0.06	−0.02

* Values are expressed in log units. Plus (+) denotes a lowering of the threshold, minus (−) denotes a rise compared to the control. T.D.A.=total dark adaptation curve.

are of small magnitude and that they are both plus and minus. The statistical analysis of the results shows that light muscular exercise has no effect upon the rate of dark adaptation.

The effects of heavy exercise on the rate of dark adaptation are represented in Table 3. It will be seen here that, under Intervals I and II, the values fall fairly equally on both the plus and minus sides. In Interval III, however, all the values are minus except one and, in the column T.D.A., all values are minus. Statistical analysis shows that, although there is a tendency to a decrease in sensitivity in Interval III, which represents final rod thresholds, and in the T.D.A., none of the changes are of sufficient magnitude to reach statistical significance.

Table 4 represents the results of the experiments with the effect of light exercise on the final rod threshold—that is, on the threshold of the fully dark-adapted eye. It will be noted that there is a tendency to both a lowering and a raising of the threshold. The lowering of the threshold occurs immediately after exercise and is of comparatively short duration as shown in Column 3; it is followed by a rise in the threshold of

TABLE 4

EFFECT OF LIGHT EXERCISE ON THE FINAL ROD THRESHOLD*

Subject	Lowering of Threshold	Time of Lowering Threshold	Duration of Lowered Threshold	Rise of Threshold	Time of Rise of Threshold	Duration of Rise of Threshold
			ERGOMETER			
S.C.	+0.16	0–1½	1½	−0.08	3–5	2
S.C.	0	0	0	−0.08	5–15	10
W.P.	+0.08	0–1	1	−0.04	6–8	2
B.S.	0	0	0	−0.04	3¾–4¼; 8–10	2½
C.G.	+0.04	0–½	½	−0.12	1–15	15
J.E.	0	0	0	0	0	0
Mean	+0.04		½	−0.06		5¼
			GENUFLEXIONS			
W.P.	0	0	0	−0.04	9–11	2
D.M.	0	0	0	0	0	0
B.S.	0	0	0	0	0	0
O.G.	+0.08	0–3½	3½	0	0	0
C.G.	+0.08	0–¾	¼	−0.08	2½–3; 4–5; 6–9	4½
L.H.	0	0	0	0	0	0
W.N.	+0.04	2¼–2¾; 3¾–4¼	1	0	0	0
Mean	+0.03		⅔	−0.02		9/10

* Threshold changes are expressed in arbitrary log units and represent maximum changes. Plus (+) denotes a lowering of the threshold, minus (−) denotes a rise compared to values before exercise. Time intervals are given in minutes and include the entire time any lowering or elevation of the threshold occurred.

somewhat longer duration (column 6). However, the changes again are not statistically significant.

The effect of heavy exercise on the final rod threshold is seen in Table 5. In the majority of subjects, the reaction is biphasic; that is, there is a temporary improvement in sensitivity of short duration, followed by a decrease in sensitivity often of considerable magnitude and duration. Treated statistically the tendency shown in light exercise has here become highly significant. Superimposed upon the overall biphasic change are wavelike fluctuations of the threshold especially marked during the depression phase. These fluctuations are evident in Columns 3 and 6, Table 5.

There was no difference in the reactions between men and women. Sixteen out of 20 subjects showed some transitory improvement immediately following exercise; whereas, all showed a reduction in sensitivity beginning in 1 to 5¾ minutes following exercise and lasting from 1 to 16 minutes. The improvement immediately following exercise varied from none to 0.2 log units; the elevation of the threshold from 0.08 to 0.56 log units. Thus, considerable individual variability was present. The maximum decrease in sensitivity of 0.56 log units represents almost a fourfold change in sensitivity. The mean lowering of the threshold was 0.08 log units with a mean duration of ⅔ minutes; the mean rise of threshold was 0.26 log units with a mean duration of 5¾ minutes. In two subjects, pilocarpine fixation of the pupil was used and in one, an artificial pupil. Control of pupillary size in this manner in no way influenced the response of the subject to the exercise.

TABLE 5

EFFECT OF HEAVY EXERCISE ON THE FINAL ROD THRESHOLD*

Subject	Lowering of Threshold	Time of Lowering of Threshold Following Exercise	Duration of Lowered Threshold	Rise of Threshold	Time of Rise of Threshold Following Exercise	Duration of Rise in Threshold
L.C.	+0.08	0–¼	¼	−0.24	2–3; 7¼–8¼	2
E.B.	0	0	0	−0.36	1½–12	11½
J.K.	0	0	0	−0.32	1¾–2¼; 6½–7¼	1½
J.B.	+0.04	0–¼	¼	−0.20	2–3; 3½–4½; 7–12	7
M.O.	+0.16	0–1½; 2–4	3½	−0.08	7½–8½	1
J.P.	+0.20	0–½	½	−0.24	1¼–6; 10½–11	5¼
H.S.	+0.12	0–1¾	1¾	−0.20	2½–5; 5½–7	4
F.J.†	+0.12	0–¼	¼	−0.12	1¾–2½; 3¾–4	¾
M.H.	+0.16	¼–¾	½	−0.28	1–1¼; 2¼–8	5¾
D.M.	+0.04	½–¾; 2½–2¾	½	−0.24	3¼–4; 7½–8½; 9½–10	2¼
D.M.	+0.08	0–½	½	−0.16	1¼–1½; 3–3¼; 4½–5½; 7½–7¾	1¾
L.W.	+0.04	0–¼	¼	−0.40	1¼–9; 12–13	7¾
L.W.‡	0	0	0	−0.44	2–2½; 3¾–11	7¾
J.P.W.‡	+0.20	0–1	1	−0.56	2–16	14
H.W.	+0.04	0–¼	¼	−0.24	5½–7; 8½–9½; 11–12	3½
P.W.	+0.12	0–1¼; 2¼–2½	1½	−0.28	5¾–7	1¾
K.J.	+0.12	0–1¼	1¼	−0.28	5¼–5½; 6–14	8¼
D.K.	0	0	0	−0.20	5½–8	2½
E.T.	+0.04	0–½	½	−0.12	4–20	16
L.H.	+0.08	0–1	1	−0.20	4–15	11
Mean	+0.08		⅔	−0.26		5¾

* Threshold changes are expressed in arbitrary log units and represent maximum changes. Plus (+) denotes a lowering of the threshold, minus (−) denotes a rise compared to values before exercise. Time intervals are given in minutes and include the entire time any lowering or elevation of threshold occurred.

† Artificial pupil used.

‡ Pilocarpine fixation of the pupil.

Therefore, pupillary reactions cannot play a part in the results found.

Figure 1 represents graphically the response to heavy exercise. It will be seen that actual average magnitude, for it was computed by averaging the values of all the subjects at given time intervals following the exercise. As the subjects showed considerable variability in the time of occurrence of the depression phase the general effect of averaging their values would be to level off the curve. This biphasic response is somewhat similar to the effect of muscular exercise on the fusion frequency of flicker.[8]

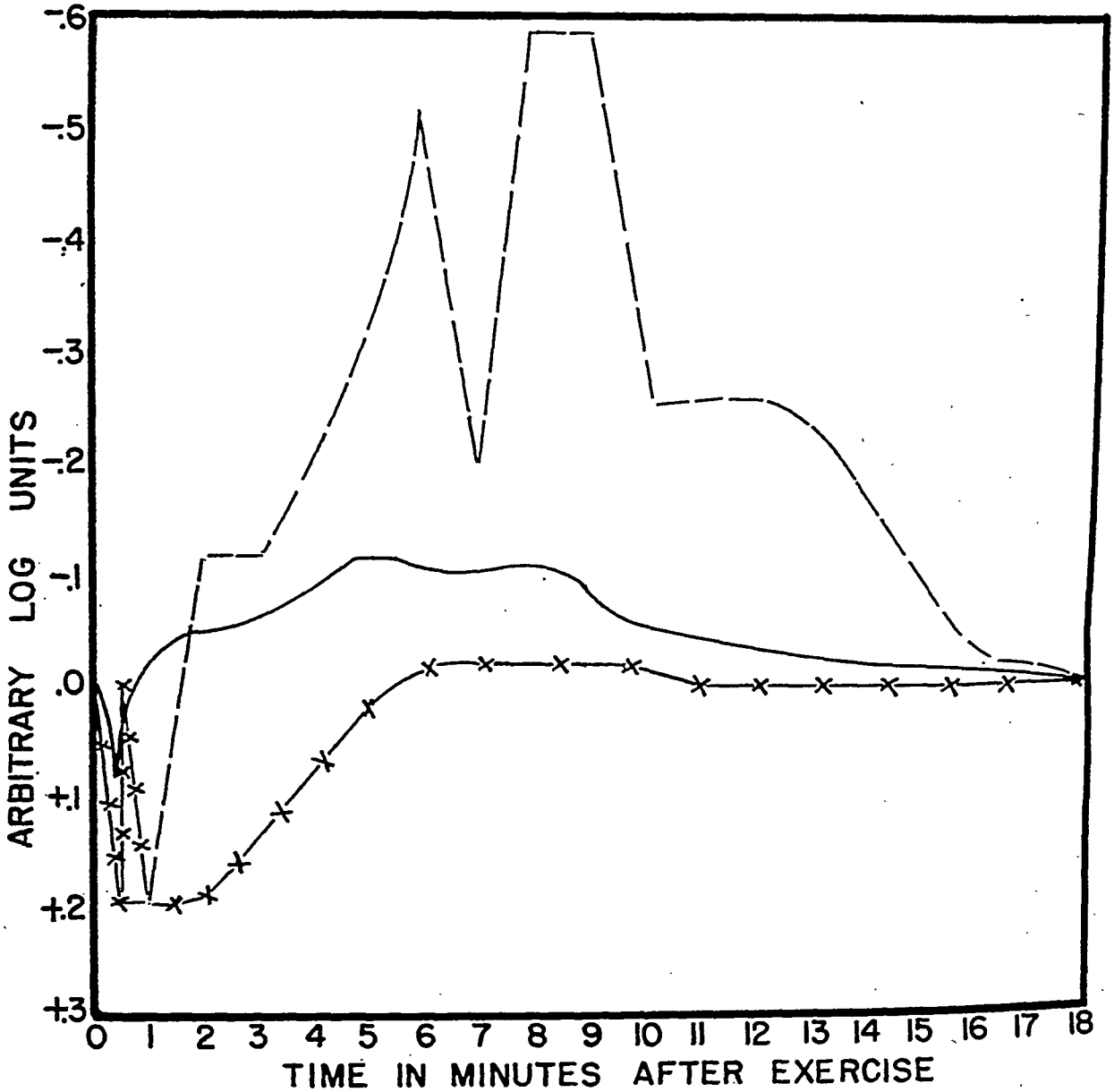


Fig. 1 (Wendland). Effect of heavy exercise on the final rod threshold. "O" represents the threshold level before exercise. Minus (—) values denote a rise in the threshold, plus (+) values a lowering of the threshold. –x–x– Subject showing maximum lowering of the threshold. – – – Subject showing maximum rise of the threshold. ——— Mean of all subjects.

the rise in threshold is much more marked and extends over a longer time interval than the lowering of the threshold. The curve showing the mean response is of value mainly for showing the general biphasic character of the response rather than the

In none of the tests was any correlation found between the physically trained and untrained subjects.

Discussion

The following factors may be concerned in the production of the changes in dark adaptation following exercise:

1. In muscular exercise, an irradiation of impulses from motor centers to other parts of the nervous system is generally assumed. This is thought to be responsible for the marked change in respiratory rate which occurs immediately after exercise before any blood changes could have reached the respiratory center.[9] This irradiation continues throughout exercise and may be responsible for the lowering of thresholds immediately following exercise.

2. The increased blood flow during exercise may improve the blood supply of the retina and brain, a factor which possibly would tend to lower thresholds.

3. The oxygen debt found in heavy exercise is possibly the major factor in causing an elevation of thresholds. All investigators are agreed that reduced oxygen tensions, such as those caused by high altitude, cause an elevation of thresholds.[6, 10-14] It would seem at first glance that the oxygen debt in muscular exercise acted in an exactly similar manner. However, the physiology of the two situations is different. In anoxia there is reduced oxygen saturation of arterial blood; whereas, in muscular exercise the blood becomes properly oxygen saturated as it passes through the lungs. Thus in muscular exercise, the brain and eyes possibly do not receive a diminished oxygen supply. Nevertheless, the oxygen debt does express a need of oxygen by the organism and it is probably in some measure responsible for the elevated thresholds following muscular exercise. The maximum depression in the final rod threshold following exercise, as noted above, was 0.56 log units, or a change equal to the effect produced by an altitude of approximately 15,000 feet.

4. Wald and associates[15] have shown that the addition of 5-percent carbon dioxide to the air an individual at rest inspired elevated the final rod threshold from 0.2 to 0.5 log units (approximately a 1⅔ and threefold change, respectively). Conversely, washing out of carbon dioxide by breathng room air at rates 50 to 100 percent more rapidly than normal caused a lowering of the threshold of about 0.27 log units. Thus according to Wald *et. al.*, respiratory acidosis and alkalosis exert opposing effects upon the visual threshold. Possibly the increased production of carbon dioxide and acidosis found in severe exercise may contribute to the elevated thresholds noted following exercise.

It is interesting to note that most of these same factors have been used to explain the changes observed in the fusion frequency of flicker following exercise.[8]

The coexistence and temporal relationships of these factors in exercise are responsible for its effects on dark adaptation. The depressing effect of heavy exercise is of importance in tasks performed at night and requiring good night vision—for example, night flying.

In general, the findings of Bodansky and Hendley[1] have been confirmed, although some differences are noted. In contrast to our observations, they were unable to demonstrate a significant improvement in normal individuals shortly following exercise. Likewise, they found no correlation between the amount of exercise and the depression of sensitivity obtained. In the experiments reported in this paper, normal individuals showed a statistically significant improvement in rod thresholds immediately following exercise followed by a depression of sensitivity similar to that obtained by Bodansky and Hendley. Also in my experiments, there is correlation between the severity of the exercise and the effects produced; light exercise produces both a smaller improvement and depression phase than does heavy exercise.

Kekcheev's results have not been confirmed.

It is suggested that as part of the standardization of dark-adaptation testing, investigators limit the physical activity of their subjects for one-half hour prior to testing.

Summary

Twenty-nine subjects were used, on whom 60 tests were performed, in studying the effect of light and heavy muscular exercise upon both the rate and final rod threshold of dark adaptation.

Light exercise has essentially no effect upon the rate of dark adaptation and only a tendency to produce a slight biphasic response in the rod threshold. For practical purposes it may be said to exert no effect on dark adaptation.

Heavy exercise produces a tendency to elevation of the thresholds of the total dark-adaptation curve and causes a marked biphasic response in final rod thresholds. The biphasic response consists in, first, a lowering of the threshold of short duration, followed by a rise in the threshold, often of considerable magnitude and of longer duration. In one subject, the depression of sensitivity was equal to that produced in an individual at an altitude of 15,000 feet. In practical application, heavy exercise may be said to produce a definite decrease in ability to see at night.

The factors responsible for these observations have been discussed and the importance of the changes in critical visual tasks performed at night pointed out.

The Medical School (14).

Acknowledgment: Sincere appreciation is expressed to Dr. Erling Hansen and Dr. Ernst Simonson for their interest and helpful suggestions in this study.

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POSTOPERATIVE HYPERTROPIA*

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Hypertropia which is first recognized following the surgical correction of either esotropia or exotropia is familiar to every ophthalmic surgeon and orthoptic technician. It is, in fact, a frequent source of chagrin to the conscientious surgeon. The commonly accepted explanation is that the surgeon when reinserting one or both of the horizontal rectus muscles selected a new site which was either above or below the horizontal meridian of the globe.

If it had been the intent of the operator either to recess or advance the point of insertion of a muscle and yet keep that muscle's line of pull unchanged, the appearance of a vertical deviation following surgery would be an obvious source of embarrassment. An occasional surgeon is too surprised to comment while the more intellectually honest one, in speaking of a postoperative hypertropia, sadly concludes "... I must have gotten a muscle too high!"

VERTICAL DEVIATIONS

Before going further into the subject, it would be worthwhile to consider how much vertical deviation it is possible to produce by purposely reinserting the horizontal rectus muscles either above or below the line of their original insertions. Foster and Pemberton (1946) reported results in a series of 26 patients in whom they had purposely raised or lowered the insertion of one of the horizontal rectus muscles. Their results, cited in the next paragraph, represent the averages for the various forms of correction found in the series.

LATERAL RECTUS

Whole width raising with resection and advancement	11.2$^{\Delta}$
Whole width raising with resection	7$^{\Delta}$
Half width raising with resection and advancement	9$^{\Delta}$
Half width raising with resection	5.4$^{\Delta}$

MEDIAL RECTUS

Half width raising	2.75$^{\Delta}$

They concluded that ". . . there is some justification for such a procedure when the vertical error is constant and less than 11 prism diopters at all horizontal angles."

The significance of this study with respect to the present line of thought is inescapable. It is entirely possible that a surgeon might erroneously reinsert one of the horizontal rectus muscles a millimeter or so too high in operating on these muscles. It is almost beyond the realm of possibility, however, that one could erroneously reinsert one a whole width (10 mm.), or even a half width (5 mm.) too high. And even if such an erroneous reinsertion were made, the maximum resultant deviation would not be more than 11 prism diopters!

The "mysterious" vertical deviations which "appear" following surgery on the horizontal rotators are frequently of an order greater than this 11 prism diopter maximum, particularly in lateral directions of gaze. The conclusion is therefore forced upon us that one could not possibly produce many of these observed postoperative vertical deviations by working only on the horizontal rotators even if one tried to do so!

An intentional vertical effect may be so produced but its magnitude is relatively small—that is, 11 prism diopters at a maximum. True postoperative hypertropia in surgery of the horizontal rotators alone is

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always the intent of the surgeon and will seldom if ever exceed 11 prism diopters even in lateral directions of gaze.

If, as has been indicated in the reasoning so far, true postoperative hypertropia is almost invariably the intent of the surgeon and is otherwise quite rare, then all other hypertropia recognized postoperatively must also have been present preoperatively!

It would be more correct to say that the reason for the existence of this type of postoperative hypertropia was present preoperatively but was hidden, for one reason or another, from the casual observer. How is this possible? The explanation is usually simple and is to be found in a brief review of the mechanics of the oculorotary muscles.

Mechanics of oculorotary muscles

Each of the six oculorotary muscles has a primary action when contracting in moving the globe from the primary position. Secondary actions, when present, exist solely because the line of pull of the particular muscle makes an angle with the optic axis of the globe instead of coinciding with it.

Medial rectus

As examples of these widely known facts, consider the medial rectus muscle and the superior rectus muscle. The line of pull of the medial rectus coincides with the optic axis of the globe when the eye is in the primary position. The medial rectus, therefore, has a primary action of ADduction and no secondary actions when acting from the primary position.

Superior rectus

The line of pull of the superior rectus, on the other hand, makes an angle of about 25 degrees with the optic axis in the primary position and its line of pull runs medial to the center of rotation of the globe; meanwhile, the superior rectus is inserted into the globe at a point anterior to this same center of rotation. Although contraction of the superior rectus from the primary position results principally in elevation, the angulation of its line of pull with respect to the optic axis and to the center of rotation is responsible for its secondary actions of ADduction and INtorsion.

When the line of pull of a muscle makes an angle with the optic axis of the globe and bears a certain relationship to the center of rotation of the globe, then that muscle has a certain mechanical efficiency in producing its primary and secondary actions from the primary position.

The superior rectus is most efficient, acting from the primary position, as an elevator (its primary action) although some of its power resulting from contraction is expended in producing the secondary actions of ADduction and INtorsion. Since its mechanical advantage as an elevator in the primary position is not perfect, its mechanical efficiency in elevation is less than 100 percent; indeed, Adler (1945) estimated it at 73.7 percent.

As the eye moves to assume various secondary and tertiary positions of gaze, the mechanical advantage of each oculorotary muscle changes and hence its mechanical efficiency also changes. As the globe is ABducted 25 degrees from the primary position, the line of pull of the superior rectus moves to coincide with the optic axis and when this occurs the superior rectus acts maximally as an elevator—its primary action—while losing entirely its secondary actions of ADduction and INtorsion.

On the other hand, if the globe is ABducted 65 degrees from the primary position, the line of pull of the superior rectus will make an angle of 90 degrees with the optic axis; it is an obvious mechanical impossibility for the superior rectus to elevate the globe when acting upon it through an angle of 90 degrees. The efficiency of the superior rectus as an elevator will have fallen to zero; meanwhile it can now act with great efficiency both as an ADductor and as an INtortor. So much for a brief review of the superior rectus.

Superior oblique

The superior oblique makes an angle of about 55 degrees with the optic axis when the globe is in the primary position, and its primary action is one of INtorsion; secondarily it is an ABductor and a depressor by virtue of its angular attachment with respect to the optic axis and to the center of rotation. In the primary position, the superior oblique is able to expend about 56.1 percent of its effort in producing INtorsion (Adler, 1945); the balance of its power is expended in producing its secondary actions of depression and of ABduction.

If the globe were ABducted 35 degrees from the primary position, the line of pull of the superior oblique would make an angle of 90 degrees with the optic axis; in such a position, the superior oblique would act maximally as an INtortor but would have lost entirely its secondary action of depression for obvious mechanical reasons.

On the other hand, if the globe were ADducted 55 degrees from the primary position, the line of pull of the superior oblique would coincide with the optic axis and that muscle would act maximally as a depressor and not at all as an INtortor.

Right esotropia

Consider a patient with 45 degrees of right esotropia who has a paretic right inferior rectus muscle. If paresis of the right inferior rectus were the only cause of any vertical deviation, one would expect a right hypertropia resulting from the partially unopposed action of the right superior rectus.

If a right esotropia is present in the amount of 45 degrees, the right inferior rectus paretic, and the right superior rectus therefore acting partially unopposed, nevertheless the expected right hypertropia would be almost if not completely hidden because the right superior rectus, even though acting partially unopposed, is an extremely poor elevator when the globe is ADducted 45 degrees from the primary position.

Right exotropia

If a right exotropia is present and the right inferior rectus paretic, however, any right hypertropia due to the partially unopposed right superior rectus would be quite obvious because the superior rectus acts far more efficiently as an elevator when the globe is ABducted (as it would be in exotropia) than when it is in the primary position.

It is obvious that vertical deviations resulting from involvement of the vertical rectus muscles are decreased (hidden) in esotropia and increased (exaggerated) in exotropia.

Discussion

A patient with 45 degrees of right esotropia and a paretic right superior oblique would have a right hypertropia due to the partially unopposed action of the right inferior oblique and the right hypertropia would be quite obvious. It would be obvious because the obliques are far better elevators or depressors in positions of ADduction than in the primary position.

If, on the other hand, a patient had 45 degrees of right exotropia and a paretic right superior oblique, although the right inferior oblique would be acting partially unopposed, its mechanical advantage as an elevator would be so poor in the position of the globe in ABduction that little or no right hypertropia would be apparent *until the eye was returned to the primary position.*

It should also be obvious that vertical deviations resulting from involvement of the obliques are decreased (hidden) in exotropia and increased (exaggerated) in esotropia.

Predictions about postoperative hypertropia

An appreciation of the foregoing facts enables one to make some perfectly logical predictions about so-called postoperative hypertropia:

1. If a *vertical rectus* is involved and there is *esotropia,* surgical correction of the esotropia will uncover or will apparently exaggerate any existing vertical deviation.

2. If a *vertical rectus* is involved and there is *exotropia,* surgical correction of the exotropia will cause any vertical deviation present to decrease or appear to disappear entirely.

3. If an *oblique* muscle is involved and there is *esotropia,* surgical correction of the esotropia will cause any vertical deviation present to decrease or perhaps make it seem to disappear entirely.

4. If an *oblique* muscle is involved and there is *exotropia,* surgical correction of the exotropia will either uncover a vertical deviation or will apparently exaggerate any existing vertical deviation.

It must be emphasized that these rules apply only to cases of lateral heterotropia in which there is but a single vertically acting muscle involved. It will perhaps have been noted that the term "involvement" rather than "paresis" or "spasm" of muscles has been carefully used, and there is a reason for this seeming ambiguity. According to Hering's law, any impulses of central origin destined for the muscles of one eye will arrive at the muscles of both eyes in equal amount. This simply means that the fixing eye will determine the innervations going to both eyes.

If the fixing eye is the eye with the paretic vertically acting muscle (whether it be an oblique or one of the vertical rectus muscles), then the yoke muscle of the paretic muscle will produce the vertical deviation. The yoke muscle of the paretic muscle is the muscle "involved" in producing the deviation.

If the nonfixing eye is the eye with the paretic vertically acting muscle, then it will be the direct antagonist of the paretic muscle which is the muscle "involved" in producing the vertical deviation. It should now be clear why the term "involved" muscle is used advisedly.

The appearance or disappearance of a vertical deviation following the surgical correction of a lateral heterotropia is neither mysterious nor should it be surprising. Accurate identification of paretic vertically acting muscles will allow accurate predictions with respect to the postoperative behavior of vertical deviations.

A careful preoperative study will enable one to diagnose paresis of vertically acting muscles as well as to identify the muscle, or muscles, involved. The subject of the diagnosis of paresis of the oculorotary muscles is beyond the scope of this paper. Suffice it to say that the laws of Sherrington and of Hering are the keys to the problem in its entirety.

Conclusion

In conclusion, it may be said that unless it was the specific intent of the surgeon, there is no such thing as postoperative hypertropia; it is really preoperative and requires only careful diagnostic study for its recognition.

640 South Kingshighway (10).

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SOME METHODS OF LID REPAIR AND RECONSTRUCTION

VI. Reformation of the inferior fornix

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The inferior fornix of the anophthalmic socket is of far greater importance than the superior in the satisfactory fitting of a prosthesis. The upper fornix need only be of sufficient depth to prevent the artificial eye from slipping out from under the upper lid.

The lower fornix, however, not only does most of the weight bearing but it must also be deep enough to supply firm anchorage for the prosthesis in the usual upright position of the head. This is why, in socket reconstruction, the dissection is carried well below the lower orbital rim to provide a sufficiently deep lower gutter.

When the socket has been badly traumatized, enucleation should be done carefully and the tears in Tenon's capsule repaired meticulously. Otherwise, there may be a tendency for the orbital contents to prolapse forward with a shallowing or obliteration of the lower fornix to the point where retention of a prosthesis becomes impossible.

Figure 1A illustrates the extreme of such a case. This is not postoperative chemosis but an irreducible prolapse of orbital contents present three months after enucleation.

Figure 3A is the type much more commonly seen. The prolapse of orbital contents here has simply obliterated the lower fornix, converting it into a downward sloping shelf which pushes the lower lid outward and makes retention of a prosthesis impossible Repair of this deformity is not too complicated.

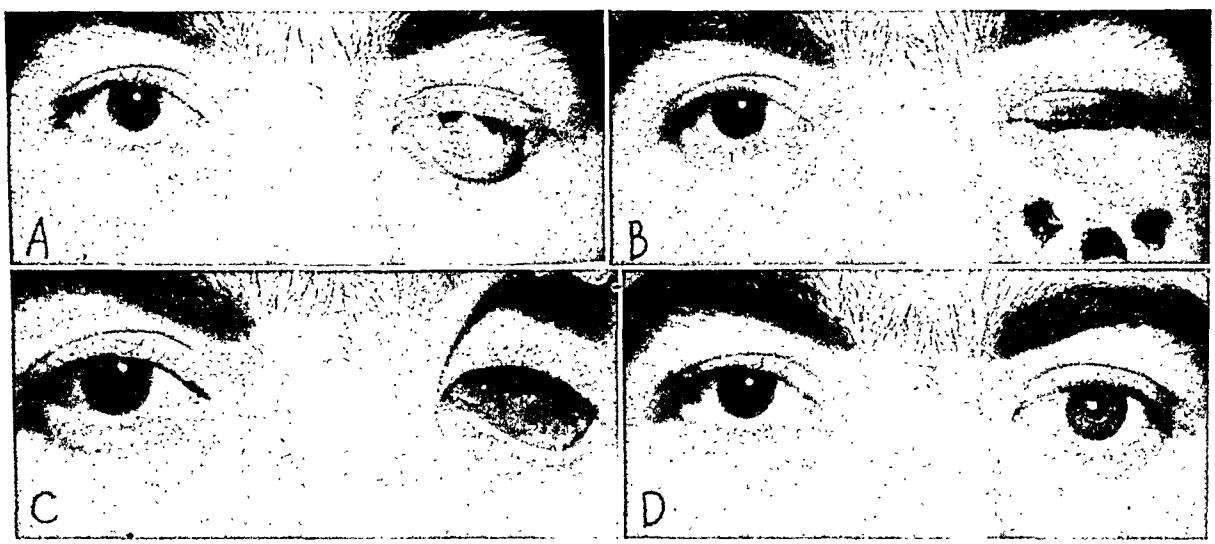


Fig. 1 (Fox). (A) Prolapse of orbital contents with obliteration of inferior cul-de-sac following trauma to globe and enucleation three months previously. (B) One week after repair, before removal of sutures. (C) Restored inferior cul-de-sac. (D) Prosthesis in place.

Technique

The conjunctiva is incised horizontally from external to internal canthus well above midline (fig. 2A, broken line) and undermined to the upper and lower lid edges. The lower conjunctiva is retracted forward and all excess fibrous tissue resected. The sub-

conjunctiva is then carefully resutured with 4-0 chromic catgut, interrupted sutures.

The inferior fornix is recreated by blunt dissection carried down to the periosteum well below the orbital rim as is done for socket reconstruction. The conjunctival incision is closed with a 4-0 black silk, running suture. Three double-armed 3-0 black silk sutures spaced equidistantly (fig. 2B) are then passed from within outward through the floor of the newly created cul-de-sac. The needles are carried close to the periosteum well below the lower orbital rim and brought out on the cheek where they are tied over oiled silk pegs (figs. 1B, 2B, and 3B).

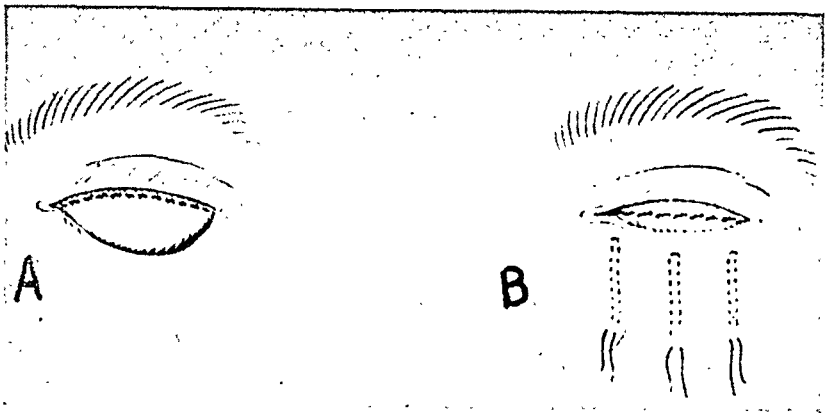


Fig. 2 (Fox). Technique of repair. (A) Dotted line shows position of initial conjunctival incision. (B) Position of sutures before insertion of conformer and application of pressure bandage.

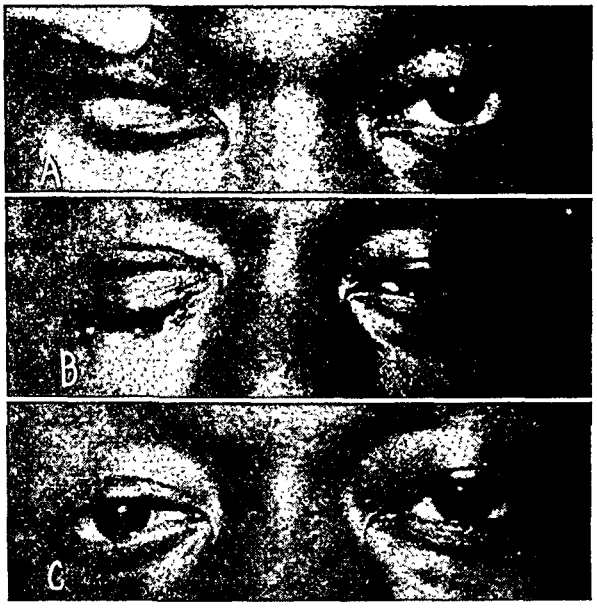


Fig. 3 (Fox). (A) Prolapse of right orbital contents with shelving and obliteration of lower cul-de-sac and displacement of lower lid. (B) Seven days after surgery, before removal of sutures. (C) Final result with prosthesis in place.

A snug conformer is inserted to assure healing of the tissues in proper position as described in a previous communication[1] and a firm pressure dressing is applied. On the seventh day after operation the sutures are removed, the conformer reinserted, and the eye repatched daily thereafter until all reaction has subsided. A permanent prosthesis may be inserted any time after the second week.

Conclusion

The problem of repair here is not difficult. No conjunctiva need be grafted since none has been lost. It is simply a matter of reconstructing the inferior fornix by a reshuffling of the orbital contents and assuring that they heal in proper position. The technique described above has been used in seven cases to good effect and is recommended unhesitatingly.

63 East 75th Street (21).

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A POSTVACCINIAL OCULAR SYNDROME

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Ocular complications following vaccination are by no means as rare as our textbooks indicate for reports of postvaccinial ocular complications are extremely meager. The importance of the appearance of symptoms within a very constant incubation period has not been stressed. In neurologic reports, the appearance of signs or symptoms 9 to 11 days after vaccination has been shown to be pathognomonic of postvaccinial neurologic disease (Putnam,[21] Ferraro,[5] Flexner,[7] and Finley[6]). The eye should not be exempt from this response especially since it has been shown that the pathologic lesion in the brain in postvaccinial encephalitis is specifically a vascular one, possibly of allergic nature.

The frequency of unexplained exudative choroiditis in young and apparently healthy adult soldiers during the recent war is one of the outstanding impressions left upon me, as well as upon several colleagues with whom this observation was discussed. The idea of a possible relationship of exudative choroiditis and other complications to vaccination for smallpox, accidentally thrust upon me, has gradually evolved into a concept now grown to complete acceptance.

This concept aims to establish the causal relationship of any ocular eye lesion to vaccination if the incubation period is of 10 to 12 days, no matter what the nature of the lesion may be.

In order to substantiate such a diversified and far-reaching claim it was necessary not only to review the available literature upon ocular complications following vaccination, but also to obtain all available data upon postvaccinial complications, particularly of the neurologic variety.

In the spring of 1947, an excellent clinical opportunity presented itself when mass vaccination for smallpox became necessary in the New York metropolitan area. During this period I encountered approximately 50 ocular complications following vaccination, some of which I shall attempt briefly to describe.

REVIEW OF LITERATURE

Ophthalmic literature contains two varieties of ocular complications following vaccination.

A. DIRECT, PRIMARY INOCULATION

The more commonly described and better understood variety is that of direct inoculation, with pustule formation upon the lid and the production of a primary disciform corneal lesion. Of this variety there are several hundred reported cases. They are direct and primary.

Usually the individual inoculates his or her own lid or cornea by scratching the vaccination. The virus is transplanted upon the lid or upon the cornea and within 10 days a palpebral and/or an ocular lesion develops.

This ocular complication has frequently been described and is well understood. For example, Schirmer[17] first reported postvaccinial disciform keratitis in 1891 and again in 1904, at which time he reviewed 6 previously reported cases and added a 7th case.

Characteristic findings in this syndrome, according to Schirmer were:

1. A central, parenchymatous, gray, disciform corneal lesion
2. A deep, circular, grayish line resembling a ring
3. Involvement of Descemet's membrane
4. Mild uveal involvement
5. Clear peripheral cornea
6. Long duration
7. Permanent opacification

Schirmer noted the striking similarity between "keratitis postvaccinolosa" and

disciform keratitis as described by Fuchs. Schirmer tried to show that these two conditions were identical. In the cases reviewed by him the keratitis was exogenous, being produced by some form of primary contact.

B. Indirect, delayed ocular complications

The second type of ocular complication is a systemic, secondary, delayed reaction usually associated with and considered part of a postvaccinial encephalitic complication.

Ocular symptoms which appear with any of the acute exanthemas (virus) are probably of similar etiology, since the histopathologic picture of all the postexanthematous encephalitides are identical. The rarely acquired pathologic material obtained from eye sections in these diseases tend to bear out this statement (Von Herrenschwand;[19] Scheyling[16]).

There have been only a few cases recorded in which postvaccinial encephalitis has been followed by complications involving the ocular structures. Scheyling[16] reported upon a case of bilateral optic neuritis in a child, aged 14 months, with complete loss of vision appearing 2 weeks after vaccination for smallpox and associated with postvaccinial encephalitis.

The cerebrospinal fluid was under increased pressure; there was a 363 cell count; the fluid was sterile. At the onset there was marked edema of both the optic nerve and retina. Vision returned to normal after several weeks.

Scheyling believed that the vaccine virus activated a latent infection. The fact that the patient improved with convalescent serum led Scheyling to believe in the toxic or infectious nature of the disease rather than in any allergic phenomenon.

Smiley,[18] in 1903, reported a case of bilateral paralysis of all of the extraocular muscles with involvement of accommodation. These complications appeared 10 days after vaccination and were associated with other evidences of encephalitis. Complete recovery ensued after 5 weeks.

Von Pollnow,[20] in 1910, reported a case of bilateral papilledema coming on 3 weeks after encephalitis which appeared 3 days after vaccination. This 12-year-old child was left with a bilateral optic atrophy.

Giorgi[9] reported a case of bilateral optic atrophy 14 days after postvaccinial encephalitis which appeared 5 days after vaccination. The 3-year-old girl remained blind.

Von Herrenschwand,[19] in 1939, reported 3 additional cases of ocular complications in postvaccinial encephalitis. His original case, reported in 1912, was that of a 6-year-old child who developed a postvaccinial bilateral sixth-nerve palsy. Rapid improvement took place in this case. In his second report he listed 3 new cases each of which came to autopsy. The patients were approximately 8 years of age in each instance. Encephalitis occurred 7 to 10 days after inoculation with death following in 2 or 3 weeks.

Clinical eye studies were not recorded in these cases but autopsies, including sections of the eye, were performed with some rather interesting revelations. In the first case there was an internal and external hydrocephalus with recent hemorrhage below the dura upon each side of skull. Both trigeminal nerves and their sheaths were edematous. The entire histologic picture was that of an allergic response. A bilateral perineuritis of the optic nerve was present.

The postmortem examination of the second case was most interesting as regards the ocular findings. The histopathologic picture uncovered in this case was that of an early retrobulbar neuritis, a condition which rarely comes to autopsy unless death ensues from some other cause.

Von Herrenschwand believed that the presence of continuous circular lines of connective tissue within the vein was characteristic of postvaccinial neuritis and from this feature one could rule out other forms of encephalitis.

Perhaps this concept of retrobulbar neuritis as determined by Von Herrenschwand's histopathologic investigation in cases of postvaccinial encephalitis and the sugges-

tion that we are dealing with an early allergic response may fit into the picture portrayed by Benedict[2] in his studies of retrobulbar neuritis. Certainly there is more than casual coincidence in the fact that retrobulbar neuritis terminates as multiple sclerosis (Benedict[2]) and that multiple sclerosis resembles the postvaccinial encephalitis histopathologically (Putnam[21]).

Benedict's work seems further to be substantiated by Adler[1] in whose series of 100 cases diagnosed as acute encephalitis of all varieties, 15 percent eventually were recognized as multiple sclerosis because of the recurrence of attacks. Putnam has stated that certain types of encephalomyelitis represent the acute stage of a process which we know in its chronic relapsing stage as multiple sclerosis.

Parker Heath,[10] in reporting upon a case of measles encephalitis, described an ophthalmoscopic picture resembling embolism of the central retinal artery. Because of the importance of this case I am repeating the report in detail.

Report of Heath's case

Clinical history. J. P., a boy of Italian parentage, aged 6 years, was brought to Harper Hospital, April 9, 1930. The following history was obtained from the parents and the child's physician. The family history was not important other than that there had been exposure to measles. The patient was a first child, normally born after an uncomplicated pregnancy. The child had been breast fed and there had not been any serious sickness before the present attack. He had been an average child in all respects with good general health.

Present illness. Measles had begun 11 days prior to admission with the typical onset. There had been a rash and later convalescence. The temperature had not been high and on the 11th day he had arisen alert, happy, and able to see. At noon, without complaint, it was noted that he groped about in a confused manner. He also appeared indifferent to his surroundings. The father established to his own satisfaction that the boy was blind. He was sent to the Hospital and was seen the same afternoon, the 11th day following his initial measles attack.

Eye examination. The eyes were noted to have a somewhat irregular motion, attracted toward sounds, not influenced by light. There was some dissociation of the eye movements. Pupils were unequal and were varyingly dilated from two thirds to nearly maximum. The dilation varied in each eye in a period of several hours. There was no exophthalmos, bruit, nor increase of intraocular pressure. On command the child could move his eyes about in all directions. There was no swelling of the lids. The conjunctivas were clear and not congested. There was no evidence of discharge.

Ophthalmoscopic examination showed: R.E., clear media, nervehead slightly elliptical vertically, a distinct pallor of the nervehead, and a distinct loss of capillary color, without loss of substance. A thin, hazy edema blurred fine details in the physiologic depression of the nervehead. The lamina cribrosa was not seen. Both pigment and scleral rings were partially obscured. The most extraordinary picture was seen in the arteries which were reduced, practically throughout the fundus, to threads and apparently were carrying little, if any, blood. The veins were dark in color and were reduced in caliber throughout but, relative to the arteries, were engorged. No pulsation was seen. No marked increase of opaqueness was seen along the course of the vessels. The entire retina showed definite loss of transparency not associated with hemorrhage or exudation. In the macular area the foveal reflex appeared a deep red, somewhat diffuse, through a more exaggerated overlying nontransparent retina. The left eye presented essentially the same picture. In both eyes appearances closely resembled bilateral embolism of the central arteries.

Ophthalmoscopic examinations were made at intervals several times a day and showed but little change during the first week. At the end of a week there was some persistent increase in the diameter of the arteries. The retina by this time was more opaque and seemed more edematous. Blood vessels were more obscured as though suspended in a less transparent or translucent medium.

Treatment. On the 7th day the patient's eyes responded to light stimuli for a short interval. There was no increase in the caliber of the retinal arteries following inhalation of amyl nitrite. Heavy sweating from heating with an electric blanket produced slight temporary enlargement of the caliber of some of the arteries. The same phenomenon was observed following foreign-protein injections, typhoid vaccine given intravenously in sufficient amounts to cause a temperature of 103°F. Considerable apprehension was felt that the long-continued anemia would cause neuritis and permanent loss of sight.

Course. At the end of the first week in the Hospital, it was noted that, on the nervehead of the left eye, there were two small capillary hemorrhages and in the macular region were short lines and diffuse dots arranged in a regular manner, neither radiating from nor tangential to the macula. These lines did not coalesce and increased in width. In the periphery were noted similar lines which looked like short, fuzzy, wool yarns of lighter gray color than the surrounding nontransparent retina.

On the 10th day, the child suddenly announced that he could see. Tests with objects bore this out. The fundi showed more filling of the arteries.

From this time on there were irregular but steady increases in diameter of the arteries until on the 23rd day, when he was discharged, they were nearly

normal in caliber. The nerveheads still appeared pale. (This persisted for many months.) With restoration of vision and increase in the diameter of the arteries, the edema in the retina or loss of transparency disappeared.

At the end of 6 months it was noted that the arteries and veins were nearly normal in caliber and the retinas were transparent. Exceptions consisted of fine pigment somewhat lineally arranged in the macula and irregularly disposed, and definite, fine, pigment tracery throughout the extreme periphery as viewed with the ophthalmoscope.

Unfortunately, it was not practicable to make visual-field studies because of the patient's inability to coöperate. On March 16, 1931, the child's vision was 6/7, uncorrected, in each eye, and with a minor correction for astigmatism and far-sightedness it was improved to 6/6.

Comment

Since the pathology of measles and post-vaccinial encephalitis have been shown to be identical, it may be assumed that the histopathologic picture, found in Von Herrenschwand's second case, could possibly produce a variation of the fundus picture seen in Heath's case. Heath's patient revealed an eye condition which was bilateral, edematous, transitory, reversible, and, in several other features, characteristic and unquestionably allergic. The fundus picture may have been modified by the pressure exerted by fluid in the tissue spaces. The arterial thinning was related to this extra-arterial pressure; whereas, the intra-arterial pressure likewise was unusually low, for the systemic diastolic blood pressure was reported as 40 mm. Hg, or even lower.

Heath, who stated, "it is very unlikely that an opportunity will ever arise for an anatomical study of a similar case," probably would be very interested in the post-mortem report of Von Herrenschwand's Case 2. Although Heath does not claim an allergic basis for his case, it would appear that, in stressing the localized edema as the dominant symptom, he points toward just such a concept.

Furthermore, it would appear that the acute retinal edema and other vascular changes in the retina in Heath's case and the retrobulbar picture in Von Herrenschwand's case may be similar in nature to the acute perivascular pathology of encephalitis if we make proper anatomic allowances.

In 1935, Redslob[12] reported a case of spasm of the central retinal artery (bilateral), which appeared suddenly one day after vaccination in a 14-month-old child. The child was blind for 6 weeks. The eyegrounds were described as being "ischemic."

In *Ophthalmologica,* 1947, Redslob reported a follow up of this case. He stated that with vasodilators and arsenical therapy the child regained normal vision after 3 months. He noted that, although normal vision returned, the nerveheads remained pale, the arteries appeared contracted, and there was a general pallor of the fundus which caused him to suspect that the choroidal vessels might have been involved originally.

After the war Redslob met the mother of the patient, now aged 12 years, and he was told that the child had difficulty seeing at night. When examined in March, 1946, the patient was found to have a typical pigmentary retinal degeneration with tubular fields. (Redslob reported this case under a group of pigmentary retinal degenerations in which he listed the many causes of this degeneration.)

In this article Redslob referred to a case reported by Franceschetti,[8] whose patient developed an optic neuritis 10 days after vaccination. Later a typical pigmentary retinal degeneration appeared. Redslob believes that vaccination precipitates the vascular spasm which in turn produces the pigmentary retinal degeneration. (He ruled out all hereditary factors.)

A case reported by Hoffman[11] is of unusual interest in that a condition of retinal venous thrombosis following reaction to vaccine was described. The 21-year-old soldier was given stimulating injections of typhus and triple typhoid and at the same time was vaccinated with the vaccinia virus, the test being recorded as "immune." This patient

had had previous inoculations but in no instance was there any reaction to any of the injections. The past history was reported as being negative.

Two days after the inoculations the left eye became involved, the vitreous appearing turbid. A periphlebitis and venous thrombosis subsequently ensued. Sheathings, hemorrhage, and exudate developed in rapid succession. The author described this process as an acute endophlebitis followed by thrombosis. Later, optic neuritis and papillary edema developed.

Hoffman summarized this case "as an uncommon occurrence of retinal periphlebitis and progressive thrombosis in a young adult following stimulating doses of vaccines with associated anaphylactoid reaction." He noted areas of periphlebitis at the venous bifurcations and at arteriovenous crossings.

These findings throw some light upon the nature of the postvaccinial process and its circulatory disturbances. Hoffman also mentioned sheathing of the vessels which corresponds to the perivascular cerebral disturbance and may be remotely related to Rucker's[14] sheathing in multiple sclerosis. The therapeutic use of intravenous histamine as advocated by Horton would seem to be applicable to this condition.

Duke-Elder[4] mentioned a case of metastatic ophthalmia following vaccination and progressing to enucleation. This case was reported by Saltini[15] in 1894. Duke-Elder also states that in the prevaccination days, iritis and choroiditis was not an uncommon complication of smallpox, occurring in approximately 15 percent of the cases. The type of uveitis was mild in character and usually appeared upon the 8th to 12th day. These attacks may leave characteristic postvariolar atrophic areas in the iris frequently misdiagnosed as vitiligo.

Case reports

The following case reports may be grouped under these headings:

Group A ——— Keratitis
Group B — — — Chorioretinitis
Group C — · — Central serous retinopathy
Group D — — — Thrombophlebitis and thromboses
Group E — — — Panophthalmitis
Group F ——— Isolated muscle palsies

Group A—Keratitis

Case 1

History. The patient, aged 30 years, had served in the Armed Forces for slightly over four years. The onset of the acute episode of his illness occurred on March 13, 1945, one hour after the noonday meal which consisted of pork, vegetables, bread, butter, coffee, and canned fruit. The initial symptom was nausea which was followed shortly by wretching and then by vomiting of projectile character.

After the vomiting had ceased, the patient noticed a persistent, dull nuchal headache which, although it remained unchanged, did not keep him from work during the afternoon. There was no chill, dizziness, or fever at this time.

The patient slept well that night but, upon awakening the next morning, he was aware of a severe dizziness that made the bed seem to turn about in circles. In a few hours this improved so that he was able to report to work at the usual time.

Again, following the noonday meal which was eaten sparingly, the symptoms of the previous day recurred together with an oppressive tightness about the neck and the earlier acute dizziness. The patient returned to his house where he spent a quiet and comfortable night. On this second day there was no recurrence of the headache.

Upon arising on March 15th the patient was still acutely dizzy and somewhat faint. He was admitted via ambulance to the hospital where, except for mild retching, the only obvious symptom for the first week was a persistence of the dizziness, more pronounced when the patient was erect. At no time was the temperature abnormal.

Past history. The patient had had several virus diseases—mumps, measles, scarlet fever, and chicken pox—all without any serious sequelae. He had had several mild attacks of herpes labialis. He had never been hospitalized and had never been ill for longer than 3 days. He had a mild sinusitis and, during the past three months, had had frequent colds.

No history of sensitivity to plants or to sera was forthcoming. The patient had had many "shots" during his military career but none had been followed by any disturbing symptoms; in fact he seemed to suffer less locally following an injection than any of his companions. On March 6th the patient was vaccinated with vaccinia virus and given a stimulating dose of triple typhoid. There was no systemic or local reaction to the vaccination or the typhoid injection and the incident had been forgotten completely.

Physical examination. Upon admission the physical examination was reported as being absolutely

negative. The temperature was 98°F.; blood pressure, 114/86 mm. Hg.; pulse rate, 86. There were no positive neurologic signs and no physical findings other than the acute vertigo. The urine examination was negative.

A blood count showed a leukocytic count of 11,700 of which 72 percent were polymorphs and 28 percent were lymphocytes. Several subsequent blood counts showed an 8,000 to 15,000 leukocytic variance and maintenance of the first-reported percentage for the differential count.

Routine tests for syphilis, undulant fever, and tularemia were reported as negative. No spinal fluid studies were made until 10 days after the onset of the illness at which time the report was: Pressure, normal; cell count, 0; colloidal gold curve, 0....0; globulin, no increase; total protein, 22 mm.; Wassermann, negative.

X-ray studies. X-ray studies of the skull and the chest were reported as negative. Because of the persistence of the vertigo without associated symptoms otologic and neuropsychiatric consultation was sought.

Neurologic examination. The neuropsychiatric consultation is included in its entirety because it presents many interesting sidelights. This examination was performed and recorded one week after admission.

"The neurologic examination is entirely negative. There is no nystagmus or ataxia. There are no abnormal reflexes. The cranial nerves are normal. The fundi are normal. The history and physical findings do not speak for an expanding intracranial lesion.

"This 30-year-old patient has been married about four years. No children have been born. He is a lawyer by formal training and has been a member of the bar in his home state for several years. Following his induction into the army in February, 1941, he took basic training and upon its completion was assigned by reason of his previous training to a legal type of work in division headquarters.

"After several months at this type of work he applied for officers candidate school from which he was eliminated after 11 weeks because of 'lack of leadership in combat.' He was given the opportunity of remaining as an enlisted man at the same camp headquarters where he continued to work in several capacities requiring legal training and eventually he was given his present rank as warrant officer.

"Upon returning from officially granted leave on February 25, 1945, he learned that he had been relieved of his assignment and had been placed upon an available list expecting orders for duty elsewhere, possibly an overseas assignment.

"For the past three months he had been feeling generally weak, tired, and exhausted. He had always been a passive individual. He maintains a definite feeling of inadequacy because there have been no children in the marriage. His legal ambitions are of a passive type and he admits that he never pictured himself as a successful 'trial' lawyer. While at officers candidate school, he found the physical program quite difficult to carry through and upon many occasions he was forced to 'fall out.'

"This officer appears to be a passive neurasthenic individual. In the service he failed to gain a commission because of lack of physical performance and leadership of men in a combat type of duty. He was given a form of work following this failure which was technically and psychologically very acceptable to him. As a result of his work he gained a warrant officer's status which to him was very gratifying.

"While on leave, he was, without previously being informed, relieved of his command and placed upon an available list. He took this in a normal manner consciously, and reacted with, 'Well a soldier is never put.'

"Psychologically, however, this was a serious failure upon his part. With this news there was the threat of combat theatre duty and separation from his wife upon whom he depended a great deal emotionally. He reacted to the situation in the only manner he is capable of, namely, an acute episode of hysteria. His neurasthenic features have existed for many years and manifested themselves early in his military career.

"Diagnosis: Psychoneurosis and Neurasthenia."

Ear, nose, and throat consultations and studies were of indeterminate value. Upon rechecking the patient's history, it was learned that two years earlier the patient had had an episode of buzzing in his ears following diving. This buzzing had lasted only two days. As far as the patient could tell, this condition had entirely disappeared.

One week after the onset of the acute vertigo, the patient complained of auditory disturbances of transient character. He described these as two distinct entities; one was of the "cockleshell variety," the other resembled the hum of an "undialed telephone."

The otologist reported the results of his audiometric and labyrinthine studies as being unreliable, transitory, indeterminate, and contrary to expectation.

"Three separate cold water tests were performed in the first two weeks and in each the patient did not respond normally. Using cutaneous douching for two minutes failed to bring on any of the normal signs of an active labyrinth such as nystagmus, nausea, vomiting, vertigo, or past pointing."

The deafness from the appearance of the audiogram was regarded as a mixed type of nerve deafness rather than plain nerve deafness.

Ocular manifestations appeared about the first of April and were quite mild at the onset. The right eye was involved first. There was no pain and no secretion. There was a mild conjunctival injection and a very slight sensitivity to light.

Following the instillation of a mild astringent (¼-percent zinc sulfate) the eye seemed to improve and remained comfortable for about 10 days at which time there was a recurrence of similar but more severe symptoms.

Eye examination. Examination at this time disclosed a very mild aqueous flare, some increased thickening of the cornea with several folds in Descemet's membrane, and many "craters" visible in the zone of specular reflection. There were also several small foci of increased corneal opacification located in the stroma.

At various places the limbal vessels were beginning to push into the corneal substance superficially. Under atropine locally and typhoid therapy intravenously (a series of 7 injections was given), the right eye gradually cleared up after three weeks but, by this time, a similar picture was developing in the left eye.

Attacks continued to shift from one eye to the other. Each attack lasted about one week and cleared completely, leaving no sequelae. The ocular attacks appeared unrelated to any other systemic manifestation.

During one phase, sulfathiazole was used systemically without any apparent benefit other than to inform the department that the patient was sensitive to that drug. Penicillin therapy was also instituted, with the same unencouraging response.

Course. Throughout the course of the ocular illness, familiarity with the events leading up to the patient's hospitalization, the neuropsychiatric report, and the absence of conjunctival secretion even when a definite keratitis existed made it difficult to keep from suspecting a form of malingering.

CASE 2

History. J. S., a 30-year-old accountant, recently discharged from the U. S. Marine Corps, was vaccinated for the third time on April 20, 1947. While in service, he had never suffered any local or systemic reaction following any of the "shots." Just before vaccination, his physical condition had been reported as excellent. There was no unusual reaction to the present vaccination; no sense of discomfort, fever, malaise, or fatigue.

Nine days after vacination, while the patient was watching a ball game, he noted a sudden severe sharp pain in the right eye. The pain and discomfort were sufficiently intense to cause the patient to leave the game.

The next morning he consulted an ophthalmologist who removed a foreign body from his right cornea. He was told that he would be well in a day or two. The patient emphatically stated that there was no slitlamp examination. The eye appeared to improve for 24 hours but symptoms recurred after 48 hours and seemed to be much more intense than at the onset.

Ocular examination. Upon initial examination, 15 days after vaccination, I noted a mild photophobia, some epiphora, and a faint ciliary injection of the right eye.

A girdle of small gray, round infiltrates encircled the cornea. These were located about 1 mm. within the limbus and numbered 14 lesions. Each lesion was approximately 0.5 mm. in diameter and oval in shape. They were located in the anterior third of the cornea and did not stain with fluorescein. The lesions at the upper limbus appeared to be located just beyond a leash of blood vessels.

The patient was given atropine, compresses, vasodilators, and kept under close observation. In about one week the small infiltrates thinned out and became much flatter and of wider diameter. The patient was kept under observation for a period of 6 months. There were some exacerbations and some moments of marked discomfort, but the overall picture was one of gradual improvement.

CASE 3

History. Mr. J. K., aged 37 years, was first seen at Camp Lee, Virginia, in the autumn of 1944 because of a severe herpetic keratitis of the left eye. This was his third attack.

The lesions responded very slowly. Only after 10 weeks of hospitalization was improvement sufficiently permanent for the patient to be discharged and returned to duty.

He remained entirely free of eye symptoms until two weeks after vaccination in May, 1947, at which time the left eye became severely inflamed and very painful.

Ocular examination. Examination showed that the cornea was increased at least twofold in thickness, with a general overall grayness involving almost its entire surface. The conjunctiva was intensely reddened from the corneal margin to the periphery. There were a great many folds in Descemet's membrane.

The slitlamp beam showed a picture much like a section through a washboard. One vessel ran well into the substance of the cornea, starting at the 9-o'clock position and located in the deep corneal layers. At the onset, the activity seemed restricted to the corneal substance just beyond this new vessel. There was some disturbance in the aqueous. During the acute period the iris could not be seen.

Within the substance of the cornea there were several small infiltrates which were spindle-shaped in cross-section. Photophobia and lacrimation were intense. The red reflex of the fundus could not be obtained at this stage.

GROUP B—CHORIORETINITIS

CASE 4

History. Miss P., aged 23 years, was vaccinated on May 18th. On May 30th, she noticed several large opacities before her left eye which became much more pronounced in the bright sunlight or when she looked at a white background.

At first there was only a slight blur but, within 3 days, vision was reduced to counting of fingers. The patient was hospitalized at the Newark Eye and Ear Infirmary, where all routine studies proved to be negative. This included Wassermann, urine, and Mantoux (1:1,000,000 to 1:10,000 dilution) tests, sinus studies, and X-ray studies of the chest.

Past history revealed chicken pox, measles, and whooping cough—all before the age of 5 years and all mild in character. There were no complications

following these illnesses. The patient had never had any serious diseases; this hospitalization was her first. She had never had any indications of allergic reactions, and there was no family history of allergy. She was first vaccinated at the age of one year, with a normal response.

Eye examination disclosed vision of fingers only in the left eye. The pupil was widely dilated. There were many keratic precipitates of greasy character throughout the corneal structure, fairly large and widely dispersed.

The vitreous contained many large grayish opacities, some globular in shape, others resembling large strands. These vitreous opacities were especially thick in the region of, or just anterior to, a large, yellowish gray choroiditic patch which was about 3 disc diameters in size. This exudate was quite recent with edges still not healed and still nonpigmented.

Although it was difficult to see through the turbid vitreous, particularly in this region, an old choroiditic patch could be seen just a little beyond this lesion. It was heavily pigmented and completely healed, and was located in the upper nasal field. The disc appeared normal, although it could not be seen too clearly.

CASE 5

History. Mrs. R., aged 29 years, was moderately myopic. She had had annual refractions by a well-known ophthalmologist. Vision had always been normal with glasses. Physical examination, after the birth of her second child and three months before the onset of her present eye complaint, indicated no abnormalities.

About 20 days after an uneventful revaccination, the patient complained of small spots in front of her left eye that gradually became more pronounced until, in about 3 days, vision was limited to finger counting at 4 feet.

Ocular examination. The left eye had a characteristic severe chorioretinitis with many large and small keratic precipitates, a very turbid vitreous, and a large choroiditic patch, of recent origin and extremely exudative, in the upper nasal quadrant. A small hemorrhage was present nearby. Near this new lesion were several smaller, old, pigmented choroiditic patches all crowded along the path of the same blood vessel.

Under atropine, compresses, vasodilators, and rest, no appreciable improvement was noted during the next several weeks.

The systemic investigation showed no etiologic factor. The following laboratory studies were normal: Blood count, sedimentation rate, and chemistry, urinalysis, Mantoux test (1:1000 dilution), Wassermann and Kahn test, and chest X-ray studies.

CASE 6

History. Miss F., aged 37 years, injured her right eye at the age of 5 years, with a resultant corneal scar, anterior synechia, and oval pupil. Corrected vision in this eye was 20/50.

At the age of 20 years, she developed a choroiditis involving the left macula. The history indicates that there was a positive response to the Mantoux test. Then followed a period of desensitization, and the patient remained symptom free for 15 years. Vision in the left eye was reduced to and remained at 20/200.

About three weeks after vaccination in the spring of 1947, the patient noticed an increased visual disturbance in her left eye along with many opacities seen as small round spots when looking into bright light. A few days later she was examined by an ophthalmologist who informed her that she now had evidence of a recurrent chorioretinitis involving the macular region.

Further questioning about the period following vaccination revealed that her ocular discomfort started 2 weeks after vaccination. The chorioretinitis responded slowly.

Physical and laboratory investigations failed to disclose any systemic abnormality. Examination 6 months after onset showed no activity of the macular lesion which was completely encircled by a ring of pigmentation.

CASE 7

History. When seen 10 days after typhoid and vaccinia inoculations, the patient said that blurred vision had appeared 7 days after the inoculations. He presented an acute choroiditis with evidence of several older choroiditic patches along the same vessel. He had had several previous vaccinations while in the army but had never been aware of any discomfort, systemic or ocular, following vaccination. The medical "work up" revealed no systemic abnormality. The acute choroiditis gradually healed and after several weeks became completely pigmented.

GROUP C—CENTRAL SEROUS RETINOPATHY

CASE 8

History. Mr. M. C., a 38-year-old radio mechanic, considered himself to be in good health. He had had no physical ailments for several years. There was no history of allergy, either immediate or remote, no history of vasoneurosis, nervous tension, or other features associated with vasospasm. The patient did not smoke.

Upon awakening 3 days after being vaccinated, the patient observed a spot in front of his left eye, most noticeable when he gazed at a white background.

Examination revealed a characteristic central serous retinitis. Physical examination, including blood-pressure studies, was normal. The lesion cleared completely in 3 weeks. There was a characteristic central scotoma.

CASE 9

History. J. G., a jeweler, aged 38 years, developed a spot before his left eye 10 days after vaccination. Vision was only slightly impaired so

that he paid little attention to this impediment except when he attempted to use his jeweler's loupe, at which time he became aware of his inability to see the object at which he was gazing unless his fixation became eccentric.

When examined 3 weeks after vaccination, he was found to have a typical central serous retinitis which cleared in 3 weeks. This patient had a mild hypertension. He had been under observation for 12 years and had never had any previous ocular condition of this nature.

Group D—Thrombophlebitis and thromboses

Case 10

History. E. N., a 21-year-old Negro soldier, was vaccinated and given triple typhoid injections simultaneously. Blurred vision gradually appeared in the right eye until at the initial examination, 10 days after vaccination, vision was reduced to hand movements at 3 feet.

Ophthalmoscopic studies disclosed a thrombosis of the central retinal vein of typical water-spout appearance. The fundus was a striking yellowish color. At arteriovenous crossings and at venous bifurcations, there appeared to be a strange connective-tissue prominence that suggested a perivascular strangulation.

The hemorrhagic appearance progressed and, after 2 weeks, the ocular picture suggested a superimposed arterial obstruction. Secondary glaucoma developed after 6 weeks.

Case 11

History. M. H., a 24-year-old man, was apparnetly in excellent health at the time he was revaccinated against smallpox. Upon awakening 21 days after vaccination, he noted blurred vision more apparent in the right than in the left eye.

Since he was unable to continue his clerical work, he consulted an ophthalmologist who found the patient's vision to be 20/50 in the right eye and 20/40 in the left.

Ocular examination. There was a mild bilateral macular edema and the suggestion of a generalized perivascular bifurcational constriction. The eye became worse in the next 3 days. When examined on the 24th postvaccinial day, vision was 20/70 in each eye. At this time the macular edema and perivascular involvement were quite pronounced.

Under vasodilators, atropine, and rest, there was gradual disappearance of the edema and return of vision to normal. Etiologic investigation revealed nothing abnormal.

Group E—Panophthalmitis

Case 12

History. J. W., a 28-year-old soldier, was vaccinated and given triple typhoid injections 4 days after he was inducted into the army. His past history was entirely negative. There was no allergic background. There had been no previous hospitalizations and no history of any serious illnesses.

On the 7th day after inoculation, the patient's arm became markedly swollen. Chills, headache, vomiting, and a temperature of 104.6° F. developed. The patient was hospitalized on the 8th day. The temperature fell to 101° F. on the 10th day, but at this time the patient complained of pain, redness, and blurred vision in his left eye.

Ocular examination. The next day the left eye disclosed a very severe iritis characterized by a plastic gelatinous deposit in the anterior chamber. The usual therapy was ordered but, within 48 hours, the eye became much worse. The entire chamber was filled with a yellowish mass.

A paracentesis was performed. Culture of the aqueous proved to be sterile. In 5 days light perception was lost. At the end of 6 weeks, the blind eye had become quiescent.

Group F—Isolated muscle palsies

In this group several cases of isolated muscle palsies were observed, all coming on 7 to 10 days after vaccination. In all cases, the muscle disturbance disappeared completely after 3 or 4 weeks.

Conclusions

1. An attempt has been made to classify the ocular complications which may follow vaccination into two groups:
   - A. The direct, primary self-inoculation from contact with a pustule and leading to the production of a modified vaccination upon the lid or cornea.
   - B. The indirect, delayed, secondary ocular complication, arising through a vascular channel with the production of a variety of ocular lesions but following a very definite and constant incubation period.
2. An attempt has been made to show that this secondary type of lesion closely resembles the encephalitic type of postvaccinal complication in which the specific pathologic picture of perivascular myelinoclasis is likened to the vascular and perivascular ocular disturbance.
3. An effort has been made to point out that, in this postvaccinal ocular syndrome, there is no specific lesion. The lesion involves a highly vascular structure in every instance. A previously traumatized or a previously sensitized site is usually selected. However, it can be shown that it is the vascular portion of this site which partakes of the pathologic reaction.

That this may be true even in the avascular cornea is shown by the work of Rich and Follis[13] who attempted to study allergic phenomena in a vascular tissue and concluded that sensitization occurs at the capillaries of the corneal limbus and not in corneal tissue proper.

They showed that, in animals previously sensitized, serum subsequently injected into the cornea produced inflammatory changes at the limbus; however, if one eye had an artificially vascularized cornea, the serum placed into the cornea of a sensitized animal produced a hemorrhagic area within the corneal stroma itself.

There is no cardinal group of symptoms for this ocular syndrome. As in postvaccinal encephalitis, the variety of the signs and symptoms and the very definite incubation period—namely, 10 to 12 days—are the important diagnostic elements.

5. From these case reports, it is not difficult to assume that the eye may be the mirror in which allergic cerebral pathologic conditions, encountered in the postexanthematous encephalitic state may actually be visualized. Indeed, the sequence of events described in the venous thrombosis of the retina is not unlike the pathologic picture portrayed by Ferraro[5] in the studies of postvaccinal encephalitis.

In each case, there can be shown a very definite incubation period, followed by a variable shock reaction, and not infrequently including a previously injured or sensitized area. The edematous outpourings in the fundi, with perivenous infiltration, perivasculitis (sheathing) thrombus formation, endophlebitic phenomenon, neuritis, hemorrhage, and occlusion are extremely like the acute perivascular myelinoclasis in the postvaccinial encephalitic state. In mild instances, this may be reversible.

6. Since postvaccinial encephalitis is a comparatively new disease, first described 23 years ago, it is not difficult to understand the infrequency of observation of this postvaccinial ocular syndrome. Its recognition by ophthalmologists and its publication will indirectly aid in warning against indiscriminate mass vaccination not only of the vaccinia virus but also of other virus vaccines.

7. From the ophthalmic point of view, it is important to keep this syndrome in mind since the introduction of therapeutic sera may be of definite harm. The efficacy of foreign-protein therapy or the introduction of other viruses at the height of an altered blood state should be questioned.

8. An etiologic suggestion is offered for the new syndrome of "nonsyphilitic interstitial keratitis and vestibulo-auditory symptoms" as described by David Cogan.[3]

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THE FOGGING METHOD OF REFRACTION*

A Comparative Analysis

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Introduction

There are many conflicting opinions[1] concerning the value and application of the fogging method of refraction. Most of those who have expressed opinions have not presented data to support their beliefs. Therefore, this report of the refractive results obtained on 500 cases examined with and without cycloplegics should contribute to the factual knowledge on refractive procedures and provide a better basis for evaluation. At the outset, it should be mentioned that the purpose of this survey has been to present and discuss the data obtained, rather than intimate that a certain technique is the final answer to all refractive problems.

Procedure

In obtaining the material for analysis, 500 cases were examined for refraction by both the fogging method and by the use of a cycloplegic. The patients were of the class who usually consult private practitioners; that is, they were not clinic patients.

Cycloplegics were used when the age, symptoms, and other characteristics indicated that some additional information might be provided relative to the patients' visual problems. Both atropine and homatropine were used depending upon the age of the subject; those under 10 years of age were given atropine and older patients were given homatropine in conjunction with paredrine. Atropine sulfate (1 percent) was used routinely in cases under 10 years of age. The drug was administered for three days, 1 drop in each eye 3 times daily and 1 additional drop in each eye on the morning of the fourth day. The patient was refracted upon the fourth day.

Homatropine hydrobromide (5 percent) combined with paredrine (1 percent) was used for the older patients. The drugs were administered at 3-minute intervals; first one drop of homatropine, then a drop of paredrine, then a second drop of homatropine. The extent of the cycloplegia was judged by the residual accommodative ability of the

* The data included in this paper were obtained from the Clinical Division of the Dartmouth Eye Institute, Hanover, New Hampshire, when the authors were staff members at that institution.

subject. The patient was refracted one hour after administering the last drop and if more than two diopters of accommodation remained, further cycloplegic was given.

With regard to the cycloplegic findings, the correction which gave the maximum visual acuity was taken as the cycloplegic result to be compared to the noncycloplegic correction. The data then, represent a direct comparison between the two methods of refraction as obtained from 1,000 eyes subjected to both types of measurement.

The findings have been studied from four main aspects as follows: (1) The changes noted in the spherical findings; (2) the changes noted in the cylindrical findings (astigmatic changes); (3) the changes as influenced by the various types of refractive errors dealt with; (4) the changes as influenced by the subject's age. Each aspect will be discussed individually.

TECHNIQUE

CYCLOPLEGIC CASES

It is pertinent at this point to outline the type of refractive technique employed in this survey. Concerning the cycloplegic cases, the refractive method differs in no essential manner from the accepted principles presently used by most clinicians. One point is worth noting, however, and that is the testing of the patient for residual accommodation following the use of a cycloplegic. An accommodative ability of greater than 1½ diopters called for further use of the drug in order properly to relax the ciliary muscle.

In judging the amount of residual accommodation present after proper time had been allowed for the action of the cycloplegia, two methods were routinely used—the near point as measured by the Prince rule, and the use of minus spheres while the patient fixated a target at a known distance.

Obviously, if the refractionist uses cycloplegics to eliminate accommodative ability in order to measure the so-called static error of refraction, it behooves him to measure the effectivity of the drug employed.[2] Otherwise the drug is being used as a mydriatic, which in itself is small cause for the use of a cycloplegic drug, that is, merely to obtain a large pupil for retinoscopic purposes.

Having been assured then, of the proper effect of the cycloplegic, the patient was retinoscoped. The working distance used was 66 cm. and minus (negative) cylinders were used throughout. The most hyperopic or least myopic meridian was neutralized first, and then by means of minus cylinders the most myopic or least hyperopic meridian was neutralized. A slight overcorrection of hyperopia, or undercorrection of myopia, was obtained in both meridians by subtracting one diopter (plus 1.0D.) from the retinoscopic findings rather than the amount required for the retinoscopic distance employed (plus 1.5D.). This allowed for at least one-half diopter more plus than required by the retinoscopic measurement and enhanced the use of the astigmatic chart and dial.[3]

Since the accommodative element had been removed sufficiently by the cycloplegia, the estimation of the astigmatic interval by means of these subjective tests was accomplished in the same manner as if the patient was fogged. Care need only be taken that one does not undercorrect the hyperopia or overcorrect the myopia present as ascertained by the retinoscopic procedure.

Having thus estimated the amount and axis of the astigmatism, the sphere which gave maximum visual acuity was then found and combined with the cylindrical measurement representing the final and basic cycloplegic measurement. It is this finding that forms the basis of the comparison herein studied.

NONCYCLOPLEGIC ESTIMATION

With regard to the routine followed in the noncycloplegic estimation, every effort was made to keep the procedure standardized, in order that the comparison could be

as free from individual error as possible. The procedure was as follows.

Initially, an attempt was made to estimate roughly the error to be dealt with, either from the patient's old correction, or from clinical findings evident upon further examination. Therefore, when beginning the retinoscopic procedure as much previous information had been obtained as possible, and a fairly proximate idea of the general type of error at hand was possible in many instances.

In retinoscoping the patient the most hyperopic meridian was again first neutralized and then the opposite meridian checked with minus cylinders.*[4] Enough spherical correction was then left in the trial frame which gave a slight against movement in both meridians when retinoscoped. This step combined with the addition of one diopter of minus rather than the 1½ diopters required for the retinoscopic distance of 66 cm. insured an adequate fogged condition at this point.

Next, the attention of the patient was directed to the astigmatic chart and dial and the astigmatism measured. The cross cylinder was used routinely in checking both the axis and strength of the required cylinder. The routine was completed by finding the required sphere and the correction thus obtained formed the basis of the comparison in this analysis.

Care must be taken by the clinician to be fully aware of the principles, both optic and physiologic, involved in the proper use of these subjective tests.[5] Should the fog be inadequate or the clinician unable to interpret the patient's responses, the procedure will become at once confusing and the results more so. Obviously, the interpretation of the phenomena as seen by the patient requires a certain degree of intelligence since the test is purely a subjective one. It is expedient then, that the patient either be old enough or have enough mental vigor to respond properly to the questions offered. In the event that these conditions cannot be properly fulfilled, objective rather than subjective measurements must be resorted to.

In estimating the degree of fog present the use of a small sphere (either a 0.25 or a 0.37 diopter sphere) is frequently a valuable aid. A minus sphere is used in conjunction with a plus sphere and these spheres are placed in rapid succession before the eye being tested. In most instances, the patient's response will indicate the degree of fog present. If by quickly placing the minus sphere over the eye we get an increase in visual acuity of say one line and conversely by placing the plus sphere over the same eye we decrease the acuity by a line, the fog is usually satisfactory.

This is important since the results obtained with the patient overfogged can be as confusing as when inadequately fogged. If the results do not follow this pattern, the sphere in the trial frame should be again checked for its accuracy.

Discussion of the data

1. Spherical changes

In Figure 1 may be seen a curve which represents the entire series plotted to show the amount and direction of the changes between the two methods. These changes are spherical changes only. Each individual circle represents a group of cases in which a change has been found. The percentage figure represents the number of cases showing a change. The abscissa depicts the amount and direction of the observed changes. The zero represents no change between the two findings. Those cases plotted to the left of the zero represent instances in which more plus or less minus was found

* It would be well at this point to mention the reasons for using minus cylinders. First, by using minus cylinders throughout both the retinoscopic and subjective portions of the examination, the duration and degree of the fog present is enhanced. Second, those changes taking place in the amount of the astigmatism present due to accommodation are kept to a minimum.[4]

with the fogging method and those plotted to the right of the zero represent the number of cases showing more plus or less minus with the cycloplegic measurement.

It will be seen at once that the apex of the curve represents about 27.5 percent of the series. This means that 27.5 percent

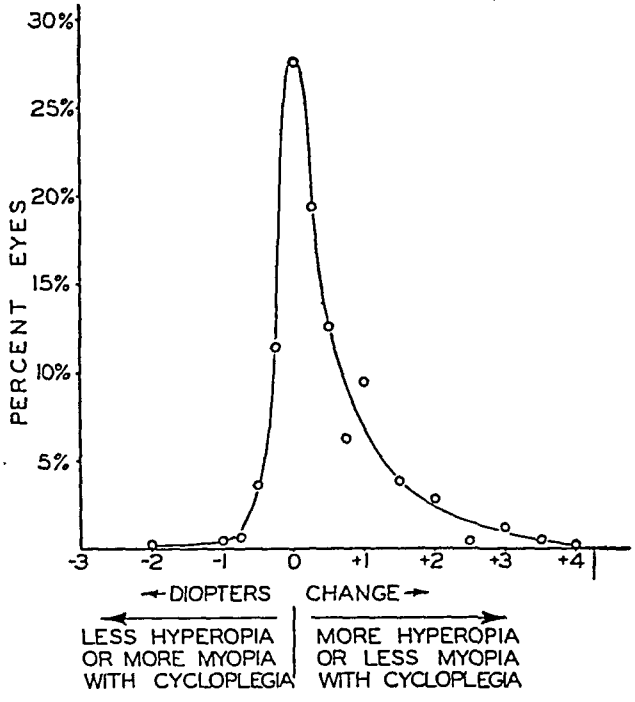


Fig. 1 (O'Brien and Bannon). Amount of spherical change found under cycloplegia. (All cases combined, 1,000 eyes.)

of the cases examined showed differences between the two methods that are not clinically measurable. In other words, the changes are less than one quarter of a diopter in either direction. However, if we take ±0.50 diopter as a comparative figure we find that almost 75 percent of the cases in the series show a similarity well within this measure.

Further study of the curve indicates that of those cases showing a difference, the majority of them lie to the right of the zero. This is the expected finding, since it would naturally be supposed that the cycloplegic cases would reveal more plus as compared to the fogging estimation.

The number of cases showing greater than 0.50 diopter of hyperopia or less myopia averages almost 24 percent. However, it is quite interesting to note the cases grouped to the left of the zero. These cases reveal less hyperopia and more minus when examined under cycloplegia. They represent 1.3 percent of the series and the changes found in this percentage were differences greater than 0.50 diopter. This phenomenon has been previously mentioned by Burdon-Cooper.[6]

2. Cylindrical changes

Figure 2. It will be noted that this curve is quite similar to the curve in Figure 1 which represents the spherical changes between the two methods of refraction. How-

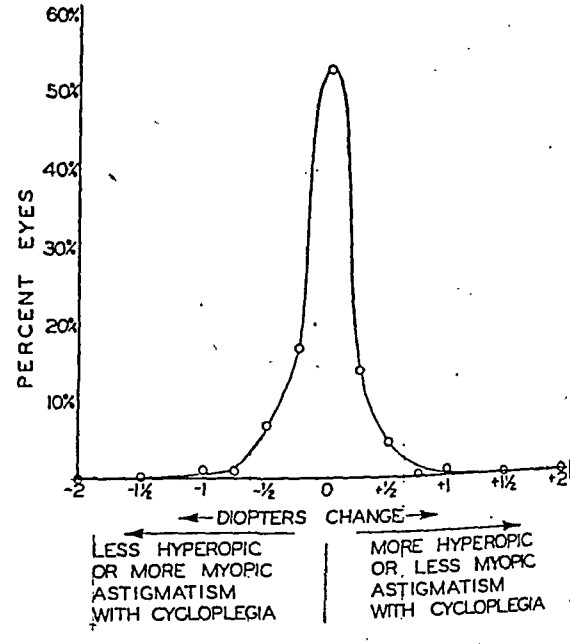


Fig. 2 (O'Brien and Bannon). Amount of cylindrical change found under cycloplegia. (All cases combined, 1,000 eyes.)

ever, inspection will further show that the changes, while following the same general pattern, are less pronounced than those in Figure 1. In this curve almost 85 percent of the cases show agreement within 0.25 diopter in either direction. If we allow 0.50 diopter in either direction as a unit of comparison, then the percentage of cases show-

ing appreciable changes in any direction become clinically negligible.

The disposition of the cases revealing difference is also interesting in that the grouping is placed evenly on either side of the zero marking, this being a slight change as compared to the curve seen in Figure 1. In plotting this curve, the most hyperopic meridian was used as the spherical component with the result that the astigmatism is represented by minus cylinders.

3. Type of error and its influence on changes found

Figure 3 illustrates the changes found between the cycloplegic and the fogging measurements as influenced by the type and degree of ametropia measured. Four sections of the graph will be noted, and, starting with the top section, the curves represent errors of increasing degree. Thus, the top section represents those cases having errors of from emmetropia to 2 diopters. In all instances, the solid line represents the hyperopic cases and the broken line the myopic cases. In this group, the myopic curve is similar to the overall curve as seen in Figure 1, but the hyperopic curve reveals more cases placed to the right of the zero. The disposition of these cases to the right of the zero represents a small number of cases actually, but the trend is as would be expected.

The next section (below) represents errors of from 2 to 4 diopters. Here both curves are flatter and show a greater spread to the right of the center. The swing of the hyperopic curve to the right is well marked, but the number of cases actually involved is small when the percentage is checked. Also the total number of cases is much smaller than the top curve.

The third section of the graph represents errors of from 4 to 6 diopters. The curves represent a total of some 75 eyes, so that the actual number of cases forming the curves is quite small compared to the top section.

The bottom section represents errors greater than 6 diopters and, as would be expected, it was in this group that the widest discrepancies occurred. Also, the total number of eyes examined was the smallest,

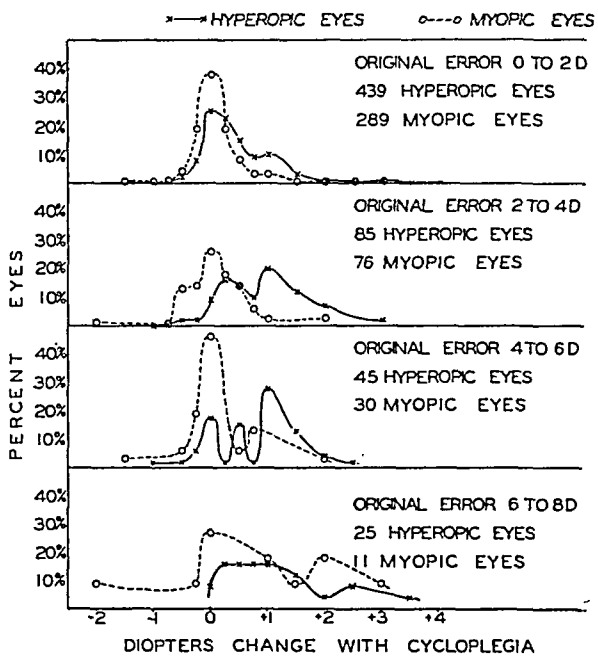


Fig. 3 (O'Brien and Bannon). Influence of original error on differences found under cycloplegia.

therefore the actual amount of change is least of all.

4. The age factor

Figure 4. Definite changes were noted when the results were considered from the age aspect. Four curves were drawn representing four standards of comparison which can be noted on Figure 4. The bottom curve depicts the changes observed when one quarter of a diopter was used as a means of comparison. The top curve represents changes of one diopter, plus or minus. The intermediate curves show changes of ½ and ¾ of a diopter. The most striking differences are immediately noted in the first column which is composed of those cases between 10 years of age and younger. It will be noted that the percentage of cases showing no change is less in this group than any

subsequent age level. Also it will be seen that after reaching the 15-year group the curve becomes almost straight. From Figure 4 the influence of the age of the subject can be clearly seen with its attendant results.

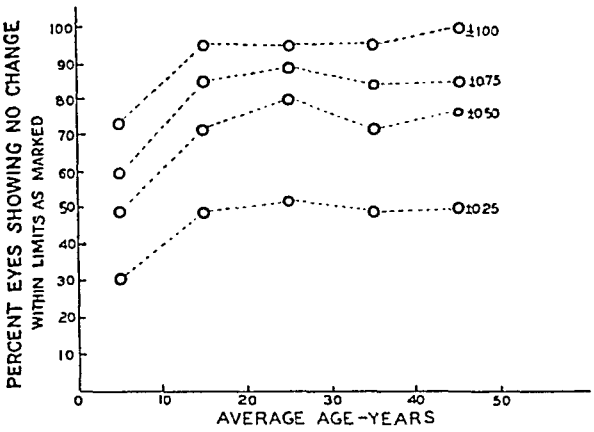


Fig. 4 (O'Brien and Bannon). Influence of age on differences found under cycloplegia using various limits of precision.

SUMMARY

The differences in spherical and cylindrical findings as found in 1,000 eyes refracted without and with cycloplegia are presented. The data may be summarized as follows:

1. In 74.4 percent of the cases, the spherical ametropic findings agreed, when ±0.50D. is allowed as being clinically insignificant and open to possibility of being due to errors of repeatability (fig. 1).

2. In 24.3 percent of the cases, more than 0.50D. greater hyperopia or less myopia was found under cycloplegia (fig. 1).

3. In 1.3 percent of the cases, more than 0.50D. greater myopia or less hyperopia was found under cycloplegia (fig. 1).

4. In 84.5 percent of the cases the cylindrical findings agreed within the clinical limits of 0.25D. (fig. 2).

Although not shown by a graph, a study[7] was made of the axis change under cycloplegia and agreement (within ±5°) was found in 81.8 percent of the cases.

5. The influence of the amount and kind of original error on the spherical difference found under cycloplegia indicated that, in general, greater differences were found in hyperopic cases and in cases having the greater degree of ametropia. Although this trend is fairly consistent, it is not particularly marked in amount (fig. 3).

6. The effect of the patients' ages on the spherical differences found under cycloplegia when various allowances (±0.25D., ±0.50D., ±0.75D., ±1.0D.) are made indicates that, in general, the greatest differences under cycloplegia were found in the younger age group—under 10 years of age (fig. 4).

Beginning with the 15-year-old group, the curve is quite flat up to the age-45 group. It shows that, when an allowance of ±0.25D. is made, the findings by both methods agreed in about 50 percent of the cases; when the allowance is ±0.50D., the findings by both methods agreed in about 75 percent of the cases; when the allowance is ±0.75D., the findings agreed in about 85 percent of the cases; and when an allowance of ±1.0D. is made, the findings agreed in about 95 percent of the cases.

CONCLUSION

The most significant fact derived from this analysis is the large percentage of agreement between the two types of refractive procedures. If one allows one-half diopter or less as a satisfactory standard of clinical agreement, then almost 75 percent of the cases surveyed show similarity within this norm. Thus, at least this percentage of an average refractive series can be said to be properly amenable to this type of noncycloplegic refraction. The influence of the age of the subject, and the type of error dealt with has been discussed and the variance pointed out. In both instances, the changes are what is estimated and expected. Even the differences in these two instances are small when compared to the overall agreement.

It is hoped then, that this study will offer

a better appreciation of the fogging of refraction and of its widespread application in refractive procedure. The capable refractionist should be familiar with the technique involved and with the limitation of its use as discussed previously. The efficacy and ease with which this technique can be employed in determining refractive errors makes it, at once, a valuable and efficient office procedure.

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BINOCULAR REFRACTION*

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Binocular methods of refraction have been said to be superior to monocular,[1] but most of the evidence has been theoretical. The only methods that have had much clinical usage are stigmatoscopy and the Dorland Smith method of using a plus 1.5D. sph. as an occluder.

In this paper I wish to add some experimental and clinical evidence on the subject, and point out the advantages and possible errors in the method. The two parts of the discussion will be, first, whether binocular refraction induces relaxation of accommodation during the procedure and balances the accommodative tone of the two eyes, and second, whether it is desirable to determine the axis of astigmatism under binocular or monocular conditions.

Whether the refraction is with or without cycloplegic is irrelevant here. Those who use binocular refraction say cycloplegic refraction deserves the added safeguards of fogging and binocular conditions.

Dorland Smith showed that if the retinoscopic or rough subjective refraction and plus 1.5D. sph. were placed before each eye in the trial frame, the patient would gradually relax accommodation, often as much as under homatropine. Frequently, the binocular acuity would start at 6/60, but gradually improve to 6/20 or better. This, he called cyclodamia, or a method of control of the ciliary muscle tone while refracting. It is binocular technique because, throughout the procedure, one is constantly asking the patient his acuity with both eyes open and fusing. First one eye and then the other eye is covered briefly, and the acuity compared. If one eye is blurred, minus sphere is placed before it, and the acuity compared. When the acuity is equal at the binocular 6/60 level, 1.5D. sph. is removed from one eye while the cylinder is determined by the Jackson crossed cylinder. It is true that the blur level depends on the intelligence and ability of the patient to interpret blurred imagery, so the sphere removed may be more or less than 1.5D. The cylinder is measured on the other eye by transferring the plus 1.5D. fog to the first one. If any change in amount of cylinder is made, the fog is replaced before each eye, and the balance repeated. Equality of visual acuity at the 6/60 level is considered as important as at the 6/5 level. Criticism of this view will be presented.

To determine the effect of plus 1.5D. uniocular fog on fusion, one simply measures fusional amplitudes. A patient with strong dominance may suppress and never get diplopia with increasing prism with as little as plus 0.25D. or 0.5D. before the recessive eye. Most patients have mixed dominance, or only moderate dominance, however, so that suppression does not interfere with the test. If the dominance is great, the patient may be so disturbed by the blurred dominant image while the recessive eye is being tested that he cannot discriminate as well as with complete occlusion of the dominant eye.

In most patients the fusional amplitudes are little disturbed by the uniocular fog until it exceeds plus 1.5D. There is some decrease at 0.25D. and 0.5D., but no further change up to plus 2.5D. Vertical and torsion amplitudes on the synoptophore break at about the same torsion with or without fog on one eye.

The plus 1.5D. fog should be placed in the rear cell of the trial frame to get the least magnification and therefore the best fusion. Magnification of the retinal image

* From the Department of Ophthalmology and the Oscar Johnson Institute of the Washington University School of Medicine.

is about 1.5 percent in the rear cell and 3 percent in the front. For determination of the cylinder, a lesser fog may serve equally well as an occluder and permit maximum fusion. Possible rotation of one of the fused images within the other magnified image could not be more than 1.5 degrees and is not significant.

Another method of obtaining binocular refraction is to use a smoked glass before the eye not under test. This method lacks the beneficial relaxation of accommodation induced by a plus sphere, which will be discussed later. The polaroid and stigmatoscopy methods are subject to the same criticism, although they excel in patients with strong dominance.

If one eye receives a stimulation from a near object that forces it to accommodate, the other eye, even if covered, will accommodate an equal amount. This is a conditioned reflex, since under no normal situation does one eye have to accommodate more than 0.3D. than the other. One eye is never more than 3.2 cm. more distant than the other from any object fixed. In the ordinary situation of fixation at 33 cm. with the gaze roving 10 cm. in either direction, there may be 0.15D. difference in the two eyes, easily absorbed by the normal depth of focus, about 0.5D.

The accommodative level is a binocular reflex, governed by an unconscious cortical demand for the clearest possible image. Like the fine tremor of the following eye due to the fixation and fusion reflexes, there is a slow fluctuation of the level of accommodation by which the cerebral center can select the level affording the best acuity. Under the influence of plus 1.5D. fog, accommodative effort brings the image still more preretinal and blurred, whereas relaxation is rewarded by a clearer image, nearer the retina.

If the retinal images in the two eyes send conflicting reports to the cortex, there is confusion, and one report must be suppressed. This usually occurs in the more blurred eye depending on dominance. If accommodation will sharpen the image of the eye under refractive test while the other is well fogged, the impulse to accommodate gets through and both eyes accommodate. This is particularly true in determining the astigmatism, and both meridional images must be kept at the retinal or just preretinal level to prevent an accommodative stimulus.

This reflex can be demonstrated in a hypermetropic patient without cycloplegic. Place a trial frame before his eyes with both cells empty. Retinoscope with distance fixation, and gradually increase plus sphere monocularly until reversal of the reflex occurs. Now decrease plus sphere until the original "with" movement is restored. This may require removal of several diopters, whereas precision with the retinoscope is usually much better. One must conclude that the patient was induced to accommodate. Why? At first, the patient had to accommodate to see the distant target. As more and more plus sphere was added to one eye, the accommodative level was gradually lowered or relaxed until it could relax no more. The eye under test controlled the level of accommodation until the image of the distant point light became preretinal and blurred. This point appears 1.5 diopters before retinoscopic reversal. Upon blur, however, the eye suppresses, and the other eye with its image postretinal takes over fixation. Accommodation is required and, of course, the retinoscope reveals immediate reversal in the original eye. Plus sphere must be placed in both trial frame cells to prevent such accommodation.

To further demonstrate this effect of accommodation of one eye on that of the other, experiments on several individuals were performed on the haploscope (fig. 1). In this device, the subject has his head fixed in the primary position toward a Snellen chart at 15 feet. The instrument has a lateral arm on each side with a fulcrum exactly below the rotation center of each eye. Fastened anterior to the arm just before each eye is a half-silvered mirror, placed so that a target

held on the arm is seen projected straight ahead toward the Snellen chart, but only by the eye on which the arm rotates. The mirror, of course, does not prevent view of the Snellen chart. A fixed plus sphere on this arm separates the eye from the object, so that when the object is placed at a zero point on the arm, it is optically at the same distance as the Snellen chart, 15 feet. This is simply to avoid unwieldy 15 foot arms. At the zero point, this object should superimpose the Snellen chart, and be in equally sharp focus.*

Now, if the left eye sees only the Snellen chart, and the right eye sees both the fused chart and also the target on the right arm, the state of accommodation of the right eye can be determined by moving the right target back and forth on the arm, which is calibrated in diopters nearer or more distant than the Snellen chart. If a minus sphere be placed before the left eye, forcing it to accommodate, the resulting accommodation of the right eye can be measured by adjusting the target on the side arm to its sharpest

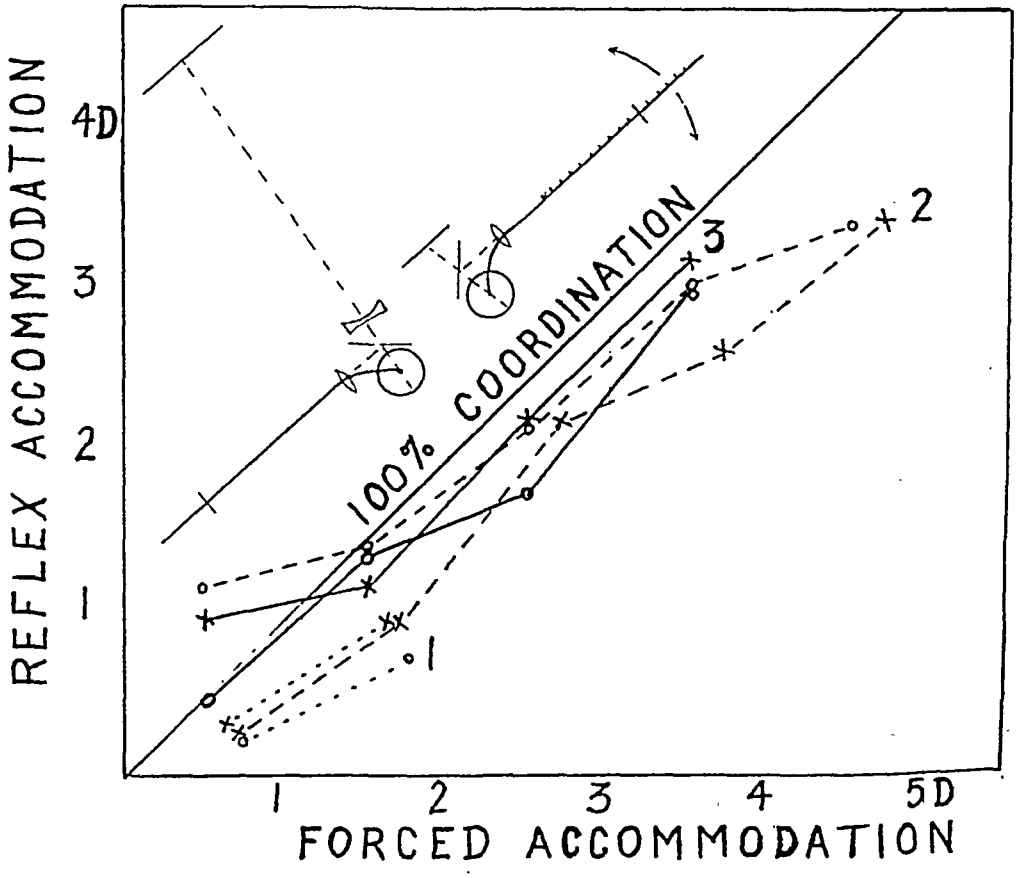


Fig. 1 (Miles). Accommodation in diopters. Forcing one eye to accommodate by minus sphere causes the other to accommodate an almost equal amount. Circles indicate right eye forced, left eye tested behind screen. Crosses indicate left eye forced, right eye tested.

*In the use of this haploscopic set up, it is unusual to find that the eyes are accommodated exactly on the Snellen chart at 15 feet. It is found upon adjusting the uniocular target on the side arm that although both eyes are fixed at 15 feet, the sharpest focus of the eye tested is nearer than 15 feet by 0.5 diopters. This may be because of the depth of focus of the human eye. If the eye is focused exactly at 15 feet, or 0.2D. it is also in focus at infinity, and at 1.4 meters, which is 0.7D. The retinal image is sharp over such a range, that an innervation to accommodate or relax accommodation is not stimulated.

focus, vision being fused on the Snellen chart.

The resulting convergence innervation requires a modification of the test to avoid fusional strain and diplopia. The eye fixing the Snellen chart has the minus spheres placed before it, while the other eye is covered and sees only the target on the side arm, not the chart. The arm can be rotated on its fulcrum just under the eye until the target superimposes the Snellen chart seen by the other. This modification removes the objection that the accommodation of the other eye is brought about by the strong innervation for convergence opposing strong fusional innervations.

The graphs in Figure 1 show in diopters how much one eye will accommodate upon stimulation of the other. Patient No. 1 was H. E., a 31-year-old woman, wearing: O.D., +4.25D. sph. ⊂ +0.5D. cyl. ax. 15° = 6/12; O.S., +4.0D. sph. ⊂ +1.25D. cyl. ax. 130° = 6/6. Patient No. 2 was A. D., a girl, aged 19 years, wearing: −0.75D. cyl. ax 90° = 6/6, O.U. Patient No. 3 was A. R., a 16-year-old emmetropic boy with 6/6 vision, O.U.

Figure 2 shows similar tests on myself, aged 34 years, wearing: O.D., −0.75D. sph. ⊂ +0.25D. cyl. ax. 90° = 6/5; O.S., −0.5D. sph. ⊂ +0.25D. cyl. ax. 90° = 6/5. Graph 4 (fig. 2) was produced one month before Graph 5 (fig. 2). The solid line, labeled 100-percent coördination, indicates the situation if fixation and accommodation of the controlling eye on the Snellen chart had been perfect, and if the following eye on the side-arm target had been equally stimulated and exactly measured. It is evident that the recessive eye follows the level

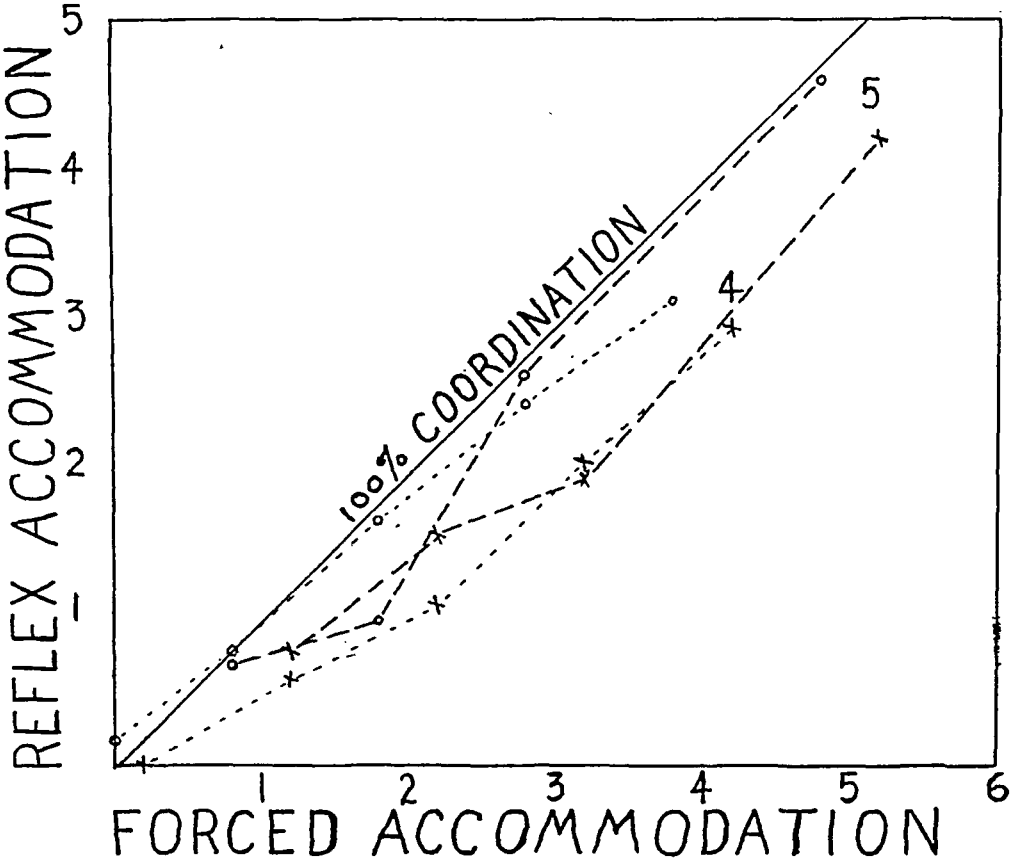


Fig. 2 (Miles). Data from subject P. W. M. Notice that the left eye follows the right better than the right follows the left. The right eye is dominant.

determined by the dominant eye better than the reverse, since No. 1 in Figure 1 is left eyed, and the graph with the left eye being forced to accommodate is nearer the 100-percent line. The cases No. 2 and No. 3 in Figure 1 being right eyed and the case in Figure 2 being right eyed show the graph with the right eye being forced nearer the 100-percent line.

In the refraction of a patient with exophoria by a monocular technique, the lenses chosen will blur him binocularly for distance, since the excess convergence innervation required will produce excess accommodation even at distance. This blur is early detected by use of a binocular technique. Pushing minus in such a case may convert even a tropia into a phoria tolerable to a young patient, although surgery is usually best.

In patients with esophoria it is desirable to "push plus." Binocular technique accomplishes this, since nearly any patient will accept plus binocularly that he rejects monocularly.

Binocular refraction may be misleading in certain patients, particularly those with high ocular dominance, or in whom one eye is constitutionally inferior to the other. The suppressing eye will lack precision, particularly in tests for amount and axis of cylinder. Likewise, on comparing one eye with the other in cyclodamia at the plus 1.5D. fog level, two such eyes will never see equally. Cyclodamia should never require reduction of sphere in one eye more than 0.5D. Moreover, precision is poor at the 6/60 level for the same reason that precision in guessing a meter length is plus or minus a few centimeters, while precision in guessing a centimeter is plus or minus a millimeter or less. The eyes can be best compared at the 6/5 level.

Whatever the method of refraction used, it is important never to blur the dominant eye. The cyclodamia method supposedly ends with the two eyes equal. If one eye is superior to the other, it may be given too much plus to equalize the two. This blur of the dominant eye tends to make it suppress, and the other lead in ocular movements. This is contrary to habits of a lifetime, and leads to confusion and complaint.

It is concluded that in regard to balancing the sphere between nonpresbyopic eyes of average dominance and equal acuity, the binocular technique is valuable.

The second question for consideration is whether the axis of the astigmatism should be determined monocularly or binocularly. This question is discussed very little in the literature. Savage[2] states, "All errors of refraction should be corrected by the examination of only one eye at a time." Curiously enough, he is the man who made himself unpopular because of his obsession with cyclophoria and oblique cylinders. He stated the rule that if minus cylinders lie with the axes symmetrically in the upper nasal quadrants, the axes need to move toward the center of the quadrant to relieve the common excyclophoria due to mechanically weak superior oblique muscles in the reading position. Minus cylinders with axes lying in the outer superior quandrants should be moved toward the nearest axis (90° or 180°) to accomplish the same end.

This rule is impractical because all objects in space do not limit themselves strictly to vertical contours with only vague horizontal lines. Uncorrected oblique astigmatism causes distortion of vertical and horizontal lines of a scissors type, opposite in the two axes. Upon correction, this distortion immediately disappears, and any cyclophoria consequent to the error on view of vertical contours also is automatically corrected. It is important only to align the spectacle cylinder axis with that of the eye in its position of action; that is, under binocular conditions.

This alignment depends upon whether fusional reflex movements of the two eyes are able during refraction to keep whatever target is used imaged upon corresponding retinal points. If this condition is satisfied,

the axes of the spectacle cylinders will align with those of the eye during and after the period of metamorphopsia and "getting used to the glasses." If there is cyclophoria, whether in or out, the axes have been determined in the position they must have to place the images on corresponding retinal points. Monocular refraction fails in this aim, because when one eye is covered it takes its position of rest, and the eye under test may also rotate to its position of cyclorotary rest, being fixed only as to visual direction.

The possibility of cyclophoria makes binocular refraction a necessity in determination of the astigmatic axis.

Another consideration is the physiologic excyclophoria[3a] (12:00 o'clock on the eye rotates laterally under cover) or the monocular physiologic incyclotorsion of the eye in the reading position. This phenomenon is attributed to the mechanical secondary action of the superior oblique muscle in the reading position. Monocular tests should show this incyclotorsion by the change in the measured axis of astigmatism for near, which should not be found on binocular test, due to fusional correction.

In 16 patients with astigmatism, the axis was determined for distance and near both monocularly and binocularly. For binocular determination of cylinder at near, the eye not under test is occluded by a plus sphere just enough to blur out the printed word being used as a test object with the Jackson crossed cylinder. This is usually about plus 3.0D. in the monocular tests, the change in axis from distance to near was toward incyclotorsion 20 times in the 32 eyes, compared to excyclotorsion 5 times, and no change 7 times.

In the binocular tests, the same patients showed incycloversion from distance to near in 10 eyes, excycloversion in 16, no change in 6. This suggests that binocular tests prevent the monocular physiologic incyclotorsion. The amount of change in each instance averaged about 7 degrees. In only 12 eyes did monocular and binocular changes from distance to near correspond in direction.

Comparison of monocular tests to binocular at distance showed change toward incycloversion in 20 eyes, toward excycloversion in 6, no change in 6. The axis changes averaged about 8 degrees.

Some refractionists prescribe cylinders measured in the reading position with the other eye totally occluded. This permits the known incyclotorsion to occur, uncorrected by normal fusional adjustment. The difference may amount to 10 degrees, which is important even in small cylinders. There is also a difference in binocular tests between distance and near. The axis prescribed depends on the patient's occupation, either chiefly distant or near. If the difference is great, two pairs of glasses may be necessary.

Actual clinical evidence that astigmatic axes determined binocularly are more comfortable is difficult to evaluate. Some patients with oblique astigmatism have no complaints at all. Perhaps they suppress, or have less precise fusion demands than others. Some patients can never wear the full prescription over both eyes, even if corrected for aniseikonia.

Axis variation from distance to near is markedly greater in small cylinders than large. This fact, along with other large variations in my data, strongly suggests a large subjective element in the tests. No repeat determinations were made, which would undoubtedly reveal more gross variation.

It may be asked, will an eye the axis of which is not exactly aligned with its spectacle lens in time rotate to align itself in the interest of a clearer image? It is known that the cortical center will initiate a change in the accommodative level to obtain a clearer image. Why will not the reflex mechanism rotate the eye slightly to align with the spectacle cylinder? The obvious answer is that such rotation would throw the retinal images off corresponding points and oppose the fusion mechanism. There is no evidence that, even over the course of years, corresponding points of the two retinas will

change to adapt to different conditions.

It is quite possible that such adaptation could occur in a monocular individual. If not by the reflex mechanism, it could occur by tilting the head, eliciting the ocular righting reaction.

Three patients with astigmatism varying from 2.0D. to 5.0D. were placed before the slitlamp in such a way that they could see a test object clearly 4 feet away. A trial frame with correcting lenses was placed before the eyes so that the observer could see a small portion of limbus of the eye being tested. On slight rotation of the cylinder in the frame, there was no evident movement of small vessels on the limbus in either monocular or binocular fixation. The patients simply reported blur.

Javal suggested testing an astigmatic patient's axis by the novel means of having him tilt the head from side to side. If the blur due to the righting reflex of the two eyes is not equal on tilting the head from one side to the other, the axis should be adjusted until it is. This is possible only in high errors.

Prescription of the spherical equivalent of oblique astigmatism, to reduce the amount of cylinder one fourth or so, will usually give greater comfort. This produces blurred images, which excite less intense fusional innervations, permit less exact fusional movements, and may permit one image to suppress more readily.

Conclusions

It is concluded that binocular refraction is a valuable refinement which permits more exact balance in the sphere between the two eyes, and permits more exact determination of the axis of astigmatism in the position of action.

The method of cyclodamia advocated by Dorland Smith is the most useful method of binocular refraction because the presence of plus sphere before one eye encourages maximum relaxation of the level of accommodation. Other methods have not this advantage, but may be superior in patients with strong ocular dominance.

In the reading position of the eyes, in the usual monocular refraction, physiologic incyclotorsion causes an error in measurement of astigmatic axis amounting to about 10 degrees in small cylinders and about 5 degrees in large cylinders. This error is diminished by the use of a binocular technique, due to fusional movements fixing the eyes in the position of action.

The level of accommodation is kept equal in a pair of normal eyes by a reflex mechanism. Stimulation of one eye will cause the other to accommodate equally even if not stimulated. The fact that the accommodative state of one eye controls the accommodation of the other necessitates the use of binocular refraction.

Binocular refraction is not useful in the absence of fusion, and is less efficient in conditions where one eye is inferior to the other. It should always be used in the determination of the axis of astigmatism, even in amblyopia ex anopsia when fusion is present.

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TREATMENT OF SUPERFICIAL CORNEAL INJURIES*

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Different types of superficial corneal injuries vary greatly in their rate of healing. A burn by a curling iron or cooking utensil, or an abrasion produced surgically in the treatment of herpes of the cornea commonly heals in 1 or 2 days. Lime burns and abrasions by fingernails or twigs often require 1 or 2 weeks or longer under some of the usual methods of treatment. It has been my observation that the time required for many of the more stubborn lesions to heal may be greatly shortened and visual impairment reduced in proportion to the rapidity of healing.

For the purpose of this discussion "superficial" corneal injuries are those in which, even though the entire cornea may be denuded, the damage is chiefly to the epithelium, and the stroma remains transparent or almost so. In such cases there is a brilliant stain with fluorescein.

Chemical burns of eyes in which the entire limbal conjunctiva has been severely damaged, in which the cornea is semiopaque, taking fluorescein poorly, and in which there is exudate in the anterior chamber are not included. Such severe burns are fortunately rare, and they are probably best treated by paracenteses as recommended by Oaks.[1]

The importance of superficial injuries is their far greater frequency and the fact that complete recovery of normal vision is possible if there is rapid healing, a condition that is more hindered than helped by certain methods of treatment.

Alkali burns

Any consideration of this subject would be incomplete without references to Hughes's[2] excellent review and analysis of the literature on alkali burns which make up a large percentage of the more extensive superficial corneal injuries.

For years it has been stated that burns by lime leave deposits of calcium-carbonate crystals that cause the corneal opacity often remaining after such injuries, and neutral ammonium-tartrate solution has been recommended to remove the calcium. After reviewing the experimental work on this subject, Hughes concludes that "it is unlikely that calcium ions per se accelerate the progress of the ocular lesion or contribute much to the intensity of the final corneal opacity"; also "it is doubtful whether such calcium deposits are harmful, or whether ammonium salts effectively extract calcium from the cornea." Clinical observation has led me to the same conclusion. I have seen an extensive abrasion, unhealed after two weeks, that had a crystalline appearance resembling calcium deposits, probably the result of scar tissue formation.

In discussing therapy of alkali burns of the eye, Hughes[2] refers to "conservative treatment with irrigation, neutralizing agents, symptomatic therapy" and lists substances which have been recommended as neutralizing agents or for the purpose of extracting lime from the cornea, as well as some substances whose purpose is not clear, such as trinitrophenol ointment, glycerine and water, sugar solution, and many others.

Treatment by bandaging

Regeneration of corneal epithelium is rapid if it is not hindered by the eye and lid movements which necessarily occur during waking hours, and which are increased by repeated instillations and irrigations. I have for some time felt that, after the initial treatment, such procedures are illogical and

* Presented before the Section on Ophthalmology, New York Academy of Medicine, February 16, 1948.

harmful, and that the ideal treatment consists simply of stopping all movement of the eye and of the lids for a few days, an ideal which can most nearly be attained by firm bandaging of both eyes. This is desirable in any case in which as much as one quarter of the epithelium has been lost, especially if the pupillary area is involved.

Preliminary treatment

If the caustic substance was in solution when it entered the eye, it has usually been already washed out by the tears when the patient is first seen by an ophthalmologist, so that further irrigation is unnecessary. Solid particles must, of course, be removed as quickly as possible by forceps, swab, and generous irrigation. Necrotic conjunctiva should be removed at the same time, but I have never followed the practice of denuding the cornea, described by McLaughlin.[3]

An eye whose cornea has lost all its epithelium and presents the smooth, shiny surface of Bowman's membrane often seems only slightly injured and has surprisingly good vision. Fluorescein should, therefore, always be used when the extent of the corneal lesion cannot be clearly seen without it.

The pupil will dilate widely and quickly in an eye whose corneal epithelium has been damaged and atropine may well be instilled as soon as it is discovered that the corneal injury is fairly extensive. If it is applied alternately with the anesthetic, the pupil will be found to be well dilated by the time first aid has been completed and the patient has been made comfortable and has been given an explanation of his injury and the proposed treatment.

This explanation is most important. The patient and anyone who accompanies him must be told, step by step, what has happened to the eye, what is to be accomplished by treatment, how it is to be accomplished, and why other treatment is ineffective. The accompanying friend, relative, or fellow worker will be helpful in persuading him to follow the recommended treatment, especially if it includes hospitalization, and a demonstration of the denuded area, stained with fluorescein, is often convincing.

It should be pointed out that the injured cornea is similar to an abraded or burned area on the skin, that it cannot heal promptly if there is continued friction over the area, and that movements of the eye and of the lids produce this friction which can be avoided only by keeping the injured and the sound eye closed. The possibility of scar formation and permanent visual impairment resulting from delayed healing should be emphasized.

Hospital treatment

Hospital treatment is advised for any eye whose cornea is about one third denuded, and, except in the case of those who live alone, is usually at first refused. When it is pointed out to a man that he will probably be in the hospital for only 3 or 4 days, that there is to be no operation, and that the purpose of going to the hospital is only to have some one wait on him while his eyes are covered, instead of being an additional burden at home, he will often consent to hospitalization.

In the case of those who persist in refusing hospitalization or who can be cared for at home, a modification of the bilateral bandaging may be made. Only the injured eye is bandaged, and the patient is given a dressing which is to be fastened over the other eye, except when eating. He is given a prescription for 3 or 4 tablets of morphine sulfate, and instructed to go to bed, take one of the tablets at once and a second one in the early evening. One must be insistent about the sedative, otherwise the patient who "can stand pain" will spend a restless night, and probably remove the dressing so that he may apply home remedies.

After 12 to 18 hours, the pain usually subsides. There is no reason to inspect the eye for 2 days. The patient is instructed to

stay in bed during this time and, if the bandage is in position and he is comfortable, for an additional day or two. When the cornea no longer stains with fluorescein, or stains very faintly, he is given a snug-fitting black patch, with cotton beneath, to keep the eye closed, and a bland ointment to be applied several times daily for a few days.

still showed any staining with fluorescein are indicated.

Both 1 P. K. and 2 M. F. are from patients who had a corneal burn by wet lime. The injured eye was bandaged and the uninjured eye was covered with a dressing at home, 3 J. B. and 4 J. H. illustrate burns by dry lime that were treated by binocular

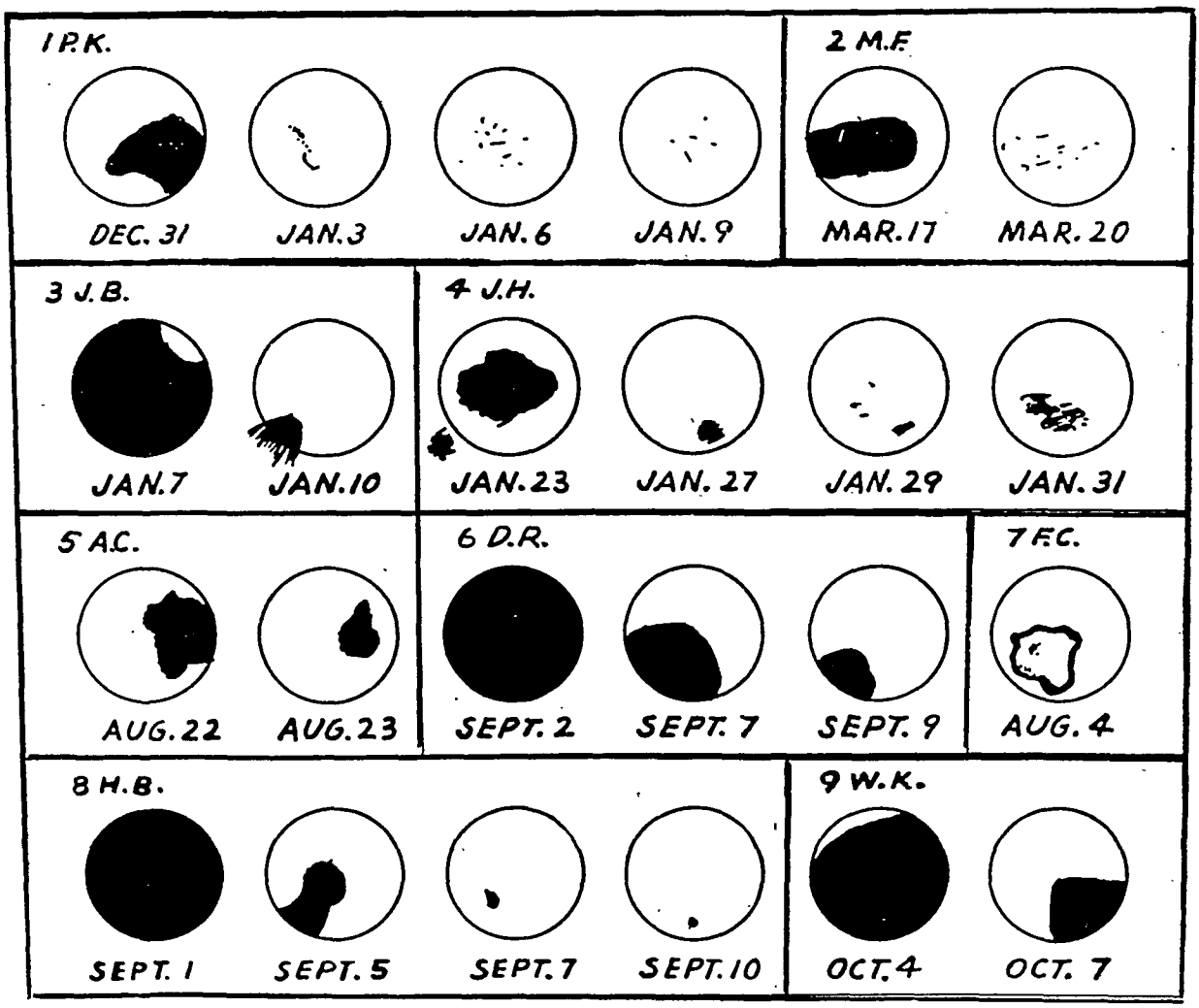


Fig. 1 (Sherman). A chart indicating the rate of healing in nine cases of extensive superficial corneal injuries treated by binocular bandaging. (Cases 1 P. K. to 9 W. K.)

Case reports

In Figure 1, the diagrams labelled 1 P. K., 2 M. F., 3 J. B., 4 J. H., 5 A. C., and 6 D. R. show the rate of healing in 6 patients with lime burns of moderate to moderately severe intensity. The dates of the first and each successive examination while the cornea

bandaging in the hospital. Case 4 J. H. had a craterlike burn in the bulbar and in the superior palpebral conjunctiva, in which lime particles were embedded.

Cases 5 A. C. and 6 D. R. (fig. 1) represent burns by wet plaster, treated by binocular bandaging in the hospital. Case 6 D. R.

had a burn which would be considered severe by any standard since the entire cornea was denuded. It had healed by the 12th day, but a faint central scar remained and the visual acuity 7 months later was reduced to

ing which time the eye had been treated by the usual conservative methods. There was nothing to suggest that the injury had originally been any more severe than those in cases 1 P. K. to 6 D. R. (fig. 1) or that it

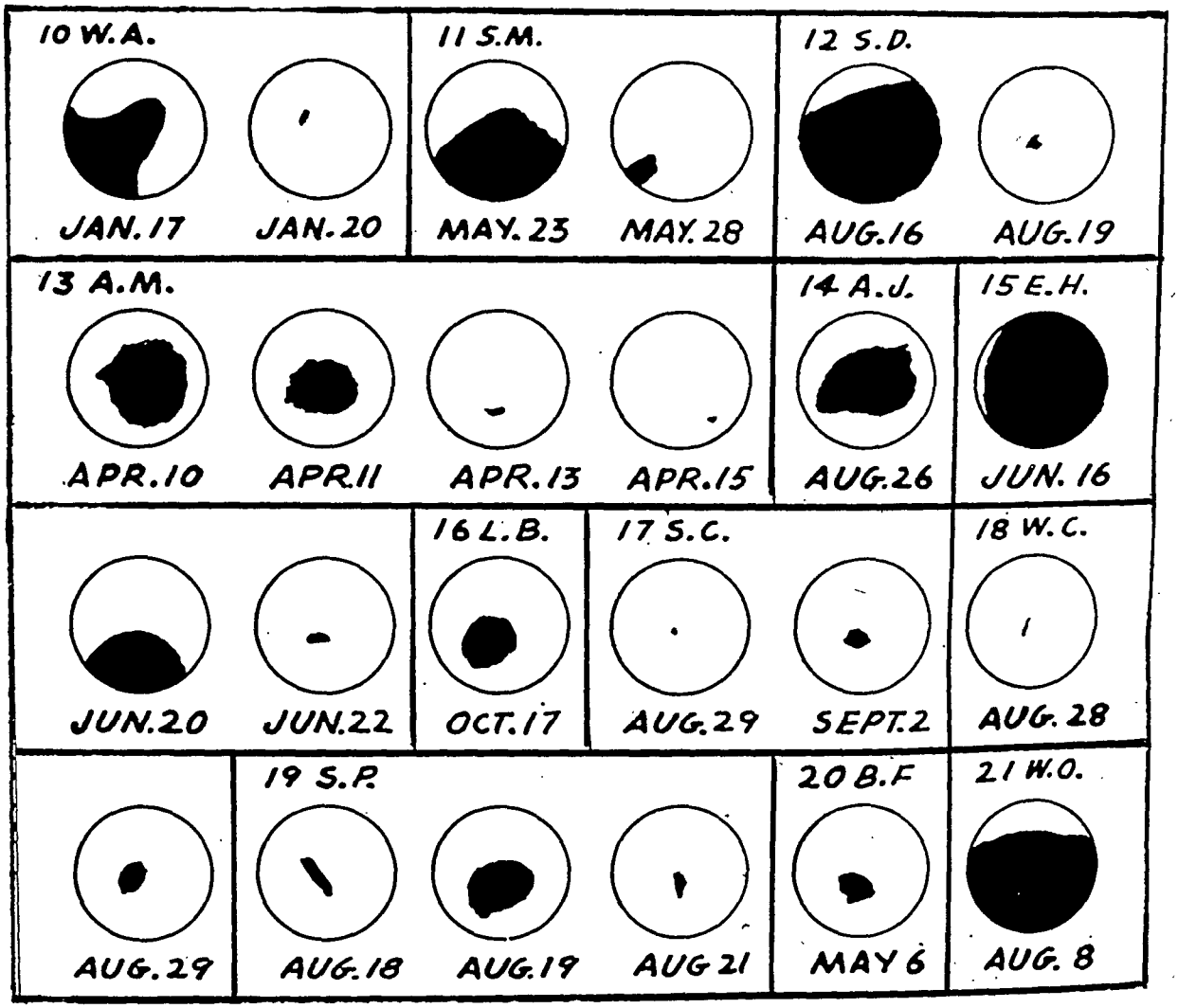


Fig. 2 (Sherman). Twelve cases (10 W. A. to 21 W. O.) are represented in this chart illustrating the rate of healing.

20/38. The other cases had no residual corneal opacity.

Cases 3 J. B. and 6 D. R. (fig. 1) illustrate an interesting feature of the healing of moderately severe burns with damage to the limbal area; namely, the failure or marked retardation of epithelial regeneration from this area.

The patient represented in 7 F. C. (fig. 1) was burned by wet plaster. He was not seen until 2½ weeks after the injury, dur-

would not have healed as quickly with similar treatment.

There was the staining area shown in the diagram, with a raised border, as if the proliferating epithelium, having been prevented from growing across the denuded area, had piled up around it. The cornea healed after three months' treatment which included bandaging, curetting the raised edges, application of iodine to the denuded area, and covering with a conjunctival flap,

none of which procedures had any noticeable effect. The final vision was 10/200. There was no symblepharon or other conjunctival lesion suggesting that the injury was of greater severity than in the first six cases, and with the same initial treatment, there would probably have been just as rapid healing. Lesions caused by other common caustics heal equally rapidly when treated by occlusion.

Figure 1 (8 H. B.) shows the rate of healing of a cornea which was burned by 50-percent sodium-hydroxide solution, and Figure 1 (9 W. K.) that of a cornea burned by potassium hydroxide.

Figure 2 (10 W. A.) is from a patient with a burn by muriatic acid and 11 S. M. represents a sulfuric-acid burn, sufficiently severe to cause scarring of the conjunctiva of the upper lid. Figure 2 (12 S. D.) is a burn by concentrated sodium-peroxide solution, and 13 A. M. is a liquid sulfur-dioxide burn.

In 14 A. J. (fig. 2) the extent of the denuded area of a cornea burned by carbon tetrachloride is shown. No healing had taken place after 24 hours of monocular bandaging, but after 3 days of binocular bandaging, healing was complete.

The extent of denudation of a cornea burned by mercuric iodide solution is shown in 15 E. H. (fig. 2). After 48 hours' treatment with a simple dressing there was no change, but with binocular bandaging, healing progressed as indicated.

Discussion

The severity of injuries observed clinically cannot be standardized as one standardizes experimental injuries. Visual acuity certainly cannot be used as a standard, since it may seem to be impaired by some unimportant condition like blepharospasm or lacrimation.

On the other hand, an eye which has lost its corneal epithelium may have good visual acuity, much better than one whose epithelium is in position but is hazy. The extent of epithelial loss may be observed and recorded, but there is no unit of measurement for the extent of corneal opacity, and any attempt to measure and express this factor in grading the severity of a chemical injury will necessarily be inexact.

I believe that the 15 cases of chemical injuries cited in this paper should all be classed as severe or moderately severe. Except for the case represented by 6 D. R. (fig. 1) which presented a complete loss of epithelium from a lime burn, none had any residual visual impairment after treatment by binocular occlusion.

The reasons which make binocular occlusion a logical treatment for chemical injuries of the cornea apply equally to the treatment of mechanical injuries. Among the most troublesome and painful of these are certain superficial abrasions and erosions. The patient suffering from such a lesion is commonly seen after having spent a sleepless night and needs no persuasion to submit to binocular occlusion or any treatment that promises relief.

Treatment of corneal abrasions

Binocular occlusion has been satisfactory in the treatment of several patients with corneal abrasions which did not heal with "open" treatment, or which would have been expected to be slow in healing.

Case reports

Case 16 L. B. (fig. 2) had an abrasion by a fingernail. He was sent home with both eyes bandaged and the cornea was healed when he was next seen four days later.

Case 17 S. C. (fig. 2) had a foreign body in the cornea that was removed by a foreign-body gauge, used in the manner that one uses the corneal burr. He returned after 4 days with a painful erosion which healed after 2 days at home, with the injured eye bandaged and the uninjured eye closed by a dressing.

Case 18 W. C. (fig. 2) had a superficial wound from a nail. The pupil was dilated

and a dressing applied. The following day the denuded area was much larger and the eye very painful. A bandage was applied and he was given a dressing for the other eye. Four days later he returned with the cornea healed, stating that the eye had become comfortable within 24 hours.

Case 19 S. P. (fig. 2) had an abrasion caused by the end of an airhose. After dilatation, a dressing was applied and he was told to keep his other eye closed at home. He returned to work, however, and the following day about one quarter of the cornea was denuded. The eye was bandaged and he went to bed at home. Healing was complete after 4 days.

Case 20 B. F. (fig. 2) was seen in consultation 10 days after something entered his eye while he was taking down storm-windows. Under customary treatment with atropine, antiseptics, and hot compresses, the condition had become steadily worse. The eye was bandaged and he was advised to stay in bed with the other eye closed. He was not seen again, but reported 18 days later that the eye had become comfortable within 2 days.

Case 21 W. O. (fig. 2) was seen August 8th in consultation at the hospital to which he had been admitted for treatment of a most extensive erosion of the cornea, following an injury by a needle 13 days before. After 4 days of binocular bandaging, there was complete healing and he left the hospital, but was readmitted 3 days later because of a recurrence of the erosion, which healed after 2 more days of binocular bandaging. The affected eye was kept bandaged for another 2 weeks to prevent further recurrence. When he was examined September 11th, there was a diffuse haze over the lower two thirds of the cornea.

Comment

Before the eye is bandaged, the pupil is, of course, dilated with atropine and a local anesthetic, usually nupercaine, is applied. Morphine is still the most reliable analgesic and hypnotic. Its use during the first day or two is an essential part of this treatment which, to repeat, is based on the fact that corneal epithelium regenerates rapidly, and the idea that this regeneration may best be encouraged by preventing lid and eye movements.

Summary

1. Certain superficial traumatic lesions of the cornea are characteristically slow in healing.

2. This delayed healing results in corneal opacities from scar-tissue formation, which can be prevented by rapid regeneration of corneal epithelium.

3. Corneal epithelium tends normally to regenerate rapidly and the treatment most likely to encourage this regeneration is to abolish movements of the eye and lids by binocular bandaging.

4. Twenty patients with extensive superficial corneal injuries and one patient with an entirely denuded cornea who were treated by this method are described, with charts indicating the rate of healing.

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EDWARD LORENZO HOLMES*

Pioneer Chicago Eye Doctor

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Many biographical sketches are too factual. They deal too much with what their subject did rather than the why and how he did as he did. The present sketch will therefore aim to understand and explain its subject rather than to tell in too great detail just what he did.

The essential facts are about as follows:†

Edward L. Holmes was born in Dedham, Massachusetts, near Boston, in 1828; attended the village school; prepared for, attended, and was graduated from Harvard College in 1849; taught Latin, Greek, French, and mathematics at the Roxbury Latin School for two years, then returned to Harvard Medical School and, after a three-year course, was graduated in 1854. He spent the next year as surgical resident at the Massachusetts General Hospital and followed this with a year and a half of study of the eye and ear in Paris and Vienna. He then located in Chicago late in 1858 and practiced ophthalmology and otology here some 44 years until his death in 1900.‡

Shortly after coming to Chicago, he joined the faculty of Rush Medical College, then in its 13th year, and two years later established the Illinois Charitable Eye and Ear Infirmary.

Holmes had more than a dilettant interest in things basic to ophthalmology. I started work in the Rush Eye Clinic in 1898, the year Dr. F. C. Hotz succeeded Holmes as head of department, and I soon ran across a series of 30 or 40 eye specimens prepared by Holmes in a unique way.

For the most part they demonstrated gross changes—tumors, ectasias, and foreign-body effects, such as phthisis bulbi and atrophy bulbi. But their permanent labeling clearly demonstrated Holmes's interest and his ingenuity. He had hammered out a number for each specimen on a 1 by 4 cm. thin slab of lead and placed this slab beside the specimen in alcohol within a well-stoppered bottle. A little later I spent many weeks just trying to make out numbers and identifying hundreds of other specimens at the Infirmary where Holmes's successors had left them in a sad state. He was both careful



Edward Lorenzo Holmes

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* First presentation under the gift of the Rudolph Wieser Holmes and Maria Baxter Holmes Fund in Memorial to Edward Lorenzo Holmes. Read before the Institute of Medicine of Chicago, at a joint meeting with the Chicago Ophthalmological Society and the Society of Medical History of Chicago, January 30, 1948.

† An excellent article on "Edward Lorenzo Holmes" was written by Dr. Arthur Tenny Holbrook and published on "The Corpuscle," March, 1900, pp. 273-283, and is to be found in the Rush Medical College Library, Chicago.

‡ Being an ophthalmologist, I will not attempt to evaluate Holmes as an otologist.

and resourceful, and he was definitely interested in eye pathology.

Although he wrote over 50 interesting and valuable articles, some of which were translated into German, it cannot be said, if rigid standards are used, that Holmes left any significant writing. Holmes was, however, of great significance to the culture of his city and time, using culture in a broad sense. One commentator says that he was the most significant Chicago medical man of his time.

In addition to the Infirmary, Holmes helped to establish the Presbyterian Hospital and was the one most responsible for its affiliation with Rush Medical College. He was one of the founders of the Chicago Historical Society and of Unity Church and was very widely known as an amateur musical critic. I have also learned that Dr. Holmes was the one who first proposed the affiliation of Rush Medical College with the University of Chicago. He brought his idea before the Rush trustees and Dr. E. Fletcher Ingalls was delegated to take the matter up with President William Rainey Harper in the late 1890s.

Holmes's special talent evidently lay along the lines of institutional management and development, for he soon became a head of the department at Rush and eventually served eight years as president of the college (1890-1898) during one of its periods of most energetic growth, the one just preceding 42 years of affiliation with the University of Chicago. His capacity as an administrator is shown by the fact that 15 years after he started the Infirmary, Holmes and others were able to convince the state of Illinois that the state should buy and take over the Infirmary as a state institution (1871).

It has taken Holmes's successors 75 years to make any further move in the vital interest of this important institution, namely, to sever its medical and administrative management from the semipolitical control of the Department of Public Welfare and place its professional and administrative control in the hands of the state university where it has long belonged.

Looking for the unusual in any outstanding man, one naturally turns first to his parentage. In Holmes's case we find good substantial God-fearing English-New England stock. His father was a machinist and had his own shop. His mother was the granddaughter of the "For-God's-sake-fire" Major Buttrick who led the Minute Men at Concord.

On the side of environment there was a great deal that was very favorable, even if fortuitous, for he grew up close to the Harvard and Boston of the 1840s and 1850s with its Emersons and Thoreaus, Lowells and Longfellows. In any case, for one reason or another, this boy and youth had something which made more than one unusual person anxious to help him.

Some incidents show rather clearly. Thus Holmes's taste for books and learning was stimulated at the age of 14 years, when Motely, the Harvard historian, asked him to help unpack a lot of books. Here were books in German and French. The queer-looking Russian intrigued Holmes. Next, the well-to-do father of one of his boy friends wanted to have his son tutored and asked Holmes to join in, and eventually Edward Holmes obtained three years of unusual preparation for Harvard in this way.

In these formative years he had an unusual set of teachers. Included were Charles A. Dana, later editor of the *New York Sun*, who taught him Greek; Elijah Howe and John E. Dwight, Latin; George Ripley, literature—all men of great erudition and culture. One spring and summer were spent at the famous Brook Farm colony.

Evidently, too, Holmes had a good voice, for he sang in the village choir at home and later, as a Harvard student, in the combined city-wide Cambridge church choirs. So it came about that one Alexander W. Thayer asked him to hear a Haydn oratorio of a

Saturday afternoon. Not knowing what an oratorio was Holmes accepted, and throughout his whole life continued to hear and enjoy every musical affair he could.

In college, Holmes deliberately stressed the languages, both ancient and modern, although mathematics and science were his bent. With a fellow student he bought a "key" or "pony" for the German course. The instructor was somewhat surprised at the perfection of their exercises, became suspicious, and gave them searching oral drills day after day. But they had also memorized the material and so impressed the teacher that he asked them if they were especially interested in German. When he received an affirmative reply, he offered to read Wilhelm Tell with them during an hour he had free three times a week. They surprised themselves with their progress.

Much the same thing happened with Longfellow who offered to read *Gil Blas* with them in his free hours three times a week. And some years later in Paris, a gruff, unfriendly American sculpture student, eating at the same table with Holmes, burst out with an offer to explain the pictures in the Louvre to him. They spent many hours there together to Holmes's great profit. These are only minor incidents. But they bespeak an attractive, eager personality, one which encouraged people to go out of their way to enjoy association with the individual.

After a year and a half in Paris and Vienna under the influence of Albrecht von Graefe, the greatest ophthalmologist of all time, and of Virchow and Helmholtz, with Graefe's iridectomy for glaucoma and Helmholtz's ophthalmoscope only 5 or 6 years old, Holmes came to Chicago, then a town of only 30,000, in 1858, on borrowed money, made a place for himself, and was able, within 2 or 3 years to loan $4,000 to the Infirmary, a sum the state later paid back.

He interrupted his busy life to make a trip back to Vienna and marry, when 34 years of age, a charming, musically talented woman of the lesser nobility. Returning to Chicago, he engaged in all the cultural activities possible to one of his make-up and time.

With these facts in mind, may we not say that Edward Lorenzo Holmes was an ideal pioneer Chicago eye doctor, one whose well-rounded life we can contemplate with satisfaction and profit, a man whom we can honor and admire, and one whose memory this Institute does well at this time, a hundred years later, to perpetuate.

122 South Michigan Avenue (3).

NOTES, CASES, INSTRUMENTS

AN UNUSUAL CASE OF PROGRESSIVE MELANOSIS OCULI

CARL D. F. JENSEN, M.D.
AND
GILBERT N. HAFFLY, M.D.
Seattle, Washington

Ocular melanomas steadfastly resist the efforts of our best ophthalmologists to raise the iron curtain that jealously guards the origin, the course, and the prognosis of these potentially dangerous tumors.

Bouqien,[1] in 1917, made the first great stride toward recognizing the congenital forms of melanosis oculi. His classical description of the "true and constant signs and characteristics of hereditary melanosis" stimulated the interest of his contemporaries in reporting unusual cases of ocular discolorations and growths. Ophthalmologists began to become increasingly aware that early recognition of benign and malignant melanomas together with the precancerous and cancerous melanotic states meant life or death to the patient.

It remained for Reese[2] to direct the attention of his colleagues to the clinical and pathologic recognition of precancerous and cancerous melanotic states with his analysis of 17 of his own cases which included one case of spontaneous regression. Recognizing that the whole subject of pigmented tumors is "in a state of flux," Reese[3] recently has attempted to replace the indiscriminate use of the term "melanoma" for all pigment-bearing tumors with a suggested terminology based on histologic findings that disregards the prominent pigment factor common to all such tumors.

This attempt to establish a degree of order in a controversial and chaotic subject is a courageous step forward in the right direction. Unfortunately there are certain cases which defy any convenient attempt to pigeon-hole them clinically or histopathologically. We wish to present one such case.

CASE REPORT

History. L. E., a married Chinese man, aged 40 years, with two entirely normal children, aged 8 and 10 years, was first seen in October, 1946, with a pigmentary disturbance of the right eye, the right side of his face, and the right side of his forehead and scalp. He had no physical or ocular complaints and was unaware that the excessive pigmentation was remarkable. He had been born in China of nonconsanguineous parents. He had had the usual childhood illnesses. He had come to the United States at the age of 10 years.

When questioned about the duration of the pigmentation, he stated that his parents had noticed a small pigmented area on his right eyeball when he was approximately five years of age. This pigmented spot slowly became larger during the first two decades of life. However, at 17 years of age, the pigmentation was still confined to the right globe. In his early twenties pigmentation of the upper and lower right eyelids began to appear. During the past two decades the pigmentation has spread extensively over the right side of his face, nose, brow, forehead, and the parietal and occipital portion of his scalp.

General physical examination. Entirely negative except for the abnormal pigmentation to be described.

Face. There was a diffuse slate-gray, nonelevated pigmentation irregularly spread over the right side of his face, extending through the floor of the nose into the mucous membrane of the mouth. In the mouth the pigmentation was confined to the region of the hard palate. The overall pigment picture might be likened to the end result of a severe powder-blast burn.

Ophthalmic examination. Uncorrected

visual acuity was: O.D., 20/20; O.S., 20/20. Cycloplegic refraction showed: O.D., with a −1.25D. sph. ⊂ +2.0D. cyl. ax 90° = 20/20; O.S., with a +0.25D. sph. ⊂

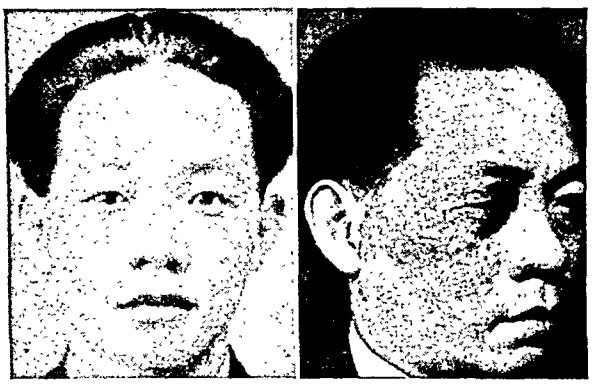


Fig. 1 (Jensen and Haffly). The patient at the ages of 17 and 40 years. (Left) Small pigmented area confined to the right globe. (Right) Side view of face showing the irregular patchy distribution of the lesion.

+0.75D. cyl. ax 60° = 20/20. Tension was 18 mm. Hg (Schiøtz).

Right Eye

Conjunctiva. Diffuse, irregular patches of grayish-black pigment were scattered throughout the bulbar conjunctiva, becoming more confluent in the region of the fornices. This pigmentation was continued into the palpebral conjunctiva to the lid margins.

Sclera. A diffuse bluish-violet discoloration occupied the majority of the visible sclera.

Cornea. The cornea was clear macroscopically. Slitlamp examination revealed infiltration of pigment granules that extended from the sclera a millimeter or more into the corneal stroma at the limbus.

Iris. Pupillary responses were normal. The iris had a deep, rich-brown color with a velvetlike sheen. The heaviness of the pigment granules present made the iris trabeculas indistinct. The iris color was much darker than that of the left eye.

Ophthalmoscopic examination. The media were clear. The fundic reflex of the right eye was dull as compared with the left. The



Fig. 2 (Jensen and Haffly). Close-up view of the right eye showing the bluish-violet and grayish-black patchy distribution of pigment.

macular area and the retinal vessels appeared normal. The optic disc had a deep physiologic cupping. Within the depths of the physiologic cup were scattered flecks of black pigment, interlacing with the weblike network of the strands of the lamina cribrosa.

Left Eye

The findings in the left eye were entirely normal with the sole exception of the presence of an isolated clump of rich-brown pigment approximately 1 by 1 by 1 mm.



Fig. 3 (Jensen and Haffly). The right eye with speculum in place.

lying on the surface of the iris in the 5:30-o'clock position, midway between the chamber angle and the pupillary margin. This elevated pigmented area had the same rich-brown color as the entire iris of the right eye and was much darker than the remainder of the iris.

Microscopic examination

The microscopic report of a section of skin taken from the margin of the lesion on the forehead read: "A piece of skin including all of the cutis. The epithelium is not remarkable. Throughout the corium are numerous cells varying from stellate to fusiform in shape, filled with brown pigment. They are dispersed, typical of chromatophores filled with melanin. There is no clumping or other features of a blue nevus. There is no evidence of malignancy."



Fig. 4 (Jensen and Haffly). Photomicrograph showing pigment-ladened chromatophores in corium. There is no evidence of melanotic nevus. (×200.)

Comment

This lesion may properly be called a nevus, if one uses this as a generic term to include any congenital discolored lesion of the skin. It is not the common type of neuronevus, the cells of which resemble epithelial cells and are probably neural in origin. These cells usually contain melanin. Such a lesion may undergo malignant transformation to become a malignant melanoma.

In the present case the histopathology may be likened to that of the Mongolian spot in which the pigment may be increased in the epithelium, being particularly noticeable in chromatophores, scattered throughout the corium. When such heavily clumped pigmented chromatophores band together in discrete nodules, the term "blue nevus" is usually employed. Thus there is much similarity between the histopathology of the Mongolian spot and the blue nevus. In the present case the lesion is diffuse and, histologically, the chromatophores are not clumped into nodules. It would seem unwise to use the term "blue nevus" for the diagnosis. The term "melanosis cutis" would seem to be an adequate diagnostic term for the skin lesion in this case.

Discussion

This case seems without parallel in the medical literature. Reese[4] states that he has never seen a similarly advanced case and adds that it may well represent a precancerous melanotic state. Whether one is dealing with an acquired diffuse precancerous lesion that will develop in time into a malignant melanoma or whether one is merely witnessing the widespread development of a benign congenital condition that has gained momentum with the passing years, can only be a matter of conjecture. Microscopic studies of a skin section taken from the advancing margin of the lesion reveal no evidence of malignancy in the area of biopsy. In many ways the findings fit Bouqien's classical description of congenital melanosis oculi that includes the following characteristics:

1. Brown to blackish iris with no evidence of trabecular structures. The iris may assume a velvety appearance.

2. Dark iron-gray color of the fundus without any evidence of transillumination of

the choroidal vessels and intravascular spaces.

3. Pigmented spots in the conjunctiva.

4. Spotty diffuse discoloration of the sclera surrounding the cornea.

5. Pigmentary deposits in the optic papilla.

6. Discoloration of the skin of the lids.

7. The refracting media, as well as the nervous part of the retina, are not affected.

8. Occurrence is more frequent in individuals with dark complexion and dark hair.

9. Usually monocular.

SUMMARY

An unusual case of excessive pigmentation of the right globe, right optic papilla, right side of the face, right side of the scalp, and the roof of the mouth is presented with suitable pictorial evidence that the widespread disturbance was not present when the patient was 17 years of age.

Microscopic studies reveal a benign pigmentation of the skin made on a biopsy of the advancing margin of the lesion. In the absence of more definitive findings it is felt that the case should be considered one of benign progressive melanosis oculi. It is entirely possible that this widespread pigmentary disturbance represents a precancerous melanotic state. Only time can tell.

1315 Medical and Dental Building (1)

The authors wish to express their appreciation to Dr. Clyde R. Jensen, pathologist at King County Hospital.

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PLASTIC REPAIR OF A CONGENITAL DEFORMITY OF THE EXTERNAL CANTHUS

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New York

Malformations of the external canthus are usually acquired through burns or injuries of the temporal region followed by retraction of the scar tissue. Very seldom are slight deformities observed as congenital anomalies, and the literature on the subject is very poor; in fact, no description is found of cases similar to the one herein described.

In 1938, Wheeler described an interesting case with complete absence of the external canthus ligament. In order to rebuild the canthus in proper position, he had to use two strips of orbicularis that were brought close to the periosteum of the zygomatic bone.

In the case which I am about to describe, the ligament existed but was ectopically implanted at the margin of the zygomatic bone, about 1 cm. lower than the normal position. Because of this abnormal insertion, the lower lid was pulled down and forward, leaving a space between the lid and the eyeball. Even when the patient's eye was tightly closed some part of the cul-de-sac was exposed and a moderate lagophthalmos was present.

A plastic operation which would correct the deformity had to deal both with the external canthus ligament, by transplanting it to its right place, and with the skin of both lids, because when a manual traction was done to raise the external canthus to the

level of the one of the left eye, there was a bulging in the skin of the upper lid and a pulling downward by the stretched skin of the lower lid.

Case report

M. N., a woman, aged 20 years, was first seen in my office on October 3, 1945, for



Fig. 1 (La Rocca). Congenital deformity of the external canthus.



Fig. 2 (La Rocca). Appearance after plastic correction.

the condition of the right eye already described and illustrated in Figure 1. The patient was admitted to the New York Eye and Ear Infirmary on October 19, 1945, for plastic repair under local anesthesia. After infiltration of the region with novocaine (2 percent), a flap of skin 2½ cm. long and 1 cm. wide was delimited on the outer part of the upper lid; an incision of the same length was made in the skin of the lower lid parallel to the palpebral margin (fig. 3). The external ligament was exposed and completely detached from its attachment to the lower margin of the orbital rim. A double-armed silk suture was passed through the conjunctiva, the tendon of the external ligament, and then through the periosteum of

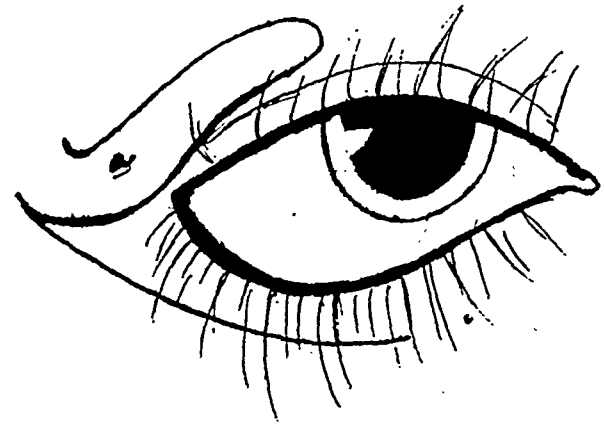


Fig. 3 (La Rocca). A skin flap (a) is delimited on the outer side of the upper lid and an incision of the same length is made in the skin of the lower lid.

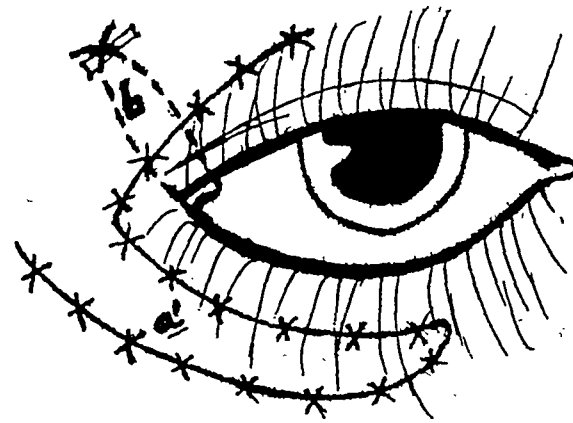


Fig. 4 (La Rocca). The skin flap (a') is swung from the upper lid and sutured into the bed previously prepared in the lower lid. A double-armed silk suture (b), tied over a rubber peg, pulls up the external canthus.

the zygomatic bone, 1½ cm. higher than the original insertion. This suture was tied over a rubber peg, near the tail of the eyebrows.

The skin close to the incision of the lower lid was then undermined to make a bed for the flap which was swung from the upper lid and sutured with several fine cataract

silk sutures. A light pressure bandage was applied and the patient was discharged from the hospital after 24 hours. The heavy silk suture supporting the canthal ligament was removed on the 10th day, while the fine sutures were allowed to fall by themselves. Recovery was uneventful. The appearance was improved as shown in Figure 2, and the lagophthalmos disappeared as soon as the lid was brought near to the eyeball.

SUMMARY

An unusual case of congenital malformation of the external canthus with lagophthalmos is described. The correction was obtained by lifting the external canthal ligament to a proper position, plus a skin flap taken from the upper lid and transplanted into the lower lid to diminish the traction of the lid downward and eliminate the lagophthalmos.

42 Fifth Avenue (11).

SQUAMOUS-CELL CARCINOMA OF THE ORBIT

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The case of squamous-cell carcinoma of the orbit here described presents several unusual features. A comprehensive review of the literature revealed no similar case. First, this type of tumor is almost unknown in this location. Secondly, the earliest symptom was diplopia, for which extraocular muscle surgery was done with an apparently successful result. There was no recognition of any unusual pathologic change in the region of the internal or lateral rectus muscles at the time of the original operation. Thirdly, the late symptom of blurring of vision was complained of by the patient, despite rather recent refraction, approximately 10 months after the original operation. The refractive change in this case illustrates the possible role of this evidence in differential diagnosis.

REPORT OF CASE

History. H. R., a florist, aged 53 years, complained of pain in the eyes almost constantly and double vision on looking to the right, for the last three months. The diplopia was not present in any other position of the eyes. He had received injections of thiamin and penicillin and had taken some thiamin by mouth.

There was a history of many skin cancers removed by irradiation, particularly a large growth in the right temporal region within the four years immediately preceding. The patient was of fair complexion, and there had always been great intolerance on exposure to sunshine. He had no unusual habits, vocations, or avocations, and the family history was noncontributory.

Eye examination. On January 11, 1946, ocular examination showed that the bulbar and palpebral conjunctivas were normal. There was greatly limited external rotation of the right eye and a tendency to close this eye in the right lateral position. The pupillary size, shape, and reactions were normal. The eyegrounds gave evidence of moderate arteriolar sclerosis. The media were clear. Vision of 20/30 in both the right and the left eyes was corrected to 20/20 with the following combinations: R.E., +0.25D. sph. ⊂ +0.5D. cyl. ax. 127.5°; L.E.; +0.5D. sph. ⊂ +0.5D. cyl. ax. 82.5°; with a +2.0D. sph. addition, J1 was obtained in each eye.

The accommodative power was equal and normal in both eyes. The near point of convergence was normal. Esotropia of 8 prism diopters was present in the primary position with no vertical component. There were 10 prism diopters of esotropia at near.

A homonymous diplopia was present in the primary position, exaggerated in the right lateral position of the eyes and disappearing almost entirely in the corresponding position on the left. A 5-degree prism, base out, fused images on the red-glass test in the primary position, while in the right lateral

position it required a 15-degree prism, base out, for fusion.

The palpebral fissures were equal in the two eyes, and the exophthalmometer readings were the same for both. The peripheral visual fields were normal for form and color during the entire course of the disease, as were also the central fields and blindspots.

There were many flat glistening skin scars scattered over the body with a large scar, measuring 4.5 by 5 cm., in the right temporal region just above the external angle of the orbit. These were postirradiation scars, resulting from treatment of the skin cancers.

Diagnosis of palsy of the sixth nerve on the right side was made. The patient was referred for a neurologic examination, which gave negative results, including examination of the spinal fluid.

When the patient was seen 19 days later, the ocular findings were about the same. There was, however, the additional complaint of drooping of the right upper lid. This symptom was not verified, for the palpebral fissures were, as before, equal, 14 mm. on the two sides. An injection of prostigmin was given, but there was no alteration in the width of the fissure nor any change in the heterotropia. The exophthalmometer readings were still equal. The apparent ptosis complained of was then ascribed to the involuntary closure of the right eye in order to overcome diplopia.

Two months later the diplopia had about doubled in degree. On May 29th, a 7-mm. resection of the lateral rectus and a 3-mm. recession of the mesial rectus were performed. The postoperative course was uneventful.

Orthoptic exercises were given until July 2nd. At that time the following prescription for glasses was given: R.E., +0.5D. cyl. ax. 97.5°; L.E., +0.75D. sph. ⌒ +0.5D. cyl. ax. 105°. Vision of 20/20 was obtained in each eye at distance, and at near with the addition of a +2.25D. sph. a J1 was easily obtained in each eye. There was exophoria of 2 degrees at distance in the primary position and of 8 degrees at near. Slight diplopia of the heteronymous type was present at distance, particularly in the left lateral position. The segments in the glasses were decentered in, and convergence exercises were prescribed for home use.

In December, 1946, the patient reported for treatment for a moderate conjunctivitis. Conjunctival smears were negative for organisms, as were cultures in blood agar and in broth. This condition responded to treatment and soon subsided. The operative scars showed nothing unusual.

On February 24, 1947, on complaint of the patient, another refraction was done with the following findings: R.E., +0.5D. sph. ⌒ +0.25D. cyl. ax. 15°; L.E., +0.5D. sph. ⌒ +0.25D. cyl. ax. 120°. Reading addition, O.U., +2.25D. sph. The external deviation was about the same at distance and near. The patient was advised to continue the convergence exercises and was also given a rotary exercise from the midline to the left.

One month later, he returned complaining bitterly of the new glass for the right eye. To my astonishment on rechecking, the manifest test showed for this eye a −0.5D. sph. ⌒ +1.25D. cyl. ax. 165°. With this combination normal distance vision was obtained. The findings were checked carefully with the use of homatropine and paredrine, and this prescription was then given for the right eye, with no change in the glass prescription for the left eye. There was considerably diminished internal rotation in the right eye and practically no near point of convergence.

On May 8th, the patient reported blurred vision in the right eye, and the manifest refraction showed a pronounced change since the previous examination, being for this eye −0.75D. sph. ⌒ +2.25D. cyl. ax. 85°. With this prescription a distance vision of 20/20+ was obtained, and at near, with a +2.25D. sph., J1 was obtained.

At this time the right eye was almost fixed in the lateral position, and there was little internal rotation. A heteronymous di-

plopia was present with some suppression of the right eye. The palpebral fissures and the exophthalmometer readings were equal. The patient was advised to have another general neurologic examination and a roentgen study of the orbital regions. The results of these examinations were negative. An exploratory operation for the purpose of doing again the muscle surgery and also checking for a tumor in the region of the lateral rectus of the involved right eye was then advised.

On May 18th, under local anesthesia, the region of the operative scar over the lateral rectus of the right eye was exposed, and it was found that the muscle was surrounded by dense scar tissue of a rather granular type, particularly posteriorly. There was so little elasticity present in the belly of the muscle that it was difficult to cut it free from the globe after placing the recession sutures.

When it was freed, rotation of the globe inward, previously impossible, could be readily accomplished. After the muscle was reattached to the globe posteriorly, several portions of tissue were obtained for biopsy. The mesial rectus, previously operated on, was resected and advanced to the mesial limbus. The conjunctiva was closed. A small piece of rubber tissue was, however, inserted in the depth of the wound around the lateral rectus.

The pathologic report made by Dr. H. R. Mills and Dr. J. N. Patterson, was probable squamous-cell carcinoma, but available tissue showing this pathologic condition was insufficient for positive diagnosis. The wound was reopened on May 26th, and about 1 gm. of pathologic tissue was removed. On microscopic section, this specimen showed squamous-cell carcinoma of about grade III malignancy.

On May 30th, exenteration of the orbit was carried out under pentothal sodium anesthesia. Posteriorly, a large scirrhous mass extended to the periorbita and was firmly fixed to it in the regions of the superior and inferior orbital fissures. The stripping of the periorbita was not easy in these regions, but was accomplished. The lids were removed flush with the orbital margins. The postoperative course was uneventful. Figure 1 shows the completely epithelized wound with scars of irradiated skin lesions, particularly in the right temporal region.



Fig. 1 (Forbes). This photograph shows the completely epithelized wound and also the scars of irradiated skin lesions, particularly in the right temporal region.

Discussion

This case suggests several interesting points. The location for such a tumor was most unusual. The diagnosis of paralysis of the sixth nerve might have been correct, due to the nerve being affected peripherally by a tumor located in the region of the superior orbital fissure. The other nerves in this region should, however, have been involved. Possibly early, the tumor affected mechanically the external rectus far back

and this condition could of course have been overlooked at the time of the original examination.

In addition, the history of skin cancer in multiple form, especially the large one in the right temporal region, was definite. There was no biopsy of these lesions, since it was assumed that they were of the basilar type. The possibility of tumor cells being introduced into the orbit from a very early lesion not recognized at the time of the first muscle surgery must also be considered rather than metastasis.

The refractive changes of the eye on the side of the retrobulbar tumor were really the first concrete signs suggestive of a tumor in this location. Brav and Brav[1] directed attention to the possible diagnostic value of refractive change in selected cases of retrobulbar tumor, and it was mentioned in association with two cases of cavernous hemangioma of the orbit in my report[2] of a series of eight cases of unilateral exophthalmos caused by orbital tumors. In one of these cases there was present squamous-cell carcinoma over the posterior part of the orbital plate with further evidence of the tumor around the optic nerve.

Summary

A case of squamous-cell carcinoma of the orbit is reported.

The outstanding features relating to site, symptoms, diagnosis, and surgical measures in this unusual type of case are discussed.

The significance of refractive change as a possible aid in diagnosis is mentioned.

409 Citizens Building (2).

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EXOPHTHALMOS IN NEWBORN DUE TO ORBITAL HEMORRHAGE

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Duluth, Minnesota

An 11-year-old girl came to the office for refraction recently. She had beautiful and normal eyes and eyelids, and her vision in both eyes was 20/20. Her record contained the following interesting history.

She was born on January 31, 1937, in the position of face presentation. After birth her face was so swollen that the eyes could not be seen. By February 5th the swelling had receded to such an extent that they could be inspected. It was found that there was a marked proptosis of the right eye with limitation of movements.

When I first saw her in consultation, there was beginning ulceration of the upper cornea of the right eye and the lids did not cover the eye. There was a marked protrusion of the globe with every crying effort. There was considerable congestion of the cunjunctivas, and a moist chamber was prepared to protect the eyes. By February 11th all signs of external irritation had subsided but the proptosis still remained. In fact, during the next few days the globe was extruded out of the conjunctival sac beyond the eyelids several times, and enucleation was considered. However, on February 13th the eyelids were stitched together with double sutures over the globe in order to protect it. Spinal and cistern punctures were attempted on February 14th but were unsuccessful.

On February 15th a needle was passed

into the orbit behind the globe and 3 cc. of old blood were aspirated. Aspiration was repeated on the following day, and 1 cc. of blood was removed. After these aspirations the proptosis was reduced by three-fourths. There was still some limitation of movements, however, especially in the upward gaze. Eventually this also became normal.

A diagnosis of orbital hemorrhage due to birth injury was made.

Discussion

Orbital hemorrhage following birth injury seems to be very uncommon. I found only three reports in the literature of unilateral exophthalmos in newborn infants which might be due to hemorrhage. In none of the three was hemorrhage proven.

Velter and Margiat deTrigny[1] reported a case of proptosis, with marked swelling of the eyelids, in 1939. They made a tentative diagnosis of angioma and took a biopsy which proved to be negative.

Windham[2] reported a case, in 1942, in which a sudden exophthalmos developed on the sixth day. He concluded that an orbital tumor was present and planned to operate but the next morning the proptosis had receded 40 percent. He assigned this recession to the effect of the X rays which had been used in taking roentgenograms. He continued treatment with X ray, and 20 days later the eye was normal.

Harley[3] reported a similar case, in 1943, in which the exophthalmos developed the day after delivery and reached such an extent that it measured 17 mm. in the left eye as compared with 6 mm. in the right. The exophthalmos persisted unchanged for about 13 days and then began to get better. It was about gone on the 23rd day, and entirely gone on the 32nd day. Harley concluded that this was probably an orbital hemorrhage and that the effect from the X rays used was debatable.

It is likely that all three of these cases, as well as the one reported here, were due to orbital hemorrhage from birth injury. These cases emphasize the fact that radical measures should be avoided when the eyes of an infant show marked displacement from an unknown cause. Recovery may be complete with simple therapeutic measures and a little patience.

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RETINOCHOROIDITIS RADIATA*

Chi Hsin-Hsiang, M.D.
Chengtu, Szechwan, China

From the Rigshospital of Professor Roenne in Copenhagen, T. H. Brown† described an interesting case which he called retinochoroiditis radiata. Both eyes of a man, aged 47 years, showed a similar change of circumpapillary atrophy of the choroid around the normal papilla. From this area atrophic stripes with considerable pigmentation followed the veins to the periphery. The field of vision was slightly contracted and vision was 6/9.

Since a perfect replica of this unique case has been found, it is of interest to describe it.

Case report

History. Patient Wan Pei Wen, a housewife, aged 36 years, complained of redness, pain, and a sense of distention in the left eye for more than three

* From The Eye, Ear, Nose and Throat Hospital.
† Brit. J. Ophth., 21:645, 1937.

weeks. Some impairment of vision was also present. These conditions became progressively worse in spite of treatment including eyedrops and three injections of a sulfonamide. When the pain was severe, it radiated to the corresponding side of the head.

She had never noticed any discomfort in the right eye. Four years ago she had had the same trouble in the left eye which lasted for about three months. At that time she was taken care of by a general practitioner.

The patient was married 17 years ago, had had 11 pregnancies, with two 3-month abortions. The

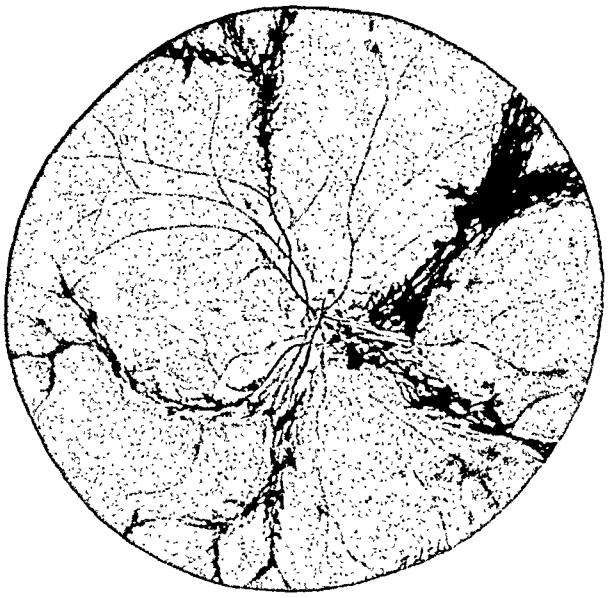


Fig. 1 (Chi Hsin-Hsiang). In the atrophic areas there were irregular-shaped, dark, pigmented patches, scattered evenly on the nasal side. On the temporal side, they were relatively dense at the periphery.

first child, she was told by a doctor, was supposed to have congenital syphilis. A serologic test for syphilis was positive once in 1941, but repeatedly negative for seven times since 1942, after injections of neoarsphenamine. During each period of pregnancy, she received some neoarsphenamine injections which amounted to about 30 altogether. She had no history of chronic cough or hemoptysis, although her father had died of chronic cough and hemoptysis 24 years ago. Her husband had a history of venereal exposure, penile sore, and G.C. urethritis. The woman was admitted to the hospital on July 21, 1947.

Ophthalmic examination. Right eye: The anterior part of the right eye was normal. The disc appeared normal. There was a circumpapillary atrophic area of ½ to 3 disc diameters, the longest diameter being on the nasal side. There were four stripes of atrophic areas radiating out from this circumpapillary atrophic region. These stripes followed the distribution of the main retinal veins. Before these stripes terminated at the equatorial region, they divided and subdivided until they became much narrower in width. The color of the atrophic area was partly grayish with a bluish tint.

In the atrophic areas there were irregular-shaped, dark, pigmented patches, scattered evenly on the nasal side. On the temporal side they were relatively dense at the periphery (fig. 1).

At some regions the pigmented patches ensheathed the retinal veins, so that the vessels appeared black. The retinal arteries were definitely narrower. At certain regions the superior and inferior retinal arteries showed whitish lines running along their sides. The macular region appeared to be normal. Vision was 6/6, J1.

Left eye. The lids were slightly swollen and the palpebral conjunctiva was moderately congested. There was a tender nodule (episcleritis) 1.5 by 1 cm. in size at the 3-o'clock position of the limbal area, with deep injection which did not fade after using adrenalin. There were numerous fine deposits on the posterior surface of the cornea, chiefly located on the temporal side. The anterior chamber was slightly deeper than on the right side. There was blurring of the iris pattern. The pupil dilated well under atropine. Fine whitish and brownish spots were found on the anterior lens capsule. Intraocular pressure was normal.

The general appearance of the fundus was the same as in the right eye except that the circumpapillary area of atrophy was narrower and the stripes which ran from the papilla to the periphery, following the veins, were thinner. As the eye was irritated by the scleritis, a picture could not be taken of the fundus. Vision was 6/30, J3.

Visual fields. The right eye showed a slight concentric contraction and a horizontal enlargement of the blindspot. The left eye showed more concentric contraction but did not show an enlargement of the blindspot.

Laboratory findings. Wassermann, Kahn, and Ring tests were negative. Tuberculin test was positive to 1/1000 mg. Fluoroscopy of the chest was normal.

Treatment of the left eye consisted of atropine dionine as eye drops. The episcleritis was treated by rubbing a copper sulphate stick on it.

Course. On discharge, August 6, 1947, the episcleral nodule had completely disappeared. There was no photophobia or lacrimation. Vision was 6/7.5.

Comment. The change of the fundus was apparently an old one, since the patient and all her present complaints were due to the episcleritis. In these factors this case resembles that reported by Brown, as it also does in the good vision and the change of the field. Another similarity is that the disease apparently originates on the retinal veins because all the bands of choroidal and retinal change follow the veins and their distributions.

The retina shows the most conspicuous changes because the pigmented deposits are lying in its innermost layers, covering many parts of the retinal vessels and, in places, enveloping the retinal veins in black sheaths. The white part of the circum-

papillary atrophy and the stripes are due to the atrophy of the pigment epithelium and of the choroid.

Discussion

In agreement with Brown, we consider the origin of this disease to be an inflammation of the veins. The arteries in our case also showed considerable changes by their attenuation and by their accompanying sheaths, that means that there was once an arteritis. Without doubt, however, the change of the veins is more marked and important and the acute stage of this whole fundus picture was apparently once a widespread periphlebitis.

A difference between Brown's case and the one herein presented is the etiologic factor. In Brown's case tuberculosis was apparently the etiologic factor, while in our case there was very little evidence of tuberculosis but the patient had had syphilis.

The explanation of this characteristic and unusual picture of the fundus is difficult if we consider the etiology. Periphlebitis, as a rule, is of tuberculous origin but has a quite different clinical picture. Usually, it is on the periphery. It also has a tendency to recur and finally leads to vitreous hemorrhages (Eales's disease) and retinitis proliferans. A third difference is that tuberculous periphlebitis does not lead to any pigmentation of the retina. In arrested cases of periphlebitis retinae we have newly formed veins, with fine white membranes of connective tissue following the veins and crossing the newly formed loops.

Periphlebitis retinae occurs near the papilla but rarely. Apparently it causes the destruction of the nerve-fiber layer of the retina with corresponding defect in the visual field. If tuberculosis was the etiologic factor in Brown's case, it produced an unusual condition in that the periphlebitis started near the papilla, following all the veins and producing much pigmentation.

On the other hand, syphilis, the etiologic factor in our case, is known to be a cause of arteritis of the retina and to produce pigmented sheaths on the peripheral arteries of the retina. Periphlebitis apparently does not play any role in the pathology of syphilitic diseases. In our case, we have only a slight involvement of the arteries, but very marked pigmentation along the veins. One is tempted to deny syphilis because the veins are involved in such a degree, and yet the pigmentation makes the syphilitic origin very likely.

Retinochoroiditis radiata presents not only a marked and typical appearance of the features: (1) The acute stage probably does not cause much visual impairment. (2) It does not cause much impairment of the whole retina since vision is good.

A CASE OF MULTIPLE NEUROFIBROMATOSIS WITH SOME UNUSUAL FEATURES*

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The following case of neurofibromatosis is presented because of the unusual distribution of the lesions on the palms of the hands, the scalp, and the mucocutaneous borders of the upper and lower eyelids, where they are responsible for a recurrent trichiasis. In addition, in this case there is a clear-cut history of the existence of the same condition in three successive generations, both the father and son of this patient being similarly afflicted. A 3-year-old grandson has developed café au lait spots, a precursor of the condition.

Case report

History. B. G., a 58-year-old white man, was hospitalized in July, 1941, with chronic, far-advanced pulmonary tuberculosis. He stated that he first noticed multiple small

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Fig. 1 (Wallach). Small, discrete tumors are visible on forehead, face, and eyelids where they cause a turning-in of the lashes.

tumors on the chest in 1918 when he was about 30 years of age. Since 1925, when small tumor masses appeared on each eyelid, he has had to have his lashes plucked out because, as he put it, "they turn in and rub against my eyes."

On physical examination his entire body was found to be covered with multiple small tumors located, in general, between the skin and subcutaneous tissue. Many of the lesions were pedunculated, soft, pliable, and moderately tender to pressure. An actual count of the number of the masses in the middle of the back averaged between 25 and 40 per square inch, with diameters varying from 1 mm. to 1.5 cm. The majority of the larger lesions were pedunculated and most of them had a definite ring of tissue at the base through which the tumor mass protruded. Some could be felt better than seen and presented themselves to the palpating finger as soft masses beneath the skin, not readily visible. In general they were of a dull red color which was not continuous with the hue of the surrounding skin. No areolas were present.

The general distribution defied accurate description. Although densest over the lower lumbar region and lower abdomen, they also extended from well into the scalp to the face where they invaded the eyelids (fig. 1) causing a turning in of the lashes.

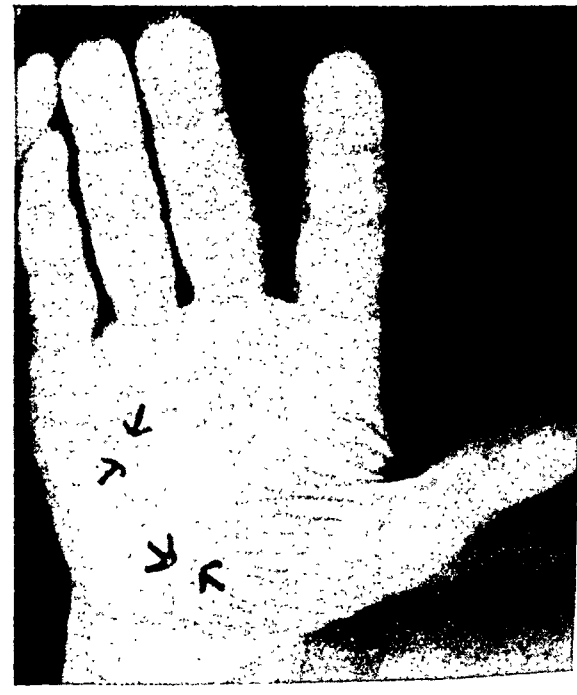


Fig. 2 (Wallach). Multiple, discrete pinhead-sized to pea-sized lesions on inner aspect of both forearms and palms.

At this site, the lesions were smaller and firmer than elsewhere on the body. From the face they extended down the neck to the arms, forearms, and into the palms (fig. 2). The upper chest and sternal area were densely covered with the masses, and the penis and scrotal sac were also involved. The lower extremities were not heavily invaded, the number of lesions decreasing markedly from below the hips to the upper thighs. Those on the legs and thighs were small and slightly raised. Light brown pigmented areas (café au lait) were noted on the thighs, these areas varying in size and shape. The patient stated that he noticed a progressive increase in the number and size of the lesions.

A neuropsychiatric examination revealed the patient to be mentally clear and adequate.

X-ray examination of the spine showed narrowing of the anterior portion of the interspaces of the lower dorsal vertebras due to pressure. X-ray examination of the lungs, bones, and skull revealed no abnormalities.

Laboratory tests. The blood Wasserman was negative. Calcium-phosphorus and phosphatase levels were normal. Examination of the blood was normal.

Comment

There have been cases reported in the literature of von Recklinghausen's disease involving the eyelids. These articles, however, as well as the standard texts on ophthalmology mention only the single, large, soft type of tumor, not involving the lashes. These tumors were removed en masse surgically. The lesions on the eyelids referred to in this article are the small, multiple, hard type of neurofibromas associated with a widespread distribution of the disease. I have been unable to find a report of this type of lesion associated with a trichiasis. Palmar and scalp involvement in multiple neurofibromatosis is also very rare, but has been reported.[1]

Our patient was one of a family in which similar lesions were present in three consecutive generations and there is a strong possibility that a grandson (fourth generation) will develop neurofibromatosis, since he already shows the café au lait spots, which are generally considered a precursor of the condition. Frank[2] has reported the familial incidence of von Recklinghausen's disease traced through five generations.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

January 13, 1948

HERNIATION OF THE VITREOUS

DR. CHARLES M. KING presented a case of herniation of the vitreous following a simple intracapsular extraction of a nuclear cataract in Mrs. W. A. C., a white woman, aged 60 years. Removal of the prolapsed vitreous from the pupillary space was described.

On July 9, 1947, a simple intracapsular extraction with a peripheral iridotomy was done for nuclear cataract. Two McLean sutures were used. No vitreous loss or other complications at the time of operation were encountered. On the night following surgery the patient had pain in the eye and, on examination the next morning, there was a moderate hyphemia present. The iris was visible through the blood. On the fifth postoperative day, there occurred another moderate hemorrhage into the anterior chamber. The subsequent blood clot was slowly absorbed.

On August 1, 1947, a sacculated herniation of the vitreous through the pupil was found, and there were blood pigments and small bits of clot on the face of the vitreous. This prolapse closely resembled a mushroom in its shape, the contracted pupil causing a narrow pedicle to be present. Miotics did not effect any change in the size, shape, or appearance of the herniation.

On August 20, 1947, a Wheeler knife was introduced into the anterior chamber and the sacculated vitreous prolapse was cut on the plane of the iris. A 2-cc. hypodermic syringe with a 22-gauge needle, bevel up, was introduced into the chamber and an attempt was made to withdraw vitreous through the needle. A very small amount went into the cannula of the needle. With suction maintained, the needle was withdrawn and a long string of discolored vitreous trailed along in its path. This string was grasped with forceps and all the prolapsed vitreous was slowly pulled out of the anterior chamber. The pupillary area was left clear.

On September 23, 1947, corrected vision in the eye was 20/20—2, J1. There were many fine vitreous opacities scattered over the vitreous proper and at times the patient's vision was temporarily disturbed.

This presentation was made because not much has been reported locally concerning this type of vitreous herniation following intracapsular cataract extraction. Perhaps good fortune was smiling upon the surgeon in this instance. The desired results were obtained and no special instruments were required for the procedure.

ALLERGIC REACTION OF PREVIOUSLY SENSITIZED EYE TO PARENTERAL PENICILLIN

DR. JAMES E. WILSON reported that Dr. R. H. M. had a conjunctivitis of the left eye on September 16, 1946, which was treated with penicillin. This produced a reaction of the conjunctiva and skin of the lids so that penicillin was discontinued. No penicillin was ever used in the right eye.

On December 1, 1947, he began receiving parenteral penicillin for a urinary infection. No penicillin had been used in or about either eye since September, 1946. About eight hours after parenteral administration was begun, the conjunctiva of the left eye and the skin of the lids became red and swollen. The skin was rough and the reaction extended down onto the cheek.

Pyrabenzamine (50 mg., 3 times daily),

cold boric compresses, and discontinuance of the penicillin injections completely cleared the eye reaction in 24 hours.

The right eye remained normal throughout. The only general symptom was itching of the skin of the legs.

Mr. R. L. S., Jr., Dr. Wilson's second patient, had an acute conjunctivitis of the left eye on December 1, 1946, and this eye only was treated with penicillin with prompt recovery. On February 5, 1947, he was hospitalized for a severe respiratory infection and received parenteral penicillin.

Within 10 hours he had a severe swelling and redness of the conjunctiva of his left eye. The skin of the lids became rough, red, and swollen even down onto the cheek. The right eye remained normal.

After 24 hours he developed a rash over most of his body, worse on the legs, accompanied by intense itching. He was treated with Benadryl, forced fluids, discontinuance of penicillin, and sodium thiosulphate. In 15 hours the left eye had returned to normal, but the general reaction was longer in clearing.

Value of Berman locator

Dr. James E. Wilson said that Mr. G. B.'s right eye was injured on July 14, 1947, by entry of a foreign body received while hammering on an iron fence.

The wound of entrance was 3-mm. long at the 5:30-o'clock position, one half in the cornea and one half in the sclera. The anterior chamber was shallow. One small linear hemorrhage in the vitreous was seen at the upper nasal position. The lens did not appear to be injured. X-ray localization showed a 1 by 2 by 3-mm. foreign body of metallic density well back and in the upper nasal position. According to the localization it was situated in the sclera, or very close to it, either inside or outside the globe.

Protruding iris was excised and the wound was closed with three 6-0 black silk sutures. The internal rectus was exposed. The Berman locator showed the site of the foreign body to be 6 mm. posterior to the muscle attachment and beneath the middle of the muscle. The muscle was detached and the locator, applied directly to the sclera, indicated the point for posterior-route removal. A mattress suture was placed and diathermy punctures were made. Next an incision with the keratome was made down to but not through the choroid. The foreign body came through with the first application of the hand magnet. The sutures were tied and no vitreous was lost. Three weeks after the injury the vision was 20/20 J1, uncorrected.

The Berman locator is always a help in localizing intraocular foreign bodies and is valuable in borderline cases, such as the one reported here.

Dr. Wilson's fourth case was that of Mr. L. T. K. who, while hammering on a chisel against a transmission on December 4, 1947, felt something strike his left eye causing immediate pain.

Examination showed a vertical 2-mm. wound at the nasal limbus with a small peripheral opening in the iris. The anterior chamber was full and no blood was seen. With the ophthalmoscope a small, dark-gray mass was seen in the upper nasal quadrant just posterior to where the foreign body entered. Fundus findings were otherwise negative. Vision was 20/20.

X-ray localization showed a 1 by 2 by 3-mm. foreign body near the sclera, about the position of inferior rectus insertion.

At operation, exposure was made over the insertion of the inferior rectus. The Berman locator indicated the ideal place for posterior-route extraction. The tendon and muscle fibers of the inferior rectus insertion were separated meridionally. The suture, diathermy punctures, and scleral incision were the same as in the first case. The foreign body came out with the first application of the magnet. No vitreous was lost.

The precise localization with the Berman instrument made it unnecessary to detach

the inferior rectus. On December 9, five days later, the vision was 20/20, uncorrected.

Lymphatic leukemia with lacrimal gland involvement

Dr. James E. Wilson reported that Dr. W. L. B., in September, 1946, had elevation of temperature and general malaise. White blood count was about 64,000 and, on the basis of blood tests, a diagnosis of lymphatic leukemia was made. In November, 1946, he had radioactive gold with prompt reduction of the W.B.C. to 10,000. He had a further reduction within 2 to 3 months to about 4,500 where it has remained since.

About February, 1947, he had enlargement of the spleen and axillary glands. These responded promptly to X-ray radiation. These glands were affected again in May and August when they were treated with X-ray radiation. In December, 1947, the same glands plus the inguinal and glands of the chest were involved. He received radiation treatments for these.

On November 10, 1947, he was examined and found to have enlarged glands in the lacrimal area, extending medially about 4 centimeters. The swelling was so great that the upper lids were pushed down, interfering with vision. Upon eversion of the lids, pinkish dusky masses were seen filling the upper fornices and extending from the lacrimal area to beyond the midline above. The masses extended subconjunctivally down onto the globe. The enlargements were symmetrical.

At operation on November 10, 1947, the upper lids were retracted upward through a conjunctival incision. The masses were isolated and removed. The mass on the right extended farther back into the orbit involving the superior oblique from which it was dissected. A small amount of the tumor in the area of each lacrimal gland was left to prevent subsequent dryness. Healing was uneventful and the patient left the hospital in four days. To date, December 10, 1947, there has been no return of the masses or enlargement of the part which was left.

Pathologic report. Gross appearance: Specimen consists of five ovoid pieces of pale-pink tissue, the largest of which measures 2.5 cm. in diameter. This tissue is covered by a thin capsule. On section, the parenchyma appears homogeneous throughout. Some specimens are not as well defined as the one just described. These contain a larger amount of fibrous tissue.

Microscopic diagnosis. Lymphatic infiltration of lacrimal gland, compatible with lymphatic leukemia. Mikulicz's disease cannot be excluded.

Resection-recession for external rectus paralysis

Dr. J. Wesley McKinney reported the case of Mrs. J. L., aged 42 years, whose left eye had been crossed all of her life. Her father had right abducens palsy and her daughter had bilateral abducens palsy from birth. Examination revealed an esotropia of 13 degrees. There was diplopia if she looked straight ahead. Therefore, she habitually carried her head turned to the right. There was a paralysis of the left external rectus. The left eye failed to rotate to the midline by 16 degrees. This corresponded exactly with the binocular field which showed the diplopia to be overcome beyond 16 degrees, eyes to the right. At operation, the left internus was recessed 5 mm. and the left externus resected 6 mm.

Six weeks later there was binocular single vision from 16-degrees left to 20-degrees right. The patient was entirely comfortable and no longer held her head rotated to the right side. With the red glass there was 6-degrees esophoria with the right eye fixating; and 4-degrees with the left eye fixating for distance. There was orthophoria for near. The convergence near point was 6 cm.

Muscle transplantation for external rectus paralysis

Dr. J. Wesley McKinney reported the case of R. L., aged 11 years, who was first

seen December 6, 1944. Both eyes had been turned in since birth. The grandfather had right abducens palsy and the mother had left abducens palsy.

Examination revealed a bilateral paralysis of the external recti with much secondary contracture of the internal recti. Neither eye could be rotated to the midline. Fixation alternated. With the right eye fixating, the esotropia measured 40 to 45 degrees; with the left eye fixating, the esotropia measured 35 degrees.

At operation, both internal recti were recessed, both external recti were resected, and the lateral halves of both superior and inferior recti were transplanted to their respective external recti.

The result was over correction of 15 degrees with the right eye fixating and 10 degrees with the left eye fixating. The actual exotropia was less than these figures would indicate. There was a positive angle kappa of 5 degrees for the right eye and 10 degrees for the left. The left eye was reoperated upon, the external rectus being set back 5 mm.

The final cosmetic result was good. External rotation was 30 degrees for the right eye, and 35 degrees for the left.

Melanoma of thf choroid

Dr. R. O. Rychener reported a case and exhibited the pathologic section of melanoma of the choroid.

Mr. J. G. P., aged 45 years, was seen on July 29, 1947, in consultation with Dr. Ralph W. Danielson at Denver, Colorado. One year previously the patient had been refracted with normal vision in each eye and no fundus lesion was noticed on ophthalmoscopic examination. For the past two months some visual diminution had been noticed in the left eye and, upon recent examination, what appeared to be a neoplasm of the choroid in the left fundus, temporal to the macula, was observed by Dr. Danielson and his associate. Upon examination here the media were clear. At the temporal and superior border at the left macula was a dome-shaped grayish brown mass about 2 disc diameters in diameter, elevated at its greatest height 6 disc diameters above the level of the disc. Flakes of brown pigment lay behind the retinal vessels on the temporal border. On the nasal border appeared to be a small retinal cyst flecked with pigment, overriding the mass like a bulla on the cornea. Transillumination was unsatisfactory because of the location of the lesion at the posterior pole, but at times a small shadow seemed to be present. The diagnosis established in Denver was confirmed and further consultation advised.

The patient was later seen at a well-known clinic in the north where the diagnosis of choroidal exudate was made and expectant treatment was advised. In December he was seen at another clinic in the east where diagnosis of intraocular sarcoma was made and enucleation advised. This was done and pathologic section showed a grade-2 melanosarcoma of the choroid, involving the posterior ciliary nerve.

Intraocular foreign body

Dr. Richard A. Miller reported Mr. H.I.O., aged 37 years, who was seen on February 16, 1948. The following history was given.

In the autumn of 1946, while hammering on a piece of steel, a foreign body struck him in the right eye. He immediately reported to a doctor who examined the eye and told the patient that there was no intraocular foreign body, that he was evidently struck a glancing blow by the flying material which did not penetrate the globe.

In the subsequent few weeks the vision in this eye began to fail and four months later he consulted an ophthalmologist who took X-ray films, found an intraocular foreign body, and so informed the patient. He also advised the patient to leave the eye alone unless it became painful.

When seen by me, the patient complained of dull aching pain in the right eye for the previous week. Examination showed vision

to be: R.E., light perception and projection; L.E., 20/20, J1. Examination of the right eye showed mild ciliary injection and an old perforating scar just lateral to the center of the cornea. The anterior chamber was shallow, the pupil 4 mm. in diameter and sluggish in its reaction to light. The lens was opaque and, in its lower portion just beneath the capsule, there was a brown foreign body approximately 2 by 4 mm. in diameter. There was no fundus reflex. The intraocular pressure in the right eye was 40 mm. Hg (Schiøtz); left eye, 20 mm.

The next day, under local anesthesia, an extracapsular extraction of the lens was performed through a round pupil, delivering the foreign body with the lens nucleus. The patient has made an uneventful recovery and on March 8, 1948, the vision in the right eye was improved to 20/40 with a +11D. sph. ⊃ +1.0D. cyl. ax. 180°.

Krukenberg's spindle

Dr. Philip Meriwether Lewis presented a white woman, aged 27 years, with typical Krukenberg's spindles.

The patient complained that her eyes ached and tired easily. She was quite obese and took thyroid extract regularly. The condition was discovered on making a routine examination along with cycloplegic refraction. The eyes were normal except for the brown pigment deposits on the corneal endothelium. Most of the pigment spots were arranged to form vertical spindles, centrally located. Each measured about 1.5 mm., horizontally, and 5 mm., vertically. There was a diffuse scattering of pigment over a broad area of the cornea in addition to the denser clumping which formed the spindles. Vision was 20/25 in each eye.

Comment. Duke-Elder stated in his text (volume 2, page 2036) that some 70 cases were in the literature. The condition was not nearly so rare as the small number of cases indicated. Many cases were not reported when diagnosed and many were overlooked. The spindles were first described by Krukenberg in 1899. The chief interest in them concerned the etiology. It was the consensus of opinion that the condition was not congenital, but was due to an atrophic process in which uveal pigment was deposited on the endothelium of the cornea in this unusual arrangement.

Simple versus combined cataract extraction

Dr. Philip Meriwether Lewis presented two patients upon whom simple intracapsular cataract extractions had been performed on both eyes.

Case 1. Mr. A. L. W., a white man, aged 44 years, was first seen in June, 1946, with the complaint of failing vision for four years. Examination showed a clouding in the posterior cortex of both lenses most marked in the left eye. Iridodonesis was present in both eyes, but the lenses were apparently not subluxated.

Vision was: O.D., 20/200; O.S., 5/200. With a −2.25D. sph., O.D., 20/40; and with a −4.0D. sph., O.S., 20/200. A plus 1.75D. addition gave J4 and J14, respectively. These glasses enabled the patient to carry on his work as an executive for slightly more than a year.

Complete physical and laboratory studies by his physician were entirely negative. In July, 1947, vision could not be improved beyond: O.D., 20/100; O.S., 8/200; J12 was the smallest type he could read.

On August 21st, a simple intracapsular extraction with peripheral iridotomy was performed on his left eye. Four days later the same procedure was done on the right eye. There were no postoperative complications. Eight weeks after operation final refraction was done. O.D., with a +13.25D. sph. ⊃ +0.5D. cyl. ax. 120° = 20/20+; O.S., +12.75D. sph., ⊃ +0.5D. cyl. ax. 135° = 20/20+. With both eyes, he read the 20/15 line completely. With a plus 2.5D. addition, he read J1 at from 13 to 20 inches. He was able to use his eyes together perfectly.

Case 2. Mr. M. L. W., a white man, aged 52 years, was seen first in February, 1946, with the complaint of failing vision for one year. Examination showed posterior cortical cataracts of both eyes, but vision was 20/40 in each eye. With a +2.25D. sph., vision was increased to 20/30, J3.

A general examination by his physician was negative. He was able to do his work as a metal plater until August, 1947, when his vision had become too poor (20/100, J10) to continue.

On August 26, 1947, a simple intracapsular extraction was performed on his right eye and three days later the same on his left eye. There were no postoperative complications. Nine weeks after operation he was refracted. Vision was: O.D., with a +11.25D. sph. ⊂ +1.25D. cyl. ax. 115° = 20/20; O.S., with a +11.25D. sph. ⊂ +1.0D. cyl. ax. 80° = 20/20. With a plus 2.5D. addition he read J1 at from 14 to 20 inches. He was able to resume his work almost immediately.

Comment: These patients were presented for two reasons.

1. I have in the past presented numerous cases that showed undesirable results from numerous and varied complications following cataract extractions. It seemed permissible to show a few good results occasionally.

2. To promote a discussion among the members as to the selection of cases for extraction without iridectomy. A number of years ago I did a much higher percentage of simple extractions than at present. Various complications led to the belief that they should be done only in relatively young patients who intend to lead an active and productive life for a considerable span of years after operation. In the majority of cases the combined extraction was safer.

Daniel F. Fisher,
Recorder for Eye Section.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

December 17, 1947

DR. EDWIN B. DUNPHY, *presiding*

IMMUNOLOGIC REACTIONS OF HUMAN SERUM GAMMA GLOBULIN IN HERPES SIMPLEX AND EPIDEMIC KERATOCONJUNCTIVITIS.

DR. HENRY F. ALLEN of Boston presented this subject. He said that experiments performed by J. T. Heyl, H. F. Allen, and F. S. Cheever have demonstrated in human serum gamma globulin neutralizing antibodies against the virus of herpes simplex.

The titer of this antibody was of the same order of magnitude in separate samples of serum gamma globulin obtained from the pooled serum of donors from different sections of the United States, being approximately 15 times the titer of human anti-herpes immune serum.

Passive protection tests in mice showed positive protection when a single large dose of globulin was given intraperitoneally up to 48 hours after intracerebral injection of a lethal dose of herpes virus. Since these experiments were not carried to the point where this protective effect disappeared entirely, the passive protection tests must be considered as having only preliminary significance.

The same technique employed in carefully controlled experiments failed to demonstrate either a neutralizing or a protective effect of human serum gamma globulin against the virus of epidemic keratoconjunctivitis. It was, therefore, concluded that these two viruses are immunologically distinct from each other.

Discussion. Dr. Frederick H. Verhoeff asked Dr. Allen to explain the mode of attack of herpes virus—whether the immunity is low between attacks and is boosted by each individual attack, and whether the virus is always present.

Dr. Allen replied that Burnet and others

have demonstrated the absence of antibodies in the serum of individuals prior to an initial attack of herpes simplex and the development of circulating antibodies during and after the primary attack. A demonstrable titer then remains until the end of that individual's life. It is probable that the antibody level decreases between attacks until some suitable stimulus, most frequently generalized fever or local tissue injury, predisposes to a recurrence which stimulates the formation of additional antibody. The virus is presumed to be present, either in active or in latent form, at all times after it has once gained entry to the body at the time of the initial attack. The exact role of circulating antibody in the mechanism of immunity to herpes simplex in the human body is not clear.

Dr. Verhoeff then asked Dr. Allen whether he had any explanation for the results of other workers who concluded that the virus of herpes simplex and epidemic keratoconjunctivitis were immunologically related and probably of the same genus. Dr. Allen replied that the present studies did not have any bearing upon the results obtained by these workers but that the conclusions drawn from the two sets of studies were at variance.

Dr. David Cogan pointed out that two of the stimuli for Dr. Allen's study were (1) a case of dendritic keratitis with an apparently dramatic cure by systemic use of gamma globulin and (2) the hope of obtaining therapeutic benefit from local use of gamma globulin in the high concentrations that would thereby be available. Dr. Cogan asked Dr. Allen if he had any explanation for the predilection of herpes for the cornea.

Dr. Allen said that therapeutic benefit from human serum gamma globulin could not be anticipated on theoretical grounds, since the intracellular location of the virus renders it inaccessible to circulating or locally applied antibody. Clinical trials in cases of dendritic keratitis failed to show any response to local or systemic administration of gamma globulin. Dr. Allen stated that he was unable to offer any explanation of the predilection of herpes simplex for the cornea; he stated that the virus has been shown experimentally to invade tissues derived from all three of the embryonic layers. He also stated that one of the striking properties of the herpes virus is the ease with which it is oxidized. Application of this principle is seen in local treatment of dendritic keratitis by scrubbing the corneal epithelium with strong alcoholic solution of iodine, as described in detail by Dr. Trygve Gundersen.

In reply to a question by Dr. James Regan, Dr. Allen stated that he had not attempted iontophoresis with human gamma globulin in the conjunctival sac.

Dr. Trygve Gundersen said that he had had somewhat the same experiences with the protective properties of immune blood in herpes simplex; that he had given rabbits their own weight in rabbit convalescent serum and found them just as susceptible to inoculation of the cornea with the virus of herpes simplex as ever.

Use of buccal mucosa in restoration of the orbital socket.

The above was the subject of the paper of the evening by Dr. James N. Greear, Jr., Washington, D.C. This paper was published in full in the Journal, 31:445-453 (April) 1948.

Discussion. Dr. Bradford Cannon, opening the discussion, mentioned that military patients presented a real challenge, because they were usually more demanding of the surgeon's services in the reconstructive phases of their care than civilians. The accidental injuries of a civilian were usually of his own doing or fault, while the men in the armed services did not ask to be in the service and be wounded, and therefore feel that they deserve everything that they can get.

He reëmphasized Dr. Greear's statements in regard to the importance and value of

mucous membrane in socket construction, inasmuch as in substitution one necessarily has to find tissues which resemble as nearly as possible the original tissues. He said Dr. Greear's demonstration of the possibilities of its use and the amount available from the mouth has been a tremendous boon to this phase of surgery.

Dr. Cannon thought that the reasons for the superiority of mucous membrane in socket repair were analogous to the use of the skin from the base of the neck in eyelid repair in preference to skin from the extremities and back of the ear. Not only does the skin of the neck match that of the lid better, but it is underlaid by a thin sheet of muscle which is analogous to the muscles which play upon the skin of the face and eyelids and make possible facial expression. The skin of the extremities is less suitable because it has deep fascia between the skin and muscles, and the skin behind the ear is less suitable because it is underlaid by cartilage and bone. He thought that in socket repair the mucous membrane in the mouth, played upon by delicate muscles in the cheek, is more suitable because it does not tend to shrink and is accustomed to lie adjacent to delicate muscles.

Dr. Cannon reëmphasized Dr. Greear's point that, in successful reparative surgery, it is of the utmost importance to remove the scars that are caused by the deep and penetrating wounds that are usually incurred in war. He challenged Dr. Wheeler's ability to use a graft of epidermis only, as mentioned by Dr. Greear. In his experience and that of others the removing of epidermis only from skin surfaces is possible, but they found that such a transplant falls apart very quickly.

The integrity of a sheet of skin depends on the presence of a dermal layer underneath. Microscopic sections of Thirsch grafts demonstrate that a thin layer of dermis is present. In regard to Dr. Greear's comments on the gauze used he felt that vaseline gauze was not good because it failed to absorb secretions, thus increasing maceration, and so he preferred either coated gauze or one impregnated with material to make it more absorptive.

In the general discussion that followed, Dr. Hanford Auten asked about the anesthesia used, the problem of maintenance of an airway while taking oxygen, and the after care of the mouth.

Dr. Hugh Donahue inquired why Dr. Greear does not undermine the edges of the buccal mucosa. Dr. Garrett Sullivan asked Dr. Greear to explain his method of exposure when cutting the graft.

Dr. Greear, in reply, said that he preferred general anesthesia with the mouth tightly packed to prevent aspiration of blood. Physiologic saline solution was injected beneath the mucous membrane to facilitate the cutting of the graft. This latter procedure was unnecessary if the operation was carried out under local anesthesia.

It was more desirable not to undermine the edges of the mucosa in order that the wound edges may be accurately approximated and no dead space created. The healing was by primary intention and there was no deformity afterward. The after care of the mouth consisted of washing the mouth thoroughly after eating with some mild antiseptic solution such as Dobell's. He stated that he had never had an infection of the mucosal wound. This was attributed to the fact that no patient was operated upon until the mouth, nose, and throat were free from infection.

To keep the mouth open he used towel clamps, one just above and one just below the angle of the mouth on the side from which the graft was to be taken. An excellent exposure could be obtained by putting these on the stretch and making a little pressure from without.

Mahlon T. Easton,
Reporter.

CHICAGO OPHTHALMOLOGICAL SOCIETY

DR. BEULAH CUSHMAN, *president*

December 8, 1947

CLINICAL PROGRAM

(Presented by the staff of the Illinois Eye and Ear Infirmary)

RETROLENTAL FIBROPLASIA WITH GLAUCOMA

DR. WILLIAM HIRST presented an 8½-months-old girl who was first seen at the Infirmary in October, 1946. The child was one of twins who were born after a gestation period of 7½ months and weighed 3½ pounds at birth. The twin brother has developed normally in every respect and has had no visual difficulty to date.

The mother first noticed a "whitish appearance" of the pupillary areas shortly before bringing the child to the clinic. She had also noted that the eyes fixed poorly and moved irregularly from side to side.

Examination revealed pendular nystagmoid movements of both eyes, very shallow anterior chambers, and yellowish-gray opacities occupying the pupillary areas bilaterally. Ophthalmoscopically, the grayish opacities were found to lie directly posterior to the lenses; normal red reflexes were entirely absent; the irides were dome shaped and at this time a diagnosis of bilateral retrolental fibroplasia was made. Intraocular pressure was: R.E., 27 mm. Hg; L.E., 46 mm. Hg (Schiøtz).

General physical examination showed a rather large head, with prominent frontal bosses and some flattening of the parietal areas, but otherwise was essentially negative.

Three months after the first examination tensions were taken under general anesthesia and were found to be: R.E., 26 mm. Hg; L.E., 39 mm. An iridencleisis was then performed on the left eye. The postoperative course was uneventful. One month following surgery the left eye was completely pale and the tactile tension bilaterally was considered normal. Six months postoperatively, the tension in the unoperated right eye had risen for the first time to 39 mm. Hg; L.E., 25 mm. Both anterior chambers were quite shallow and no fundus reflexes could be seen. No filtering bleb was present in the left eye.

Gonioscopy on November 12, 1947, revealed the following: R.E., shallow angle visible only to the first portion of the trabecula; an anomalous vessel at the 9-o'clock position; a dome-shaped iris. L.E., no angle details were visible temporally; nasally and below, visibility to the midportion of the trabecula was obtained. The temporal pillar of the iris was incarcerated at the 12:30-o'clock position. Many radial iris vessels were seen peripherally. Intraocular pressure at that time was: R.E., 43 mm. Hg; L.E., 32 mm.

Retrolental fibroplasia is frequently associated with microphthalmos, dome-shaped irides, very shallow anterior chambers, and is thus prone to develop glaucoma. No evidence of embryonal tissue was found in the chamber angle of either eye in this case. Therefore, from the gonioscopic findings it is felt that the glaucoma present is due to a narrow-angle mechanism rather than obstruction of the angle by embryonic mesodermal tissue. Relief of intraocular pressure in the left eye was obtained by an iridencleisis over a period of 11 months. The absence of a filtering bleb probably means that the iridencleisis is functioning as an iridectomy in the presence of a narrow-angle glaucoma.

No satisfactory form of therapy has been found for the condition known as retrolental fibroplasia. This case illustrates temporary amelioration by an iridencleisis of the increased intraocular pressure in one eye and is presented as a therapeutic problem. The iris vessels seen peripherally in the angles of these eyes may represent another manifestation of an abnormal persistence of

blood vessels, after which fibroblastic proliferation occurs.

Recovery after occlusion of central retinal artery

Dr. John M. Thompson presented a white man, aged 58 years, who was seen at the Infirmary complaining of suddenly noting a curtain of foggy vision over the right eye 15 minutes previously.

Examination revealed vision to be: R.E., 20/40—2; L.E., 20/20. However, the letters of the test chart could be seen only momentarily with the right eye and then faded completely. Visual field was markedly constricted. Tension was 25 mm. Hg (Schiøtz); blood pressure, 195/110 mm. Hg. Ophthalmoscopically, the right fundus showed one-third disc diameter of interruption of the central retinal artery with blanching of the peripheral vessels and complete obliteration of the nasal radicals. There was beading and generalized fragmentation of both the arterial and venous trees. The retina was pale, although not milky white. The left eye showed a normal fundus.

A diagnosis of occlusion of the central retinal artery was made, and treatment was instituted within 25 minutes of onset of symptoms. It consisted of inhalation of amyl nitrite, massage of the globe, retrobulbar injection of 1 cc. of 2-percent novocaine, and paracentesis. Sodium nitrite was then administered and the patient was put to bed. Tobacco was forbidden. In less than one hour blood flowed smoothly through the involved retinal vessels. The patient was allowed to become ambulatory after 24 hours of bed rest.

Vision of the right eye improved to 20/20; fields were normal. There were no residual findings other than atheroma of the inferior temporal artery. During the six months since this episode there have been no recurrences. In view of the atheromatous changes visible after the acute occlusion had been relieved and the success of vasodilator therapy, it was thought that an angiospastic process superimposed on an organic narrowing of the central retinal artery was the pathologic basis of this occlusion rather than a thrombosis or embolic phenomenon.

Congenital ectropion of pigment border of iris

Dr. Manuel L. Stillerman presented a white girl aged 5 years, first seen at the Infirmary on July 28, 1947, because of pain in the region of the right eye for six months. She had been using "drops" prescribed by an ophthalmologist for seven weeks prior to admission. The child's mother stated that the right eye had always been larger than the left and that the pupil had always looked "peculiar."

When first seen, tension in the right eye was 50 mm. Hg (Schiøtz). Vision was 20/100 (illiterate) and could not be improved by manifest refraction. There was mild puffiness of the lids. The right eye was more prominent than the left by 25 mm. (Hertel). The cornea measured 12 by 12 mm. and the anterior chamber was slightly deep.

The iris was tan in color and the stroma was thinner than in the left eye, but no true atrophy of Fuchs's crypts was noted. The pigment layer of the iris was advanced over the pupillary margin onto the anterior surface of the iris in apronlike fashion, with the appearance of a pseudocoloboma.

The pigment layer was dark brown, with velvety texture. The pupil was oval vertically, measured 6 by 6.5 mm., and was fixed to direct and consensual light stimulation, accommodation, convergence, and noxious stimuli.

Gonioscopy under general anesthesia disclosed a wide angle, but a thick tissue resembling iris extended from the root of the iris to the lower part of the trabecula, obstructing a view of the scleral spur and ciliary sulcus. The optic disc showed marked glaucomatous excavation with nasal displacement of the vessels, and atrophy.

Venous pulsation was noted on the nerve-head.

Visual field with a 3/330-mm. white target revealed marked nasal constriction, especially inferiorly. The temporal field extended to 30 degrees, superiorly, and to 50 degrees, inferiorly.

Examination of the left eye was without significance except for gonioscopic findings. Vision was 20/30 (illiterate). The corneal diameter measured 10.5 by 10.5 mm.; iris and pupil were normal; tension was 25 mm. Hg (Schiøtz); fundus and visual fields were normal. Gonioscopically the entire angle anatomy was visualized, but many iris processes were observed to lie on a thin, gossamerlike, lightly pigmented structure in front of the angle markings; these findings were most pronounced nasally.

The elevated tension in the right eye failed to respond to pilocarpine and eserine, or doryl alone. However, following instillation of a drop of D.F.P., (0.1 percent) twice during one day, the tension was reduced to 8 mm. Hg for three days, rose to 20 mm. for three days, and then to 46 mm. Doryl (1 per cent, 3 times daily) was continued during this period. Three subsequent instillations of D.F.P. succeeded again in reducing tension to normal during the following 28 days of hospitalization.

The clinical diagnosis was congenital ectropion of the pigment border of the iris of the right eye, associated with embryonic mesodermal tissue in the angle and congenital glaucoma.

The normal pigment epithelium of the iris forms a double layer which just intrudes itself over the pupillary margin to form the pigment ruff. The flat, velvety appearance of the pigment in this case is due to simple overgrowth and eversion of the two layers of pigment epithelium, which remain in contact.

It is not known whether this is due to primary ectodermal hyperplasia or contraction of the anterior mesodermal tissue of iris stroma which pulls the pigmented edge over onto the surface of the iris. The condition is not hereditary and is thought to be due to a localized upset in the balance of growth rate of ectoderm and mesoderm. The suggestion has been made that this picture might be caused by conglomerate nevi.

The present case has been controlled for only a short time on strong miotics, and it is possible that goniotomy may have to be performed to free the filtration angle of the mesodermal tissue.

Granulomatous uveitis with hypersensitivity to streptococcus and staphylococcus

Dr. Fred Cox presented a man, aged 33 years, who was first seen at the Infirmary on August 2, 1947, with the complaint of redness, tearing, and pain in the right eye for six months. Treatment under the care of a physician during this time had been unsuccessful. He had a gonococcic prostatitis at the time of onset and was treated with penicillin and sulfonamides. The prostatic discharge stopped for a time but periodically reappeared although there were no gonococci found after the first course of treatment.

On admission, vision was: R.E., 20/100. The upper lid was edematous; there was moderate mixed bulbar injection. The cornea was clear with numerous large mutton-fat keratic precipitates scattered over the entire posterior corneal surface and a 2+ aqueous ray with numerous cells.

The iris was moderately dilated by mydriatics, showing many visible posterior synechias and many Koeppe nodules from the 10- to the 2-o'clock positions. The vitreous was clear, but the fundus was hazy, showing a normal disc and macula with no gross lesions in the periphery.

Vision was: L.E., 20/20. The eye was entirely normal and showed no evidence of uveitis.

General physical examination was negative except for chronic prostatitis. Blood Wassermann and Kahn tests were negative.

Sedimentation rate was slightly increased to 25 mm. per hour. X-ray studies of the chest, hands, feet, and teeth were normal. Brucellergin and P.P.D. intracutaneous tests were negative. Complement-fixation test for gonococcus and agglutination test for brucellosis were negative. Repeated smears and cultures of prostatic secretion on both blood and chocolate agar failed to show any gram-negative intracellular Diplococci. However, repeated cultures showed growths on both media of Staphylococcus and Streptococcus. Hospitalization treatment consisted of atropine (1 percent) locally, hot wet dressings, 5 million units of penicillin intramuscularly, local instillation of penicillin—5,000 units per cc. every 2 hours, and a series of typhoid injections up to 180 million organisms per cc.

Four weeks later, vision in the right eye had improved to 20/70, and he showed a mild mixed bulbar injection with scattered mutton-fat keratic precipitates and many cells in the aqueous. One week later the uveitis appeared to be as active as when first seen. On skin test with 0.01 cc. of a vaccine made of the organisms grown from the prostatic secretion, he showed a 2.5 cm. area of induration after 24 hours. Intramuscular injections of the vaccine were then begun, starting with 0.02 cc. and increasing 0.02 cc. with each injection twice weekly. After 12 injections there was definite subjective and objective improvement. At present there are only a few finely pigmented keratic-precipitate deposits, negative aqueous ray, with a few cells and no congestion of the iris. Vision is 20/70. The only other treatment during this time has been continuation of hot wet dressings and scopolamine.

Study of causes of blindness in Illinois

Dr. J. Robert Fitzgerald said that when the state of Illinois assumed from the individual counties of the state the responsibilities for the care of the indigent blind of the state, the administration of the aid to the blind was delegated to the Illinois Public Aid Commission and a medical advisory committee was named to advise on medical methods of procedure and standards of visual eligibility for blind-assistance applicants.

Recommendations of this committee were:

1. This definition of economic blindness: "In terms of ophthalmic measurement, central visual acuity of 20/200 or less in the better eye with correcting glasses is considered economic blindness. A peripheral field loss in which the visual field deficiency is reduced to 30 percent or less may be considered equally disabling, as may certain ocular conditions which do not necessarily involve visual acuity or peripheral field loss but which constitute a severe visual handicap."

2. All examinations for blind-assistance applicants be conducted by ophthalmologists certified by the American Board of Ophthalmology except in rural areas where such examiners were not available.

3. The adoption of an appropriate and complete ophthalmic medical record.

4. All blind-pension recipients who applied for state blind assistance be reexamined to determine visual eligibility with the exception of those in Cook County where all recipients had been reëxamined in the years 1941 to 1943 by competent certified ophthalmologists.

5. The appointment of a supervising ophthalmologist whose duties would be (1) To determine the visual eligibility for blind assistance of each applicant. (2) To classify the causes of blindness as developed by the Committee on Statistics of the Blind. (3) To transpose the essential medical and social information on blind-assistance recipients to a mechanical tabulating system. (4) To develop and activate a treatment program in the interests of restoration or preservation of vision. (5) To refer for vocational rehabilitation those hopelessly blind recipients who were deemed amenable to such training.

Accomplishments of this program were summarized by Dr. Fitzgerald.

1. The etiologic causes and the topographic sites of blindness have been carefully tabulated from the records of recent competent ophthalmic examinations. The facts obtained reiterate and reëmphasize the major unsolved problems of blindness and redirect our attention to the problems of prevention of blindness.

It is clear that primary glaucoma remains the greatest single source of blindness among all eye diseases in which restoration of visual loss is not possible. Until the problem of the etiologic cause and pathogenesis of glaucoma is clarified, the watchword should be early detection, adequate medical supervision with frequent and regular follow-up care.

Infectious diseases, traumatic injuries, and poisonings, representing approximately 31 percent of the causes of blindness, are definitely preventable.

Certainly the incidence of blindness attributable to general medical diseases could be reduced with proper and adequate care. The problem of prevention of blindness due to prenatal influences is vast and difficult but at least the surface has been scratched with the recent elucidation of the relationship of maternal rubella with congenital ocular defects.

In addition, it is possible that the majority of the 12 percent who were found to have remediable ocular conditions would not have remained blind if a good treatment program and competent ophthalmic advice had been available at the time of their original application for blind pension.

2. By the transference of the essential and pertinent information concerning blindness to a mechanical tabulating system, we will in the future be able to evaluate periodically our success or failure in those channels where we are now expending great efforts in the prevention of blindness.

3. As a result of standardizing visual eligibility for blind assistance throughout the state and placing the program under competent medical guidance, the visually ineligible recipients, constituting probably 10 to 15 percent of the total case load, have been weeded out and the administration of blind assistance has been removed from all political considerations.

4. A small percentage of recipients have as a result of surgical care been visually rehabilitated. The number of blind assistance recipients in Illinois who can be aided visually by corneal transplantation surgery is very small.

5. An indefinite but probably a considerable financial saving in the administration of blind assistance has and will continue to accrue to the state as a result of this program.

Cyclodialysis and iridectomy for glaucoma with cataract

Dr. Lyman A. Copps (Marshfield, Wisconsin) said that cataract often is found in glaucomatous eyes and many of these eyes require surgery for both conditions. Sometimes a cataract operation can be combined with a sclerectomy or iridectomy so that one operation satisfies them both. More often the glaucoma operation is done first and the lens extraction later, either because the tension in the eye cannot be reduced enough to render the combined operation safe or because the cataract is so incipient that its removal is not indicated when surgery must be done to control the glaucoma. It is not good surgery to do an extraction on an eye which has an elevated tension; the tension should be under control as a result of medical or surgical care at the time of the extraction and preferably for some time preceding it.

The many varieties of operations and their adaptations to the different types of glaucoma have been discussed widely, but less mention is given to the procedure of lens extraction in an eye on which a successful filtration operation has been done.

On the assumption that it is a bad prin-

ciple to disturb a well-functioning fistula operation, many surgeons prefer to extract the lens through an inferior incision; others make a corneal section below the fistula.

It is possible to cut boldly across a trephine opening and extract the lens through the usual limbus incision without ill effects. It would seem safer to dissect downward the original conjunctival flap and make the limbus section beneath it across the trephine opening or by enlarging the iridencleisis incision.

It has been said that the surgeon who is operating for glaucoma should devote his entire attention to the curing of the glaucoma, assuming that someone else is going to extract the cataract if one is present. It is better planning, however, to consider the problem in its entirety and to plan in advance the procedure or procedures necessary to provide vision in the eye.

The idea of combining cyclodialysis with iridectomy is not new. The operation was reported by Török in 1923; in 1927, Jervey reported a case and, in 1932, Wooten discussed a technique for the combined operation which varies somewhat from that which we have used. Wheeler recommended the operation for advanced and desperate cases and considered it too traumatizing for ordinary cases.

I do not recommend it for general use in glaucoma, even though I do not find it unduly traumatizing, but my experience leads me to believe that it may be suited to those cases of glaucoma where cataract extraction is not indicated at the time but is to follow later. I have not found it more traumatizing than other eye operations and the healing period has not been prolonged much, if any, beyond that of other operations for glaucoma.

The operation is done under local anesthesia, although sodium pentothal may be used. Butyn (2 percent) is first instilled into the conjunctival sac. A retrobulbar injection of 2 cc. of procaine hydrochloride with 3 min. of epinephrin hydrochloride is made and 2 min. of 5-percent cocaine hydrochloride are injected subconjunctivally at the 12-o'clock position near the limbus. Cocaine is used here because it controls the pain associated with the dialyzing process better than any other anesthetic.

A curved incision is made through the conjunctiva and Tenon's capsule 7 or 8 mm. above the limbus and parallel to it. The sclera is laid bare to the limbus widely enough to permit a satisfactory limbus incision—at least from the 10:30- to the 1:30-o'clock positions. It is extremely important that a minimum of aqueous be lost while doing the cyclodialysis and for this reason the incision through the sclera is made just wide enough to admit the spatula. This incision is made below the insertion of the superior rectus 5 or 6 mm. above the limbus at the 12-o'clock position. Because it is anticipated that extraction may follow, the 12-o'clock site is arbitrarily chosen; whereas, in simple cyclodialysis, the best site is that where the gonioscopic examination reveals the fewest adhesions.

The incision is made with a keratome or cataract knife obliquely downward through the sclera by short scratch cuts.

If the surgeon wishes to control the eyeball with O'Brien's scleral fixation suture, it must be placed before the scleral incision is made. If not, the sclera is grasped at the 6-o'clock position with a narrow-toothed scleral fixation forceps and depressed sharply.

A narrow-bladed angulated spatula is introduced into the suprachoroidal space and, hugging the sclera closely, it is brought downward into the chamber. Then by gentle pushing movements from above downward, the ciliary body is separated from the scleral spur. It is important to hold the spatula close to the sclera to prevent opening a channel through which aqueous can escape.

After withdrawing the spatula, the conjunctiva is lifted and a sharp keratome introduced into the chamber through the

limbus. If the keratome incision cannot be made wide enough without endangering the lens, it can be enlarged with scissors.

The iris is grasped widely and drawn out of the eyeball with good traction. The scissors hug the sclera closely and cut off the iris with three or four snips, the first and last cutting the sphincter. If iris remains caught in the ends of the incision, it is replaced with the spatula. If hemorrhage into the chamber has occurred during the cyclodialysis, it may be washed out with the chamber irrigator. Air can now be injected into the chamber as recently advocated by Barkan. The conjunctival incision is closed with fine silk sutures and atropine is instilled.

Thus far, this operation has been done by me only in advanced cases of glaucoma where it seemed imperative to control the tension in one operation, where a minimum of surgery was desirable, where satisfactory control of tension was not accomplished by miotics, and where some form of cataract was present.

Diathermy cauterization of ciliary body for glaucoma

Dr. Samuel J. Meyer presented a paper on this subject.

Cyclodiathermy puncture for glaucoma is safely indicated in cases where other surgical methods have failed, or where other surgical methods cannot be attempted. As a substitute operation, properly performed, it is of definite value.

Indications are: (1) Flat anterior chamber, especially after trephination or iridectomy; (2) aphakia, secondary glaucoma; (3) secondary glaucoma due to iris prolapse; (4) primary glaucoma where the chamber angle is obliterated, and where other operations are of questionable merit; and (5) hemorrhagic glaucoma.

The operative field is securely closed with a silk suture through the incised conjunctiva to prevent any secondary infection. There is practically no danger of any sympathetic infection occurring. Since 1881 (De-Wecker), and especially since 1925, many choroidal cauterizations have been done and no sympathetic ophthalmia has resulted. There is more risk of this occurring following a trephination.

For the practical ophthalmologist, the following facts are of importance: (1) Cyclodiathermy puncture is simple and safe, and can be repeated several times in malignant cases. (2) It is the only workable procedure in cases of a very shallow anterior chamber, (3) Cataract surgery in cases complicated by glaucoma need no longer be feared. (4) It is a conservative procedure in hemorrhagic glaucoma, especially after occlusion of the central vein. The operation may be repeated several times and enucleation may be prevented. (5) We do not have to fear secondary glaucoma, resulting from discission, vitreous hernia, or contusion of the eyeball.

A total of 142 cases were operated upon by cyclodiathermy puncture, but the histories of only 126 could be obtained for study. A result was considered successful if the patient was comfortable and relieved from pain, even though the tension was only reduced below 35 mm. Hg in 33 percent of the cases and below 30 mm. Hg in 28 percent. Up to the present time, 7 enucleations were necessary out of the total number of cases operated, and it is possible that more enucleations may be necessary in the future. There was complete relief from pain in 94 cases, or 74 percent, which is a satisfactory result, considering that most of these eyes had been operated upon previously and unsuccessfully; some having had several operations. The high percentage of relief from pain in hemorrhagic glaucoma should be noted, since this is a type of case which is not usually amenable to any form of surgical interference due to the newly formed blood vessels in the iris. Any surgical interference with the iris in such cases usually results in massive hemorrhage.

Discussion. Dr. Peter C. Kronfeld said

that the society is indebted to Dr. Meyer for a number of reasons. Several years ago when, to many ophthalmologists, the cyclodiathermy operation still appeared to be a dangerous and multilating procedure, he tried it on private and Infirmary patients and obtained gratifying results which he reported to this society. His results have continued to be very gratifying. He has stressed the true principle of the operation, the creation of multiple small foci of coagulation in the innermost layers of the sclera, indirectly affecting the outer layers of the ciliary body. The name "cyclodiathermy puncture" is, therefore, more to the point than the term "cyclodiathermy."

Dr. Meyer has devised a needle-shaped electrode with which the punctures, as well as the coagulations, can be performed safely and easily. It is somewhat thinner than the original Vogt needle and is very carefully insulated; only the needle itself carries the coagulating current and the places of entrance into the sclera are hardly visible.

This operation is a valuable addition to our surgical antiglaucomatous armamentarium. However, one tragic outcome has been seen at the Infirmary. A young lad with bilateral iridocyclitis and secondary glaucoma had been operated on at other institutions four times on the right and once on the left eye. Vision in the right eye was 15/200 and in the left eye, 20/40. The iridocyclitis appeared to be inactive in both eyes. On the right eye an iridectomy and several fistulizing operations had been performed without avail. On the left eye an iridectomy had been performed without avail. In both eyes, despite intensive medical therapy, the tension varied between 40 and 60 mm. Hg (Schiøtz).

On the better eye a cyclodiathermy puncture operation was performed with a needle that was not suitable for the purpose because of lack of proper insulation of its base. Each application of the needle, therefore, produced gross coagulation of the outer layers of the sclera, whereby considerable shrinkage of the fibrous coat and consecutive rise of pressure was caused. During and immediately after operation the condition of the eye did not seem in any way unusual. Forty-eight hours later, at the time of the first dressing, the patient complained of blurred vision, which was found to be reduced to just light perception. Examination of the eyegrounds revealed occlusion of the central retinal artery, believed to be caused by the rise in intraocular pressure caused by shrinkage of the sclera brought about by the unintentional surface coagulation. There was no return of vision in that eye.

Dr. Meyer stated that in 8 or 9 eyes in his series, enucleation became necessary. It would be interesting to know whether, in his opinion, the operation in any way contributed to the sad outcome. One would be inclined to think that cyclodiathermy puncture failed in that it did not prevent enucleation, but not by adding to the existing hypertension and irritation of the eye. In the last 50 cases on which this operation was performed at the Infirmary, no case was found in which cyclodiathermy puncture aggravated the situation to the extent that enucleation became necessary.

Cyclodiathermy punctures have been tried as a last resort in eyes with chronic simple glaucoma on which three operations had been performed, one fistulizing operation and two cyclodialyses, all of which had failed. In a series of such cases at the Infirmary, on which cyclodiathermy punctures were performed, in one third of the cases the ocular tension was reduced to below 30 mm. Hg. In another third of the cases, a beneficial effect could be noted in that the tension became definitely reduced. In the remaining one third of the cases, there was no demonstrable effect by operation. The price paid for normalization or reduction of tension in two thirds of the group was slight permanent diminution of corneal sensitivity. There is probably also some lens damage, although, in looking over the series at the Infirmary, no case was found where cyclo-

diathermy had greatly added to the existing cataract or produced lens opacity.

Referring to Dr. Copps's paper, Dr. Kronfeld said he had had some personal experience with that operation. Cyclodialysis and iridectomy seemed to suit a specific situation which he had had to face in China, where there was relative abundance of cases of corneal fistula with complete obliteration of the chamber angle. In most cases trachoma had led to considerable cicatrization and the results of external fistulizing operations were therefore poor.

By elimination, this operation of iridectomy combined with cyclodialysis was adopted with satisfactory results. He could give no definite data on results, principally because in those days there was not a proper follow-up of glaucoma in those patients.

In cases of corneal fistula it was found that the best method was to close the fistula by corneal transplant. Since the patients had become dependent upon the fistula for maintenance of normal ocular tension, an iridectomy was first performed combined with cyclodialysis; four weeks later the fistula was excised and closed by means of a transplant. Most patients stayed in the hospital or hostel for at least 6 to 8 weeks after the transplantation, and about half of the antiglaucomatous operations could be said to prove successful.

Dr. Kronfeld felt that both Dr. Meyer and Dr. Copps had presented very valuable antiglaucomatous procedures.

Dr. S. J. Meyer (closing) said that he had started to do this operation in 1940, shortly after reading Vogt's original article. The first case was a private patient who came to the office with a traumatic, hard, painful eye. Iridectomy was performed, but the eye became more painful and the question of enucleation was discussed. Following this operation there has been no pain, although there is a traumatic cataract for which nothing has been done. Shortly afterward, a number of cases were done at the Infirmary on eyes which were hard and painful following the original surgery, and in most of these the pain was relieved.

He had been impressed by the fact that as an end result the tension was not as low as had been expected in view of the results reported by others; in his series, tension remained high in about two thirds of the cases. All the enucleations were performed not because of surgical complications but because the operation had had no effect upon the pain. In one case, the patient was a diabetic who had bilateral hemorrhagic glaucoma; both eyes were operated on at one sitting and because infection developed in one eye it was enucleated.

In performing the operation, the effort is to go from the medial rectus to the lateral rectus, operate on the inferior half and avoid both medial and lateral rectus muscles, keeping away from the long ciliary nerve.

On the enucleated eyes, only one report is available. The eye was sectioned by the Army Institute of Pathology. Although the condition was far advanced, it showed only slight atrophy of the ciliary body.

If the operation was repeated, after failure of the first attempt which was carried out in the lower half, the punctures were made in the upper half.

Richard C. Gamble,
Secretary.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

December 1, 1947

DR. DANIEL KRAVITZ, *president*

DEVELOPMENT OF FIELD CHANGES IN GLAUCOMA

DR. ADOLPH POSNER and DR. ABRAHAM SCHLOSSMAN discussed this subject during the instruction period.

Gonioscopic studies of the canal of Schlemm

Dr. Peter C. Kronfeld of Chicago, said that the phenomenon which has been the starting point, as well as the nucleus of this work, is the appearance of blood in the canal of Schlemm in the normal eye. A preliminary report was presented before the Association for Research in Ophthalmology in 1942 (Am. J. Ophth., 25:1163, 1942).

During routine gonioscopic examinations of nonglaucomatous eyes a small percentage of cases show the phenomenon of sanguinous contents of the canal. If the gonioscopy is performed without a local anesthetic and without a contact lens of any kind, the region of the canal invariably proves colorless.

Blood is found regularly in the canal after aspiration of aqueous. If only a small amount of aqueous is withdrawn, the phenomenon can be seen to occur immediately and in close dependence upon the lowering of the intraocular pressure. Compression of the globe with the ophthalmodynamometer of Kukan is followed by a short phase of hypotony during which the canal can also be seen to fill with blood.

The phenomenon can also be produced by raising the venous pressure by means of a blood-pressure cuff applied to the neck. Mild degrees of compression (40 mm. of pressure) produce the phenomenon in 55 percent of control (nonglaucomatous, uninflamed) eyes. Dynamometry combined with neck compression of only 20 mm. produces the phenomenon in more than 90 percent of control eyes.

The gonioscopic observations essentially confirm the existing concepts concerning the canal and its connections with the vascular system and support the theory of a steady outflow of intraocular fluid through the trabecula-canal of Schlemm apparatus.

Bernard Kronenberg,
Secretary.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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THE FIFTY-THIRD SESSION OF THE ACADEMY

Opening at the Palmer House in Chicago on October 10th, the American Academy of Ophthalmology and Otolaryngology held, as usual, a bigger and better meeting. The total registration was 4,364, including ladies and guests.

The ophthalmic instruction courses numbered 37 continuous and 101 individual ones. Twelve Home Study discussion periods were well attended and appreciated. At these periods, individuals enrolled in the Home Study group had the opportunity of meeting with their instructors and talking things over. Four afternoons were devoted to scientific papers and motion pictures in the Section on Ophthalmology meetings.

Out of 25 scientific exhibits, 15 were on subjects pertaining to ophthalmology. Dr. Kronfeld, Dr. Riser, and Dr. Parker received the first award for their fine and instructive exhibit on the physical changes of the eyeball in glaucoma. Col. Victor A. Byrnes (MC) of the School of Aviation Medicine, Randolph Field, Texas, received

the second award for his exhibit on training aids for ophthalmologic instruction. Dr. Payne, Dr. Burchell, and Dr. Krug were awarded the third place for their exhibit of specimens illustrating diseases of the eye. The excellence of all the ophthalmic exhibits was such that the judges must have had a difficult time of decision.

Each scientific session began with a clinicopathologic case report. This innovation was so well received that it is certain to be retained in subsequent programs. Those presenting case reports were Parker Heath, A. Edward Maumenee, M. Noel Stow, and John S. McGavic, who did their jobs efficiently and well. In each case, after discussing the clinical findings and diagnosis, the pathologic histology was illustrated with slides and correlated with the clinical signs displayed.

The supercolossal hit of the show was the symposium on primary glaucoma held on Monday afternoon, October 11th. Its purpose was "to discuss and evaluate the present trends of thought on the subject of primary glaucoma. A committee, with Dr. Derrick Vail as chairman, has been carefully chosen to undertake this task. An attempt has been made to integrate the various phases of the subject. The thoughts expressed in each paper have been agreed upon by the committee as a whole and thus they represent the combined opinion of the committee rather than the beliefs of any one individual."

The terminology, pathologic physiology, and symptomatology were given by Jonas S. Friedenwald; the diagnosis by Peter C. Kronfeld; the medical treatment by Harold G. Scheie; the surgical treatment by John H. Dunnington; the complications of surgery by Paul A. Chandler; and the review, summary, and conclusions were presented by the chairman.

Then followed a lively hour of questions from the floor directed to the appropriate members of the committee who gave their answers, which either brought out new points or clarified those that had been mentioned during the symposium. The success of this venture can be gauged by the fact that there was standing room only in the enormous meeting hall, and four hours later when the symposium had ended there were but a few vacant chairs.

The scientific papers read at the subsequent sessions were all of high caliber. Among those of exceptional interest and value were the following:

The paper by Christensen and Swan on "Epinephrine Antagonists in the Treatment of Glaucoma" disclosed the importance of the intravenous use of these sympatholytic compounds, primarily dibenamine, in the rapid reduction of the intraocular pressure in patients with acute primary glaucoma and to some extent in those suffering from some form or other of secondary glaucoma.

Alan C. Woods lucidly discussed the ocular symptomatology and pathology of sarcoidosis. Arthur C. Curtis, dermatologist of the University of Michigan, related his experience in the treatment of this common disease with calciferol and dihydrotachysterol. There seems little doubt that both of these agents are effective in controlling sarcoidosis.

The paper on "Reading Disabilities and the Ophthalmologist," by Ralph O. Rychener was timely and helpful. The author and his discussors pointed out that expensive and elaborate bits of apparatus are unnecessary in either the diagnosis or the treatment of reading disabilities in patients.

The paper by William C. Owens and Ella M. U. Owens on "Retrolental Fibroplasia in Premature Infants" had been long expected and anticipated. The authors related their important findings in the onset, course, and development of a retrolental membrane in the eyes of a number of premature infants under observation since birth. They expressed their opinion that "unknown etiologic factors must be at work during the postnatal life of the infant" to produce the

condition. In the discussion, Reese expressed his conviction that the anlage of the disease exists before birth and that only the extreme difficulty of examining the ciliary area of premature infants prevents its discovery immediately after birth.

Interspersed with the scientific program were motion pictures of ophthalmic interest. They were all of high quality and instructive. Three of these dealt with enucleation implants of various sorts employing various techniques. Time must elapse now in order to evaluate the different implants and the success or failure of the different techniques. At the moment it begins to look as if there were going to be as many different sorts of implants as there are speculums, capsule forceps, or methods of inserting sutures in cataract surgery.

On the first morning of the meeting and during the joint session, Jonas S. Friedenwald gave the Jackson Memorial Lecture, sponsored by this JOURNAL. His subject was "A New Approach to Some Problems of Retinal Vascular Disease." He disclosed that the Hotchkiss stain, selective for the polysaccharides in tissue, affects the basement membrane in blood vessels. By this method, the fundus findings in hypertensive retinopathy and particularly in diabetic retinopathy are clarified and allow for more accurate interpretation. During his able and excellent discourse, the audience could sense the excitement and thrill of the chase, as bit by bit the author disclosed his investigations and his deductions. The paper will appear in an early number of this JOURNAL and should open up many more studies of ocular vascular disorders.

From the viewpoint of social activities, there was little left to be desired. Each evening was taken up with dinners and reunions. Among the latter was the dinner of the ophthalmologists who had served together in the Army in the European Theater of Operations. A growing list of alumni dinners attests to the popularity of these affairs. The banquet came in for its share of the social events. Dr. Ernest Irons of Chicago, the president-elect of the American Medical Association, was the guest speaker of the occasion. Fourteen honor keys were awarded, seven to ophthalmologists for their years of devotion and loyal service to the Academy.

Dr. John McKenzie Brown was chosen president elect. Dr. Fred Dixon, Dr. Donald J. Lyle, and Dr. W. E. Keith were elected first, second, and third vice-presidents, respectively. The next meeting will be held in Chicago at the Palmer House, October 9 to 14, 1949. Derrick Vail.

SUPPOSE IT WERE YOUR NAME

A recent issue of *Time* magazine says that 75 percent of the American people know no other language than their own, and 50 percent do not wish to know any other. In this respect at least any careful observer would note how strikingly ophthalmologists resemble people.

Consider this incident. It was a bleak afternoon. The last patient had gone out into the gloomy winter twilight. The Old Man was at his desk puzzling over some obscure case records. A timid knock announced the new secretary.

"Excuse me, sir, but how do you spell 'jerrum'?"

"Spell what?", still absorbed in the records.

"Jerrum, sir. It doesn't seem to be in the dictionary. The letter says, 'the field shows a beginning jerrum—'."

"Oh, you spell it with a 'B'."

Finally conscious that the girl was still waiting, he looked up and said, "Sorry. You spell it B-j-e-r-r-u-m. And look here, that word is pronounced 'Byerrum'."

The secretary moved off rather doubtfully. A few minutes later she said, "I have found it."

"Something you lost?"

"I mean 'Bjerrum'. I found it in the dic-

tionary. And it isn't pronounced 'Byerrum'."

"What do you mean it isn't pronounced 'Byerrum'."

"I mean it isn't pronounced at all."

This is true. One elaborate medical lexicon in its last edition spells 'Bjerrum", but scrupulously avoids taking any chance on the pronunciation. From which you may draw any conclusion that appeals to you.

The mispronunciation of the name of this distinguished Danish ophthalmologist has always been a sick spot in American linguistics. The combination of "B" and "J" in the same syllable is incompatible with the American way of life. When they happen together as in "abject" and "object" the word divides. Twenty years ago the struggle to pronounce "Bjerrum" usually ended in an explosion like a suppressed sneeze. Recently the pronunciation has taken a distinct turn for the worse. Ophthalmologists who would be the first to snort at hearing someone speak of "Frood" or "Go-eethe" slip out "jerrum" without a tremor. Just what started this bit of illiteracy is a profound secret. Psychiatrists might conclude that it was initiated by someone who had been stung by a "B" in infancy. It certainly cannot be called Anglicizing the word. If the unabridged dictionary can be trusted this is the only instance in the language where an initial capital "B" has gone A.W.O.L. though the little ones occasionally escape. If you want to look up the word, the silent "B" is the letter you use. It may be too late to remedy this blunder. So fast has it spread that among men who know glaucoma best it seems to be "jerrum" two to one. To be sure, a candidate for the last Board Examination was heard to say "Byerrum," but he may have been from Minnesota, By Yiminy.

This is not true of another badly mangled word in the same category. According to a neighbor who has a backyard acquaintance with the Schiǿtz family, that word is neither "Sheeotz," nor yet "Shirts." He says the home-town sound is "Shuts," as in "Shuts the door." This is definitely simpler than any of the fumbles, and might make good on its merits.

For the fraction who are curious about phonetics, the Danish Consulate calls "Byerrum" correct.

S. Judd Beach.

CORRESPONDENCE

Argentine Congress of Ophthalmology

Editor,
American Journal of Ophthalmology:

Through the invitation of Moacyr Alvaro, secretary for South America of the Pan-American Association of Ophthalmology, I had the privilege of touring some of the principal cities of South America, visiting San Juan, Puerto Rico; Rio de Janiero, São Paulo, and Campinas in Brazil; Montevideo, Uruguay; Buenos Aires, Rosario, and Cordoba in Argentina; Santiago, Chile; and Lima, Peru, in the months of July, August, and September, 1947.

I had been invited to lecture and hold conferences on surgical subjects in each of these cities. I spoke in English and, through immediate translation into Spanish and Portugese, was able to make excellent contact with the ophthalmologists who came to the four lectures given in each of the cities. We were able to have questions and pointed discussions. Many of the South American ophthalmologists understand English well, so that it may have been tedious for them to go along with the translation, but they were the personification of courtesy and put up with my ignorance of their language. Mrs. Kirby and two of our daughters accompanied me and were charmed with the graciousness and hospitality of the ophthalmologists, their wives, and families. Their personal reception was such that we can never hope to repay them for their many courtesies.

My particular reason for writing to you now in my capacity as a member of the

Committee on Inter-American Relations of the Pan-American Association is to draw attention of the readers of the JOURNAL to the group of Amigos or Friends in Ophthalmology in North and South America. Much can be done to cement the wonderful friendships which have been established with our Latin American confreres. When any of them come to our cities, we should go out of our way to afford them every facility to visit our diagnostic, therapeutic, and surgical clinics and colleges and to attend lectures, meetings, and so forth. They do not ask for social entertainment. In fact, they are all modest and retiring and will not in any instance impose upon our time or hospitality.

In return, however, I can assure you that when any of you visit the South American cities you will find a very welcome greeting in their fine institutions, colleges, hospitals, and clinics. I can urge upon you tours of South America for study, for diagnosis, for therapy, and for surgery. You know the excellent caliber of the men from having personally met them in Cleveland and in Havana. Not many of you went to Montevideo. Now with the steamships of the Moore-McCormack, Delta, and Grace Lines and the planes of Pan-American and Panagra, there is no reason why we should not enjoy the beauties of South America, benefit by study there, and know our Amigos better.

As a starter, I can urge you to attend the Argentine Congress of Ophthalmology meeting in Mar del Plata, a beautiful seaside town about 250 miles south of Buenos Aires, December 13 to 18, 1948. I would urge that you go down one coast and come back the other. The trip by motor or by air over the Andes is a most thrilling and memorable experience. I am sure that all who go will treasure memories of their trip.

(Signed) Daniel B. Kirby,
New York.

BOOK REVIEWS

OPHTHALMOLOGY IN THE WAR YEARS. Volume II (January, 1944, to June, 1946). Edited by Meyer Wiener, M.D. Chicago, The Yearbook Publishers, Inc., 1948. 977 pages, subject and author indexes. Price, not listed.

The appearance of this volume brings to a close the work projected in 1943 when it was realized that the war disrupted the usual availability of ophthalmic literature, interfered with the harmonious collection of volumes for collecting and binding, and especially created a hiatus in the supply of current ophthalmic information to hundreds of ophthalmologists whose minds were otherwise occupied. With rare exception, the ex-medical officer would never go back over the journals published during the war years except to look for an occasional article.

Here, in the two volumes that cover the years from January, 1940, to June, 1946, are to be found the salient points from most, if not all, of the articles of ophthalmic interest that appeared during that time.

Of added interest and of great importance, is the running comment and criticism of the members of the editorial staff so ably marshalled by Dr. Wiener. Thus, the volumes are more than a collection of abstracts. They form a current and noteworthy textbook of ophthalmology, of valuable use in the preparation of an article or the evaluation of a new drug or surgical technique.

The list of contributors reads like a who's who in American ophthalmology. Each has done his part exceedingly well. The editor, Dr. Wiener, has skillfully arranged the material so that duplication, inevitable in this type of project, is minimized.

Those who have had Volume I since its appearance will need no urging to acquire Volume II. Those who do not possess the two volumes are depriving themselves of a very useful and valuable tool in their work. High praise and gratitude from all English-speaking ophthalmologists are due to Dr.

Wiener for his important contribution, and to his collaborators for their difficult and time-consuming efforts. It is a job well done by editor, contributors, and the publisher.

Derrick Vail.

DISEASES OF THE EAR, NOSE, AND THROAT. By William Wallace Morrison, M.D. New York, Appleton-Century-Crofts, Inc., 1948. Clothbound, 772 pages, 359 schematic illustrations. Price, $8.50.

Because of the intimate functional and pathologic relationship of the eye to the ear, nose, and throat, an understanding of the diseases of the latter is of fundamental value to the ophthalmologist. This up-to-date text by Morrison clearly and authoritatively synthesizes the current knowledge in this field. The common problems of specialists in the head area are well presented, such as the mechanism of headache and its differential diagnosis. He believes that half of the migraine cases can be relieved by careful allergic control. The excellent discussion of allergy and antihistaminic agents evaluates benadryl and pyribenzamine but not the newer drugs in the series such as antistine, neoantergan, neohetramine, theophorin, histadyl, decaprin, diatrin, trimeton, hydryllin, and so forth.

The infections and tumors extending from the sinuses to the orbit are adequately reviewed. Although he accepts multiple sclerosis as the predominant cause of retrobulbar neuritis, Morrison still considers that a small percentage of cases are due to extension of infection from the posterior ethmoid cells and sphenoid. In cavernous sinus thrombosis, since the causative organism is nearly always a Staphylococcus, Morrison considers penicillin the drug of choice, and also advises the use of heparin to prevent extension of the thrombus. The important eye signs in tumor of the acoustic nerve and in abscesses of the frontal lobe, temporal lobe, and cerebellum are given in detail.

Each chapter has bibliographic references, many of them as recent as 1946. The book closes not only with a subject index, but with an original and valuable symptom index as well.

James E. Lebensohn.

PRINCIPLES GOVERNING EYE OPERATING ROOM PROCEDURES. By Emma I. Clevenger, R.N. St. Louis, C. V. Mosby Company, 1948. 215 pages, 32 illustrations, index, and Foreword by Conrad Berens, M.D. Price, not listed.

Miss Clevenger has had many years of experience in an exceptionally busy eye operating room at the New York Eye and Ear Infirmary. Many splendid nurses, trained under her able direction, have carried her teachings elsewhere to the benefit of surgeon and patient. Many skilled ophthalmic surgeons owe much of their fame and success to the principles learned during their residencies surrounded by her influence. In giving us this unique book, she has added to our tools.

Her book covers everything pertaining to the smooth and efficient working of an eye operating room. It contains lists and photographs of instruments, "set ups," diagrams of supply tables, descriptions of pieces of electrical apparatus and their uses, as well as directions for the proper sterilization and care of instruments, equipment, and supplies. Furthermore, it tells us where to go to get the various articles used in the eye operating room. It is a most useful book for eye nurses and surgeons.

Derrick Vail.

BULLETIN OF THE SOCIÉTÉ BELGE D'OPHTHALMOLOGIE. No. 87. Meeting of November 30, 1947.

Of the 20 papers and case histories on various subjects one of the most interesting

presentations is L. Alearts's study on the aqueous humor which he considers to be a fluid common to the whole body "a real intercellular fluid" and not a fluid characteristic of the eye only. He defends his opinion with detailed arguments on the embryology, anatomy, physiology, pathology, and experimental chemistry of the aqueous and he outlines the clinical importance of this approach.

M. Appelmans and J. Michels discuss the experimental technique in the exploration of the blood-aqueous barrier. They found that gum arabic brought into the general circulation four days before followed a curve, similar to that of the passage of the proteins in the serum and in the aqueous as well. The secondary aqueous contained a larger amount than the first and it changed with the variations in the protein content of the circulation.

A. M. Potvin and Mlle. J. Helin present the ocular complications of pernicious anemia, complications which they consider to be vascular and toxic and not specific and, therefore, often difficult to diagnose.

M. Humblet emphasizes the importance of perimetry as part of every neurologic examination and as a preliminary test in ventriculography, arteriography, and even lumbar-puncture. He describes the possible field defects in median and lateral lesions of the chiasm. M. Wibo and J. Wibo recommend fistulating sclerectomy, iridectomy, and cauterization of the tip of the ectasia in corneal ectasia and they describe a case of their own.

Van Canneyt reports on heredofamilial lattice-shaped corneal degeneration and discusses the anatomy, pathology, etiology, and classification of this rare disease. A. Heintz suggests plastic surgery in cases of elephantiasis of the lids and presents two case histories.

M. Appelmans, M. Roeleus, and J. Michels discuss iridocyclitis with rheumatic spondylarthritis which in their opinion has the following characteristics: retrocorneal pannus, pigmented posterior synechias, an aqueous rich in proteins, mononuclear cells, no organisms even during the inflammatory spells, and frequent recurrences.

R. Hermans proposes the use of vitamin K in angioid streaks of the retina. Spells of violent headache, sudden change in the appearance of the streaks, hemorrhages around the streaks, and a low prothrombin time in patients with this disease were considerably improved by vitamin K. He also points out that vascular accidents in the stomach, intestinal tracts, uterus, nose, skin, and thyroid occur in these patients.

I. François reports a patient in whom a corneal transplant was successful, in spite of the rich vascularization of the cornea which followed a lime burn. L. Weekers recommends diathermy of the tarsus in cases of ptosis with paralysis of the levator palpebras and describes his technique for this operation. Van Canneyt and Kluyskens differentiate two forms of hysterical ptosis; hypotonic ptosis which is usually bilateral and associated with a contracture of the frontal muscle and other paralytic symptoms and the spastic ptosis or pseudoptosis without contracture of the frontalis which is usually monocular and accompanied by clonic spasms and trembling.

In his paper on posttraumatic herpes zoster ophthalmicus, J. Zanen reviews 36 cases from the literature and presents a case of his own. He is somewhat skeptical about a relation between herpes zoster and trauma. He insists on the recognition of a time limit of 5 to 15 days as the incubation period of the zoster virus from the traumatized skin or mucous membrane.

A. Hoorens contributes a study on the pharmacologic reactions of the pupils. L. Weekers and R. Weekers, A. Heintz, and

F. Roussel give a statistical report on the anatomic and functional results after surgery for retinal detachment. A. Benoit describes an ocular injury caused by podophyllin powder resulting in a severe infiltration of the cornea, a yellow discoloration of the iris, and exudation into the vitreous. The outcome was favorable.

This volume also contains a paper on the X-ray treatment of bilateral retinoblastoma by F. Roussel, the description of two unusual cases of thrombosis of the cavernous sinus by De Jaeger and A. De Haene, and W. Baekeland's report of an osteoma of the nasal orbital wall.

Alice R. Deutsch.

TRANSACTIONS OF THE SOCIÉTÉ D'OPHTHALMOLOGIE DE PARIS. Meetings of June and October, 1947.

This volume of 115 pages brings a report of the meetings of the société d'ophthalmologie de Paris, held on June 21, 1947, and October 18, 1947. Twenty-three papers and case histories were presented.

E. Haas discusses the uveal complications of gonorrhea. G. Offret presents a case of uveitis and opticochiasmatic arachnoiditis. P. Bregeat takes the opportunity to outline the characteristics of corneal vaccinola after having described an observation of his own. Monbrun's and J. Lavats's study on the effect of streptomycin on miliary tuberculosis and tuberculous meningitis is of special interest because it emphasizes the importance of the ophthalmoscopic examination as a guide on the regression, extension, or stabilization of the main lesions. J. Sédan and S. Sédan-Bauby discuss the provoked diplopia which, they believe, is an improvement in evaluation of muscular deficiency in regressive paresis and in the exact classification of heterophorias and convergence anomalies.

Other papers of interest include the description of an orbital metastatic neoplasm which appeared several years before any clinical manifestation of the main tumor (Pivolean and G. Offret), a recurrent iridocyclitis following a blunt injury of the other eye (P. Designes and Nandin), the treatment of myopia gravis (J. Gallois), the history of an optic neuritis caused by food poisoning (E. Leseune), and a case history of tularemia, interesting because of the peculiarity of its localization, the lack of general symptoms of the disease, and the etiology—the scratches of a cat. Retinal hemorrhages in tuberculous persons, the mechanism of the allergic reactions, and the condition of the neurovegetative system were the topic of C. Boudon's paper.

Among the papers presented at the meeting of October 18th, special emphasis should be given to the work of Paufique, G. Offret, and Vouters on neurofibroma, because of their detailed study on the pathology of orbital tumors.

Baillart's lecture on endoscopy revives the observation of several visual phenomena and their explanation. Toulard made bacteriologic studies of corneas, 1 to 5 hours after death, none of the microörganisms found were pathogenic.

Various rare case histories are presented, among them a suprasellar cholesteatoma, keratoplasty with a living graft, monocular exophthalmus caused by a hemorrhage into the contralateral frontal sinus together with a retrobulbar hemorrhage, a pterygium which recurred in spite of conjunctival and corneal plastic surgery, and a patient with an adherent leukoma in whom repeated keratoplasty was successful.

M. Lenoir summarizes the present knowledge on contact glasses. G. Offret presents Vassiliev's paper on the probing of the lacrimal passages, a procedure which he favors

in noninflammatory stenosis. A. Gauthier and G. Bruys show several graphs in proof of their theory on the seasonal occurrence of retinal detachment in Algiers. They found the peak to be in April and June.

Alice R. Deutch.

LEHRBUCH DER AUGENHEILKUNDE. Edited by A. Amsler, A. Brückner, Franceschetti, H. Goldman, E. B. Streif. Basel, Switzerland, S. Karger, 1948. 858 pages, 342 illustrations including many in color, 4 tables, index. Price, 85 Swiss francs.

Anyone familiar with the German textbooks of ophthalmology published before the war, such as that of Axenfeld, will be struck by the similarity between this splendid volume and those published by Springer. I refer to the format and beautiful illustrations and diagrams. It may be a very long time before the textbooks of Germany appear once more. It is highly significant, therefore, that Karger conceived the idea of publishing a textbook of ophthalmology in German to be written by outstanding Swiss ophthalmologists. It is evident at once that he has succeeded in his project, for here is a modern and complete textbook that reflects great credit on its editors, collaborators, and the publisher.

The collaborators include, Babel, Bangerter, Bischler, Blum, R. Brückner, Bürki, Huber, Klein, Lüdin, Lutz, Süllmann, Weve, and Wolf-Heidegger.

The wish expressed by the editors in the Foreword that, "this textbook, the first of its kind to appear in Switzerland, will receive a warm reception," is certain to be fulfilled.

Derrick Vail.

ARQUIVOS DA CLINICA OFTALMOLOGICA DO HOSPITAL MILITAR PRINCIPAL. Lisbon, v. 1, 1944-45.

This report contains a biographical note on the founder of the clinic, several historical notes, nine reports of extensive original work, and an assortment of clinical and therapeutic notes. Four of the original papers are on trachoma; one records the first case of Crouzon's disease to be described in Portugal and another a case of Tay-Sachs's disease. There is an analysis of work of 10 years in the ophthalmological clinic of the Military Hospital S. Miguel, Azores. In a brief report the effect of vasodilators on the retinal arteries is demonstrated by a pair of fundus photographs.

F. H. Haessler.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Danis, P. C. The functional organization of the third-nerve nucleus in the cat. Am. J. Ophth. 31:1122-1131, Sept., 1948. (7 figures, references.)

Vos, T. A. Iris numerata. Ophthalmologica 115:354-358, June, 1948.

In the case reported normal iris crypts happened to be situated in such a way that they formed a dark figure 2 which was very striking against the background of the light grey iris. The author concedes priority for this observation to M. van Duyse who suggested the term "cipher iris" in 1903. Peter C. Kronfeld.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Bietti, G. Ultravirus in ocular pathology. Boll. d'ocul. 27:1-19, Jan., 1948.

Bietti presents an extensive review of the present knowledge of the ocular localization of various virus diseases. The difficult problem of the Rickettsias is discussed with particular reference to their relation to trachoma. It is suggested that this disease is caused by a Rickettsia.

K. W. Ascher.

Fridenberg, Percy. Mechanical factors in ocular pathology. Am. J. Ophth. 31: 1002-1003, Aug., 1948.

Missiroli, G., and Scano, A. Effect of the lacrimal fluid on the respiration of bacteria. Boll. d'ocul. 27:41-53, Jan., 1948.

Tears were collected from the lower fornix of numerous normal and pathologic eyes by means of a sterile pipette, then diluted with physiologic saline solution and stored in the refrigerator. Suspensions of the bacteria to be tested were prepared and the oxygen consumption was measured in the Warburg apparatus at a temperature of 38°C. The results are represented in three tables and graphs. It was found that tears inhibit the respiration of lysosensitive bacteria completely. The respiration of lysoinsensitive organisms is not modified. It was not possible to prove a bacteriostatic effect of the

lacrimal fluid on organisms during active multiplication or at rest.

K. W. Ascher.

Rapisarda, D. **Concerning tuberculous allergy and the eye.** Rassegna ital. d'ottal. 17:128-145, March-April, 1948.

Rapisarda stresses the fact that ocular tuberculosis is an affection dependent upon a general disease and that the phenomena of allergy and immunity are characteristic of the particular tissue involved. This explains the polymorphous appearances of the ocular involvement. He emphasizes the conception of the importance which the allergic state bears in the pathogenesis of ocular tuberculosis and its possible interference in nontuberculous and traumatic lesions. The practical methods adopted to study tuberculous allergy are discussed, among them the "patergico" method, which permits a quantitative evaluation. In the evaluation of the allergicometric results one must remember that the presence of a morbid ocular bacillary focus probably alters the harmony between the allergic orientation of the ocular membranes and the skin.

The analytic examination of the results obtained by the clinical and experimental studies of the author support the conviction that there exists no parallelism between cutaneous and visceral allergy. Many aspects of ocular tuberculosis can thus be explained in the light of a dual concept of allergy. Eugene M. Blake.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Aguilar Bartolomé, J. M. **The effect of some vaso-dilators on general blood pressure, the retinal vascular pressure, and the intraocular pressure.** Arch. Soc. oftal. hispano-am. 8:468-477, May, 1948.

This is a graphic report of an investigation on men between 20 and 30 years of age. The vasodilators used were nicotinic acid, and a mixture of calcium chloride with magnesium thiosulphate. The ocular tension, the retinal vascular pressure, and the general blood pressure were taken twice before the injection of the vasodilator, immediately afterwards, 15, 30, 40, 50 and 60 minutes later, and after 2 and 24 hours. The oral administration of nicotinic acid was without effect on the intraocular pressure or the retinal pressure; parenteral administration was equally without a significant effect. The intramuscular or intravenous administration are similar in effect, differing only in the intensity and latent period; the intraocular tension falls 2 to 4 mm. Hg, the diastolic retinal pressure falls 2 to 3 mm., the systolic retinal and the venous pressures remain unaffected. The effect lasts one hour. Mydriasis was observed in two of the ten patients studied. The magnesium combination is effective only in intravenous administration and the effect is proportional to the quantity injected. After some fluctuation the tension remains lower than normal for a period of 2 to 24 hours; the time depends on the dose. There is no effect on the retinal circulation. A combination of nicotinic acid and the magnesium mixture eliminates the initial fluctuations in the ocular tension and produces an immediate reduction of tension that lasts 24 hours. The other pressures show no significant change. (7 graphs.) Ray K. Daily.

Bárány, E. A. **The influence of alteration of the vasomotor system of the eye in relation to the local arterial blood pressure and the intraocular pressure. An investigation of the homeostatic reflexes.** Rev. oto-neuro-oftal. 22:73-78, July-Aug., 1947 and 22:104-110, Sept.-Dec., 1947.

Previous similar studies yielded no real evidence that a mechanism described in

the title exists in the eye. The author exposed one common carotid artery and made pressure on it. He measured the ocular tension in both eyes, before, during and after pressure and when the test animal was warmed and chilled. Similarly, tests were performed after the administration of adrenalin, cocaine, ephedrine, ergotamine, prostigmine, and atropine, and after cervical sympathectomy. Occlusion of the carotid artery caused a slight decrease in the intraocular tension (4 mm. Hg). Drugs and cervical sympathectomy did not have an appreciable influence on the relation between the eye pressure and the lowered blood-pressure. The author concludes that there is still no proof of the existence of a homeostatic vasomotor reflex mechanism to protect the intraocular pressure from changes occasioned by alterations in the blood-pressure.

Edward Saskin.

Bárány, E. and Davson, H. **A note on the physiology of the aqueous humour.** Brit. J. Ophth. 32:313-314, May, 1948.

This very short article is an extension of the opposing views of Bárány and Davson as to whether salts in the aqueous are secreted by the lining membranes or whether they enter the aqueous by simple diffusion from the blood stream. Since blood pressure and ocular pressure have no effect on the salt content and salts are not secreted exclusively by the membranes of the aqueous chamber neither theory is satisfactory. The problem of the secretion of salts into the eye, therefore, remains in a state of flux. A mere mathematical analysis of data already to hand is not sufficient for a decision.

Morris Kaplan.

Bellows, J. G., and Farmer, C. J. **The use of bacitracin in ocular infections. Part I. Tolerance and permeability in the rabbit eye.** Am. J. Ophth. 31:1070-1073, Sept., 1948. (1 table.)

D'Ermo, Franco. **Action of murexine, a new choline derivative, on the iris muscle of the horse and the cow.** Boll. d'ocul. 26: 763-766, Dec., 1947.

In the dye-producing organ of the snail Murex trunculus there is at least one substance which has a definite effect on stripes of iris tissue of the horse and of cattle. Isolated stripes of sphincter and of dilatator tissue were exposed to acetone extracts of 0.02 to 2 mgm. of the posterior median zone of fresh hypobranchial organs of the snail. The contraction of the iris stripes was proportionate to the strength of the solution, and atropine in concentration 1 to 500,000 did not inhibit or counteract the effect. Blood serum and brain tissue extracts did not have any influence on the action, neither did the addition of diazoparanitroaniline salts of formaline in concentrations between 1 to 1,000 and 1 to 10,000. Boiling for ten minutes in one-tenth-normal sodium hydroxide solution, however, inactivated the extracts. The effect of more distant parts was much less pronounced than the region mentioned above. The action of the organ extract was three to six times as strong as that of acetylcholine. All these qualities would suggest that the substance that acts so strongly on the horse iris is murexine (Erspamer and Dordoni, Ricierca Scientifica, 16, 1946). Similar results were obtained on the iris sphincter of the ass and on that of the calf, in the latter however to a lesser degree. The same extracts acted about one thousand times more strongly on the sphincter strips than on the dilatator of the horse iris. (2 graphs.)

K. W. Ascher.

Dordoni, Franco. **Dionin and histamine; the mechanism of its local action.** Boll. d'ocul. 27:20-40, Jan., 1948.

On 34 adult cats the development of ethylmorphine hydrochloride chemosis was studied and compared with the action of the same drug after previous local or systemic application of 2 (N-phenyl N-benzyl aminomethyl) imidazoline methansulfate, named Antistin Ciba, and of 2 N-dimethylamino 2 propyl-thiodiphenylamine-Cl, named 3277 R.P. Rhône Poulene. Local application of Antistin did not interfere with the dionin chemosis; subcutaneous administration, however, reduced the chemosis or even abolished it without reducing the hyperemia. Similar effects were obtained by subcutaneous 3277 R.P. administration. High atropine doses did not produce any similar effect. Histamine solutions do not fail to increase the filling of the conjunctival vessels when antihistamine substances have previously been administered parenterally. The chemosis seems to be due to a histamine-like tissue mediator whereas the hyperemia after dionin most probably results from a direct action of this drug. Repeated instillations of dionin over periods of from 4 to 10 days and repeated instillations of 0.2 percent histamine solutions did not interfere with the action of the other drug respectively. The habituation to dionin does not involve the production of hyperemia but the chemosis is less marked. The habituation to dionin is ascribed to a failure to release the tissue mediator. (9 tables, references.) K. W. Ascher.

Fanta, H. **The effect of pilocarpine on normal eyes.** Ophthalmologica 115:338-353, June, 1948.

After two instillations, two minutes apart, of equeous pilocarpine solutions of varying strength, the ocular tension, the width of the pupil and the refractive state of normal human eyes were followed for periods up to 24 hours. During the first 30 minutes the tension was determined tonometrically every two minutes. On the whole the effect of pilocarpine on the normal eye was slight and inconstant. About one-third of all subjects tested showed no measurable lowering of the ocular tension. In the remaining two-thirds the tonometer revealed a drop up to 6 mm. Hg (Schiøtz). The concentration of the pilocarpine solution influenced the duration but not the magnitude of the reduction of tension. The miotic effect was more pronounced and much more constant. No parallelism between miosis and ocular tension could be recognized. The miosis nearly always outlasted the lowering of the ocular tension. The cyclotonia following pilocarpine was very variable and difficult to measure. The concentrations of the drug tested were ¼, ½, 1, 2 and 100 (crystals) percent.
Peter C. Kronfeld.

Kapuściński, W. **Observations on the pulse and retinal arterial pressure.** Brit. J. Ophth. 32: 273-300, May, 1948.

In this very long article, the author records many observations on the pulsations of the central retinal artery and reaches new conclusions about the mechanics of the pulsation and circulation of the blood. In almost no textbooks of physiology is the mechanism of the pulse described with any degree of detail or truth. It is simply stated that the palpable pulsations are due to dilatation of the artery during the force of systole and contraction during diastole. This theory is completely untenable. The pulsation of the retinal artery is simultaneous with the pulsation at the wrist and is assumed to have the same origin; despite this rhythmic pulsation which is seen in 80 percent of people, the artery does not change in width or caliber during the pulsation but simply undergoes a temporary change in position. This is also true at the wrist or the temple. The arterial tube would increase in size with an increase in its internal pressure and volume

and if it did increase in caliber during systole, this increase would result in a lowered intravascular pressure instead of an increase. The author concludes that the blood stream in the vessels is uniform. It circulates without any oscillations due to pressure, so that there is no difference between diastolic and systolic pressure. During systole, the blood circulates faster imparting to the column of fluid a kinetic energy which results in the pulsations seen and felt.

Morris Kaplan.

Leoz de la Fuente, G., and Bartolozzi Sánchez, R. **Modifications in the retinal arterial pressure through compression of the common carotid.** Arch. Soc. oftal. hispano-am. 8:457-467, May, 1948.

This is a detailed report, with tabulated data, on the effect of a two-minute compression of the common carotid artery on the retinal vascular circulation. Since this reaction depends on the compensatory function of the cerebral circulation in the circle of Willis, it is suggested that exploration of the retinal response to carotid compression may be used clinically to determine the functional state of the cerebral compensatory circulation, preliminary to ligation of the common carotid. This investigation comprises ophthalmodynamometric measurements in forty patients, in the recumbent position. One investigator took the retinal pressures and the other exerted the compression. The data show that during the compression the pressure in the retinal vessels is nil, or very low. Two minutes later it rises and the diastolic pressure may reach its original level, but the systolic remains not less than 23 percent below its normal level. There are two patterns of behavior of the diastolic pressure: a juvenile in which the reduction of pressure does not exceed twenty percent, and a senile in which it is over twenty percent. There were patients over fifty years of age in the juvenile group and young people in the senile group. The vascular age of a patient may not coincide with his chronological age. A fall in the diastolic pressure of not over twenty percent indicates a satisfactory collateral cerebral circulation; a fall between 20 and 50 percent suggests good cerebral compensation that is subject to unpredictable variations. A fall above 50 percent is definitely a sign of poor collateral cerebral compensation. A marked difference in the systolic pressure of the two eyes is pathognomonic of poor circulation in the region of the common and internal carotid arteries particularly if the lower systolic pressure remains unaffected by compression of the common carotid of the same side, but falls after compression of the common carotid of the opposite side. The response in the retinal vascular pressure to carotid compression is attributed to an autonomous cerebral mechanism rather than to a direct effect of the compression on the carotid sinus; this assumption is supported by the quantitative dissociation of the diastolic and systolic pressures after homolateral carotid compression, and by the fact that continued compression of the carotid leads to a rise in the diastolic pressure of the opposite eye in 50 percent of subjects and in the systolic pressure in only 30 percent. A direct effect from the carotid sinus would be expected to exert the same influence on the two pressures.

Ray K. Daily.

Matteucci, Pellegrino. **On the autonomous regulation of the uveal vessels.** Ann. di ottal. e clin. ocul. 73:126-127, Feb., 1947.

If sympathetic gangliar synapses exist in the vessels of the choroid, the passage of central vasomotor stimuli through them would be inhibited by the action of nicotine. Matteucci found that vasodilatation could be ophthalmoscopically ob-

served alike in nicotinized and normal eyes when the carotid sinus was electrically stimulated; hence he concluded that the perivascular nerve fibers of the choroid in the albino rabbit (his experimental animal) have no gangliar synapses and therefore the choroidal vessels do not possess, as far as the present evidence goes, an autonomous regulatory system of their own. Harry K. Messenger.

Miller, B. **The effect of Priscol upon the retinal arteries.** Ophthalmologica 115: 11-21, Jan., 1948.

Priscol is a vasodilator related to histamine which European authors have used in the treatment of circulatory disturbances of the retina, as well as in inflammatory and traumatic diseases of the anterior segment of the eye. Miller has made actual measurements of the caliber of the retinal vessels under the influence of Priscol. With a heliometer eye piece in an ophthalmoscope of the Gullstrand type, Miller measures the width of all retinal arteries and veins near the disc. By dividing the sum of the widths of the arteries by that of the veins he arrives at a quotient that expresses the relative caliber of the arteries. In patients with signs of retinal angiospasm, Priscol in doses of 0.01 grams given intravenously 6 to 10 times over a period of 2 weeks produces a marked dilation of the retinal arteries and a moderate drop in blood pressure. The dilation of the retinal arteries may be associated with subjective and objective improvement of vascular retinal disease.

Peter C. Kronfeld.

Moreu, Angel. **Physiopathology of the irido-ciliary innervation.** Arch. Soc. oftal. hispano-am. 8:578-589, June, 1948.

The author reviews the recent literature on accommodation, and reports the data on his own investigations on the physiology of the ciliary muscle. A subconjunctival injection of adrenalin in atropinized eyes increases the mydriasis somewhat, and slightly impairs visual acuity for distance; this impairment can not be corrected with lenses, but at night vision improves with a minus 1.50 sphere. It is pointed out that variations in visual acuity for distance are more easily demonstrated in reduced light and at night. Intense eserinization produces a marked approximation of the punctum proximum, without any effect on visual acuity for distance. After an injection of gynergen the punctum proximum recedes somewhat. The double innervation of the ciliary muscle differs radically from that of any other pair of muscles with reciprocal innervation, in that paralysis of one nerve exerts no effect on its antagonist.

Another approach to the physiology of the ciliary muscle was made through gonioscopic examination of iridectomized eyes. After extracapsular extraction eserinization of the eyes produced visible relaxation of the zonule and an increased folding of the lens capsule with forward propulsion of the vitreous. The instillation of atropine was followed by a recession of the ciliary processes, with no significant effect on the lens capsule, although the zonular fibers appeared more tense. Subconjunctival injection of adrenalin produced a reaction similar to that of atropine, and the injection of gynergen was gonioscopically without effect.

The state of our present knowledge on the mechanism of accommodation is summarized as follows: accommodation for near is produced by a change in the chronaxia of the third nerve, or through the action of metabolites that cause contraction of the circular fibers of the ciliary muscle which in turn act on the zonule of Zinn. The vitreous participates in this process. There is also probably an

accommodation for distance, through the radial portion of the ciliary muscle. This negative accommodation is less in intensity, range, and significance than accommodation for near, and does not exceed two diopters. It appears certain that the action of the two parts of the ciliary muscle have different functions; it has not been possible to demonstrate the existence of a tonus between the two antagonistic portions of the ciliary muscle. The existence of two muscular antagonists, without a tonus is of great physiologic interest, and calls for revision of Sherrington's work. Ray K. Daily.

Rademaker, G. G. J., and Ter Braak, J. W. G. **On the central mechanism of some optical reactions.** Brain 71:48-76, 1948.

Four reactions were studied experimentally: 1. the blinking reflex elicited by a threatening movement and by the sudden unexpected approach of an object near the eye, 2. the conjugate ocular movements excited by optic stimulation, 3. the optic placing reactions of the forelegs, and 4. opticokinetic nystagmus. Reactions 1 to 3 were studied with dogs, 4 with pigeons, rabbits, cats, dogs, and rhesus monkeys. The first is a cerebral reaction, and still occurs when only the small lateral and caudal part of the striate area is spared surgically. In 2 the removal of the whole caudal part of the striate area abolishes the movements, whereas they still occur after extirpation of the lateral and caudal and also of the rostral part of the visual cortex. Reactions 3 are cerebral in origin, remaining when the whole caudal part of the striate area has been removed and only a small rostral part of the visual cortex spared. Reactions of the fourth group have not been proved to be cerebral. A long discussion of opticokinetic nystagmus follows. (7 figures, references.) Bennett W. Muir.

4
PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Bennett, A. G. **The optics of contact lenses.** Brit. J. Ophth. 32:257-272, May, 1948.

By means of numerous detailed Gaussian formulas, the optics of contact lenses are explained and many of the sources of error in the prescription and manufacture of these lenses are revealed. Since it is extremely difficult optically to make an afocal lens it is better to incorporate added power in the contact lens than to let the fluid lens correct the refractive error. This is now being done in most of the new lenses. In anisometropia, contact lenses do not abolish the difference in the size of the images but they avoid the unequal vertical prismatic effects arising from ordinary spectacles when the eyes rotate to view objects above or below the horizontal plane. In unilateral aphakia, contact lenses have a similar advantage. The previously emmetropic eye that has become aphakic has a retinal image about 25 percent larger than its fellow when the correction is worn 12 mm. from the cornea. Contact lenses reduce this disparity to about 9 percent and in many cases this renders binocular fusion possible. Morris Kaplan.

Brozek, J., Simonson, E., and Franklin, J. C. **A note on methodological evaluation of selected visual tests.** Am. J. Ophth. 31:979-984, Aug., 1948.

Candian, L. **The factors in the improvement of vision in myopic eyes following Fukala's operation.** Ann. di ottal. e clin. ocul. 73:193-220, April, 1947.

The improvement in visual acuity after Fukala's operation is often greater than can be explained on photo-optical grounds alone and must be attributed to the improved circulation, nutrition, and func-

tion of the choroid and retina. The lowering of the intraocular pressure, which is commonly observed after the operation, is thought to account for the improved condition of the tunics of the eyeball. With lowered intraocular pressure there is less tension on the tunics and the tendency to stretch is diminished; the choroidal vessels are better filled, and the retinal elements are closer together and are better nourished. One may believe that the eyeball itself undergoes some shortening after the operation by contraction of the elastic fibers in the sclera when the tension is lowered.

Candian analyzes the pertinent literature and reports a series of his own (14 eyes). In one eye he observed that a "Fuchs's central black spot" actually regressed after extraction of the lens and all but disappeared.

The factors are listed in the following order:

1. The lowered intraocular pressure brings about an improved condition of the ocular tunics. 2. The retinal images are larger. 3. The simplified optical system minimizes the dispersion of light (only one refracting surface as against five in the corrected myopic eye). 4. In consequence of the improved distance vision the functional capacity of the retina is increased. (Bibliography.)

Harry K. Messenger.

Corrado, Mario. **Influence of the spatial extent of the light stimulus on the pupillomotor reflexogenic power of the retina. (Pupillomotor reflexometric curve.)** Ann. di ottal. e clin. ocul. 73:171-182, March, 1947.

The same exponential curve for the pupillary reflex is found whether the retina is excited with light stimuli of increasing intensity, or stimuli of constant intensity but applied over an increasingly great area of the retina. In obtaining the curves care was taken to confine the stimuli to the foveal and perifoveal region. Similar curves have been found for the visual responses to light stimuli. Whether the visual and pupillary responses are mediated by one and the same or by two types of fibers, the point of departure for each response seems to be the retinal cone. Harry K. Messenger.

Corrado, Mario. **The behavior of certain entoptic phenomena occurring in an eye subjected to compression. Their significance in relation to the general problem of the biophysical mechanism of vision.** Ann. di ottal. e clin. ocul. 73:257-289, May, 1947.

Corrado reviews the literature on entoptic phenomena produced by pressure on the eye. Experimenting on himself, he observed, in addition to the usual well-known phenomena, that the macula, which appears entoptically at first as a dark elliptical disc, gradually, as the pressure is increased, becomes very brilliant, with finally a small very dark more or less polygonal spot in its center. The dark phase of the disc is attributed to perimacular circulatory changes, and the brilliant phase is thought to be due to electrochemical stimulation of the rods and cones. From his studies he concludes that vision is a combination of two factors, electric and chemical.

Light perception, color perception, and visual acuity are diminished as the pressure on the eye is increased. (9 figures, bibliography.) Harry K. Messenger.

Del Zoppo, Italo. **Vision with the eyelids closed (a study of the absorption of luminous energy by the lids).** Ann. di ottal. e clin. ocul. 73:247-255, April, 1947.

In making this study Del Zoppo used Maggiore's photometer, controlled with a photo-electric cell, and Corrado's pupillometer. Both instruments are described. Determinations were made by stimulating one eye and by observing the con-

sensual pupillomoter reflex in the other eye by means of the pupillometer. The threshold for colored lights except red was found to be approximately the same as for white. Red, despite its greater power to penetrate the tissues, has a considerably higher threshold. It is absorbed by the lids more than the other colors, probably because the blood in the lids serves as an absorption screen. An average stimulus of 0.6 lux, that is, an intensity 30 to 50 times greater than with the eyes open, is required to elicit the pupillomotor reflex, and the threshold is somewhat higher in elderly persons than in the young. Absorption by the lids is very great for low intensities and diminishes as the illumination is increased. (Bibliography.)

Harry K. Messenger.

Farnsworth, D. **Need for informative labeling of sun glasses.** Tr. Am. Acad. Ophth. pp. 366-370, March-April, 1948.

The purpose of this article is to dissipate the superstitions about the value of sun glasses by a summary of the simple facts. If an individual in a particular circumstance feels no eyestrain, does not squint, and is not irritated emotionally, there appears to be no reason why he should wear sun glasses. One of the best methods of protection against glare is afforded by shielding of the eyes from light from above, below, and from the sides. Most glare seems to be peripheral glare. Lobstermen's caps, which have greatly elongated visors, are efficient. We must largely rely on a simple glass which mitigates glare by reduction of intensity of light rather than by eliminating peripheral light. It should be nearly neutral in color, transmit 10 to 20 percent of the light and transmit very little energy below 400 microns or above 700 microns. Broad, well-fitted lenses should exclude peripheral light.

Sun glasses should be worn in exceedingly strong light, heat, and high altitudes, and in ordinary intensities by people whose eyes are hypersensitive. They should be worn by individuals newly subjected to unaccustomed intensities. They should not be worn when the illumination level is low and should never be worn for night driving.

Sun glasses can only be intelligently selected if the manufacturer will clearly label his product as to its essential characteristics. Chas. A. Bahn.

Guggenbuehl, A. **The dependence of stereoscopic vision upon the state of light adaptation. Ophthalmologica** 115:193-219, April, 1948.

The acuity of binocular depth perception of light-adapted eyes has been determined by many investigators with many different methods. Little attention has been paid to the influence of dark adaptation upon the acuity of stereoscopic vision. A previous paper from the same clinic (Gaus, Ophthalmologica 112:267, 1946) concerned itself with the acuity of binocular depth perception by means of eccentric retinal areas. In the paper under review this work is being extended to include eyes in the state of dark adaptation. The method is again that of Monje (Zeitschr. f. Sinnesphys. 69:73 and 69:261) the principle of which is the observation by the examinee of three black parallel threads while they are slowly being rotated from the initial horizontal (parallel to the interpupillary line) to the vertical position. From the beginning of the rotation the center thread is placed a little closer or farther than the other two threads. This disparity is not recognized by the examinee while the threads are in horizontal position. The angle of rotation at which the disparity becomes perceptible is a measure of the acuity of binocular depth perception. Under the specific conditions of the test (on examinees conditioned by

previous similar examinations) the author obtained acuities of binocular depth perception of 10 to 15 seconds of arc for the light-adapted and of 47 to 61 seconds for the dark-adapted eye. Both values, but especially the latter, were lowered by practice. In the periphery of the retina the decline of the acuity of binocular depth perception closely paralleled the decline of monocular visual acuity. As far as the binocular perception of depth is concerned, cones proved 1.5 times as sensitive as rods of the same retinal area.

Peter C. Kronfeld.

Hecht, S., Shlaer, S., Smith, E. L., Haig, C., and Peskin J. C. **The visual functions of the completely colorblind.** J. General Physiol. 31:459-472, July 20, 1948.

The visual functions of a completely colorblind individual are compared with those of the normal. The sensibility distribution in the spectrum has a maximum at 520 mμ at all brightnesses and thus corresponds to rod vision alone. This is confirmed by studies of dark adaptation which show final thresholds like those usually found for rod vision. Dark adaptation, measured both centrally and peripherally in the retina, is a single continuous function, and regardless of the brightness of the preceding light adaptation, is of the rapid type only, such as that found for the normal after low light adaptation. Visual acuity is also a single continuous function like rod vision. Both critical fusion frequency and intensity discrimination show two sections, one at low and the other at high intensities with a sharp transition from one to the other. Intensity discrimination is as good as in the normal eye, and covers much the same range. The maximal critical fusion frequency is only about 20 cycles per second as compared to 55 cycles for the normal. The two sections shown by the colorblind eye for intensity discrimination and fusion frequency possess the spectral sensitivity of rod vision since the relative positions on the intensity scale are not influenced by using different parts of the spectrum. (9 figures, references.)

Bennett W. Muir.

Hodel-Boos, M. **The perception of movement under conditions of dark- and light-adaptation.** Ophthalmologica 115: 25-46, Jan., 1948.

This study was undertaken because of the occurrence (in Switzerland) of apparently typical accidents during the long dim-out periods of the last war. Not recognizing the state of motion of a streetcar people got off too soon and fell. The author determined the threshold for the sensation of movement of various patterns moving horizontally across the field of the examinee. These determinations were made under conditions of central as well as eccentric vision, on light-adapted and dark-adapted normal human eyes. The latter recognized the state of motion of the pattern at an objective speed three to four times as great as that necessary to create the sensation of motion in a light-adapted eye. In addition to this difference in thresholds, the recognition of motion by the dark-adapted eyes was less certain than that of the light-adapted eye. Thus, the author believes to have found a physiologic explanation for the accidents mentioned before. The psychologic aspects of the perception of movement are discussed. Peter C. Kronfeld.

Imus, H. A. **Visual testing technics.** Tr. Am. Acad. Ophth. pp. 370-385, March-April, 1948.

The technical merits of the principal industrial screening gadgets are discussed. These include the Ortho-Rater, Sight-Screener, Keystone and Massachusetts Tests. The reliability and Pearsonian coefficients as well as other technical details are presented. A few practical ideas which present the subject from the

potential user's standpoint are mentioned. Generally speaking, the Orthorater and Sight Screener are best adapted for the rapid screening of large groups in which the initial cost is a negligible factor. The Keystone equipment is in the intermediate group and the Massachusetts and similar tests are best adapted for screening smaller groups, especially primary grade children in which time is a lesser factor and initial cost more important.

Chas. A. Bahn.

Lenoir, M. (with collaboration of M. G. Rose). **Tolerance to plastic contact glasses.** Arch. d'Opht. 8:49-53, 1948.

The authors note the lack of data on the toleration of the normal eye for contact glasses. Some ophthalmologists consider a glass clinically useful if it can be tolerated for two or three hours whereas others consider only ten to twelve hours of continuous wear as the criterion of usefulness. The symptoms of intolerance includes pain, discomfort and visual disturbances. The authors designate the factors leading to intolerance as mechanical or optical. Under mechanical factors they include the dimensions of the glass, its weight, and its adaptation to the eye. They note that the eye ought to be able to move in all directions without conjunctival compression or shift of axis by the glass. The weight of the glass can be reduced by making the scleral portion thinner than the corneal. The scleral fit should be such that there are neither tight nor loose areas. There should be no contact with the cornea or limbus. The optical conditions should be such as to correct the ametropia accurately. Prismatic effects should be eliminated. The authors have modified the ordinary plastic lens by cutting small grooves in the inner surface of the scleral portion in order to facilitate circulation of tears. They consider that artificial fluids should be only exceptionally required.

The authors conclude that certain persons can tolerate plastic lenses indefinitely but that others, in spite of the utmost care in fitting, are relately intolerant because of factors not yet understood.

Phillips Thygeson.

Moron-Salas, José. **The exploration of aniseiconia.** Arch. Soc. oftal. hispano-am. 8:363-367, April, 1948.

Moron-Salas describes a simple quantitative test for vertical aniseiconia. It consists in placing before one eye a figure that consists of a central horizontal line with a dot 10 cm. from it on each side and before the other eye a Maddox double prism with the bases of the united prisms in the pupil. The resulting binocular figure consists of a continuous line and doubled dots on each side. In the presence of aniseiconia the separation between the dots is unequal, and by measuring the difference in their separation in mm. the amount of aniseiconia can be calculated, from a computed table. (1 table.)

Ray K. Daily.

Scano, A., Bietti, G. B. and Schupfer, R. F. **Influence of anoxia on the retinal resolving power.** Riv. di med. aeronautica 10:1-11. Oct.-Dec., 1947.

After anoxia the retinal resolving power returns to normal in 10 minutes. Ocular fatigue of 30 minutes has slight effect. There is an average diminution of 6 percent at 5,000 meters and 12 percent above 5,000 meters. Under conditions of 50 percent reduced illumination the diminution was 3 to 7 percent and 13 to 14 percent at higher altitudes.

I. E. Gaynon.

Shapiro, J. R. **Some indications for the use of contact lenses.** Med. Record 161: 365-366, June-July, 1948.

Contact lenses correct the irregular astigmatism and curvature myopia in keratoconus. The disparity of image size

in unilateral aphakia is reduced by convex contact lenses to the point where both images can be fused easily. They may also be used in neuroparalytic keratitis because they are not irritating and allow the surgeon to observe the cornea.

I. E. Gaynon.

Sloane, Albert E. **Refraction clinic.** Am. J. Ophth. 31:995-997, Aug., 1948.

5

DIAGNOSIS AND THERAPY

Arruga, H. **Treatment with products of tissue disintegration according to the method of Filatoff.** Arch. Soc. oftal hispano-am. 8:404-406, April, 1948.

This method of therapy is described by Arruga principally on the basis of information gathered by him from the abstracts in the American Journal of Ophthalmology. Ray K. Daily.

Callahan, Alston. **Bipronged forceps; an instrument for plastic surgery.** Am. J. Ophth. 31:1165-1166, Sept., 1948. (2 figures.)

Debré, R., Monbrun, A., Thieffry, S., Brissaud, H.-E., and Lavat, J. **Ophthalmoscopic examination in miliary tuberculosis in the infant.** Arch. d'opht. 8:129-149, 1948.

This report was based on a study of 135 patients treated with streptomycin at the Hospital des Enfants-Malades, Paris. The success of streptomycin in miliary tuberculosis is increased by early diagnosis and early use of the drug. Ophthalmoscopic examination is of value in early diagnosis. In 120 cases of tuberculous meningitis, tubercles of the choroid were recognized on first examination. Tubercles were found in 23 of 35 patients with miliary tuberculosis on initial examination, and of nine cases in which the X-ray findings were doubtful, diagnostic fundus changes were present in five. Ophthalmoscopic examination was also of value in prognosis and as a guide to treatment in cases of relapse. Ophthalmoscopic examination is difficult in the infant but that with appropriate mydriasis and with patience a satisfactory examination can be made.

Phillips Thygeson.

Dekking, H. M. **Opacity meter for cornea and lens.** Ophthalmologica 115:219-226, April, 1948.

Rønne devised the "colloidometer" for measuring the opacity of the aqueous by comparing it with the opacity of the cornea of the same eye. The variability of the latter in the same and in different eyes is the main objection to Rønne's method. In 1936 Dekking devised an opacity meter which uses an invariable "physical" opacity standard. The instrument has been improved and is now described in detail. In principle it consists of an optical system that forms an image of the eye or its parts in the focal plane of an ocular. Adjacent to this image and in the same plane is a photometer field with variable and measureable brightness. The light source serving the photometer is a constant fraction of the light source illuminating the eye. Theoretically only light reflected at right angles to the line of incidence should be used for opacity measurements. This requirement has only been partly met. Light reflected specularly from the surfaces of cornea and lens is prevented from entering the system in appreciable amounts. A number of precautions have to be taken in making the measurements. No practical applications or results are reported. The instrument is apparently not being manufactured. Peter C. Kronfeld.

Friedenwald, Jonas S. **Some problems in the calibration of tonometers.** Am. J. Ophth. 31:935-944, Aug., 1948. (11 figures.)

Friedenwald, J. S. **Recent advances in tonometer construction.** Tr. Am. Acad. Ophth. pp. 543-547, May-June, 1948.

The Sklar instrument employs a small mirror in the tonometer scale to reduce errors of parallax in reading. The hammer is epicycloid in form rather than concave as in the conventional Schiøtz design. Errors due to lateral play of the plunger and to friction between the hammer and plunger are thus reduced. In the Harrington tonometer accuracy in reading is greatly increased by the use of a 360-degree dial disc. A transparent plastic foot facilitates accurate centering on the cornea. In the electronic tonometer an electrical system of making manifest the position of the plunger replaces the usual mechanical type. An induction coil is placed within the brass cylinder attached to the foot plate and the tonometer plunger forms the core. Although free from frictional difficulties, new electrical problems such as sensitivity to input voltage fluctuations exist. The sensitivity of this instrument is two to four times that of conventional mechanical tonometers. Chas. A. Bahn.

Froschauer, W. E., and Schrimpf, C. E. **Pentothal sodium in the aged with respect to eye surgery.** Geriatrics 3:231-236, July-August, 1948.

There are no contraindications to the use of sodium pentothal in the aged. The authors use sodium pentothal for basal anaesthesia and add regional and instillation anaesthesia. I. E. Gaynon.

Fuentes Noya, M. **A new blepharostat.** Arch. Soc. oftal. hispano-am. 8:611-614. June, 1948.

This blepharostat was designed for the removal of foreign bodies under slitlamp control. It is small, suitable for both eyes, and its chief merit is that, unlike most blepharostats, it remains in position with the patient seated in front of the slitlamp, and does not interfere with the manipulations necessary to remove a foreign body focused under the corneal microscope. (2 figures.) Ray K. Daily.

Gallois, J. **Action of minimal elective vasodilatation in chorioretinitis and in senile retinas.** Rev. oto-neuro-oftal. 22: 78-80, July-Aug., 1947.

A case of senile retinal degeneration with poor vision and contracted fields is presented in which vision and fields improved after treatment with nicotinic acid. Similarly, a patient with disseminated chorioretinitis showed improvement when treated with benzyl imidazoline. The author recommends low doses of vasodilators for their nutritional effect on the choroid and retina. Edward Saskin.

Gát, L. **Lid evertor for mucous membrane grafting.** Ophthalmologica. 115:47-48, Jan., 1948.

To facilitate the dissection of mucous membrane flaps from the oral cavity the author has devised three "evertors" which work on the principle of solid cylindrical supports for the tissue that is worked upon. Peter C. Kronfeld.

Haik, G. M., Breffeilh, L. A., and Barber, A. **Beta irradiation as a possible therapeutic agent in glaucoma. An experimental study with the report of a clinical case.** Am. J. Ophth. 31:945-952, Aug., 1948. (8 figures.)

Horner, Warren D. **A dependable tying forceps for fine sutures.** Am. J. Ophth. 31: 1001, Aug., 1948.

Hruby, K. **Further simplifications of the technique of slitlamp microscopy of the posterior segment.** Ophthalmologica 115:290-296, May, 1948.

To facilitate slitlamp microscopy of the posterior segment by means of a strong concave lens placed a short distance in

front of the eye, Hruby has devised a lens holder and a fixation light both of which are attached to the support against which the examinee rests his head. The lens holder permits the accurate centering that is essential for the recognition of the finer details in the vitreous. The fixation light which the patient watches with his other eye facilitates maintenance of the required position and thereby shortens the examination. Peter C. Kronfeld.

Kelly, T. S-B. **A low power infra-red microscope.** Brit. J. Ophth. 32:396-397, July, 1948.

An infrared microscope which projects its image on a flourescent screen is described. It is actually part of a binocular slitlamp, of which the source of light is an infrared image converter tube that draws its energy from a 12-volt battery. The instrument will probably be most useful in the penetration of corneal opacities, pupillary membranes, and aftercataract. Morris Kaplan.

Knapp, A. A. **Night-blindness and vitamin D.** Rev. oto-neuro-oftal. 22:82, July-Aug., 1947.

Night-blindness may be based on an ocular or systemic disorder and is frequently considered a manifestation of vitamin A deficiency. The author finds that patients with ordinary night-blindness including the nyctalopia of myopia, are aided by vitamin D and calcium, and advises a therapeutic combination of vitamins A and D, and calcium.

Edward Saskin.

Matas, B. C. **Slitlamp microscopy of the fundus.** Ophthalmologica 115:179-185, March, 1948.

Optical conditions suitable for slitlamp microscopy of the fundus can be created by means of a contact lens or of a strong minus lens placed in front of the eye. The former method was devised and elaborated by Koeppe in 1918. The latter was first described by Lemoine and Valois in 1923 and recently readvocated by Hruby. In the paper under review Matas compares the two methods with regard to the smallest pupil that permits binocular observation and the size of the fundoscopic field. By simple calculations he arrives at the result that the contact lens requires a lesser degree of mydriasis of the patient's eye than the strong minus lens. The contact lens also yields a larger fundoscopic field. Obvious advantages of the strong minus lens are the accessibility of more peripheral fundus areas and the wider applicability, especially in eyes recently operated upon.

Peter C. Kronfeld.

Missiroli, G., and Corelli, F. **Antiexudative therapy by plasma transfusions in sympathetic ophthalmia and in other eye diseases.** Boll. d'ocul. 26:737-748, Dec., 1947.

Plasma transfusions proved to be of benefit in different internal morbid entities characterized by inflammatory exudative changes, therefore the authors expected good results in eye diseases with an inflammatory exudate. They used transfusions of 20 to 200 cc. of human plasma in 8 patients with sympathetic ophthalmia, 16 with traumatic iridocyclitis, 9 with tuberculous uveitis and 4 with recurrent vitreous hemorrhages. The intervals between injections were two to five days and two to fifteen transfusions were administered. If after the third or fourth transfusion no effect became manifest, the treatment was discontinued; in some eyes good results were noted after the second transfusion. In the eight cases of sympathetic ophthalmia the results were unexpectedly good; 25 to 50 days sufficed to effect a clinical cure. The results in posttraumatic iridocyclitis were favorable, but in tuberculous uveitis and in recurrent vitreous hemorrhages unsatisfactory.

K. W. Ascher.

Rosso, Silvio. **Histomorphologic modifications induced in the ciliary ganglion and in the retro-ocular nerve trunks by the retrobulbar injection of alcohol.** Ann. di ottal. e clin. ocul. 73:97-106, Feb., 1947.

Dogs were given a retrobulbar injection of 80 percent ethyl alcohol, and the ciliary ganglia were removed 5 to 20 days later for examination. Both degenerative and regenerative phenomena were found, especially in the smaller paragangliar nerve trunks and in the more peripheral cells of the ganglion itself. It is inferred that the ganglion, despite its small size, offers a certain resistance to the penetration of the alcohol. The smaller nerve trunks are more vulnerable but tend to regenerate, whereas the alterations in the ganglion cells appear to be irreversible. This may explain the relatively rapid reestablishment of corneal sensitivity after injection, and the more permanent absence of pain. Harry K. Messenger.

Stein, Lester. **Flexible cable slit control for biomicroscope.** Am. J. Ophth. 31: 1166-1167, Sept., 1948. (1 figure.)

Toulant, M. **Tissue therapy in ophthalmology.** Arch d'opht. 8:33-48, 1948.

Toulant reviews the work of V. P. Filatov, director of the Institute of Experimental Ophthalmology of Odessa, and of his students, on tissue therapy in ophthalmology. The review is based principally on Filatov's latest book (1945), entitled "Corneal grafts and the therapeutic utilization of preserved tissues." The review presents the history of the method which began in 1933 with the observation of the clearing of a corneal graft after the use of nonpenetrating limbal grafts of preserved cadaver tissue. Filatov concluded that the graft carried stimulating substances in the nature of hormones which developed in the tissues as a result of unfavorable conditions in vitro. As practiced by Filatov, tissue therapy includes injections of cod liver oil as well as subconjunctival or subcutaneous implantations of cornea, skin cartilage, retina, choroid, placenta, brain, spleen, liver, muscle, and nerve tissue. The tissue fragments are sometimes used intact, sometimes minced, and sometimes as aqueous extracts.

Clinical results are claimed in such diverse conditions as sclerokeratitis, rosacea keratitis, herpetic keratitis, tuberculous uveitis, keratoconus, myopic chorioretinitis, retinitis pigmentosa, and optic atrophy. Certain inconclusive laboratory studies are cited. Toulant concludes that only extensive and controlled clinical studies can demonstrate the value of the method and that up to now only inconclusive studies have been made outside the U.S.S.R. Phillips Thygeson.

Traquair, H. M. **Symposium on headache as a symptom. IV. The eyes and headache.** Edinburgh M. J. 55:180-182, March, 1948.

The author presents the ophthalmologic viewpoint in a symposium on headache as a symptom. There appears to be no correlation between the ocular refraction, nor the demands made upon the ciliary body and headache. Treatment consists in the use of suitable spectacles to relieve any difficulty in achieving the maintenance of efficient binocular vision which is a frequent cause of headache. In all cases it is necessary to examine and treat the patient and not only the eyes.

Orwyn H. Ellis.

Weidmann, W. **A simple accurate self-recording perimeter.** Ophthalmologica 115:332-337, June, 1948.

The perimeter consists, in principle, of a hollow hemisphere made of transparent plastic with a thin, translucent coat of dull white paint on its outer surface. The perimeter target is a small electric bulb which is moved along the outer surface by a mechanism invisible to the exam-

inee. By means of diaphragms and filters interposed between the electric bulb and the outer surface of the perimeter sphere a light spot of variable size and color is projected onto the inner surface of the perimeter sphere and thus serves as perimetric target. The instrument is manufactured by the firm of M. J. Purtschert in Luzern (Switzerland).

Peter C. Kronfeld.

6

OCULAR MOTILITY

Adler, F. H. **Some confusing factors in the diagnosis of paralysis of the vertically acting muscles.** Tr. Am. Acad. Ophth. pp. 447-457, May-June, 1948.

In the first group discussed, the motor anomalies observed cannot directly be explained by a single lesion. For example, the subjective and objective symptoms which suggest a paralysis of the superior or inferior rectus muscle of one eye, combined respectively with superior or inferior oblique paralysis of the other eye, is not explainable by a single, nuclear or internuclear lesion. Motor limitation is quantitatively and qualitatively dependent upon which eye is chosen for fixation, a fact that is not sufficiently emphasized nor illustrated in ophthalmic literature. Many factors individually and collectively determine the master or fixing eye. Under some circumstances an eye with a paralyzed muscle becomes the fixing eye, for example, when in right superior rectus paralysis the antagonist of the weaker muscle in the fixing eye (right inferior oblique) will move with relatively less effort than normal, and its yoke muscle in the other eye (left inferior rectus) will therefore also tend to overact. This results in an apparent weakness of the antagonist (left superior oblique) in the other eye. Obviously, such a diplopia cannot be explained by a single nuclear or internuclear lesion because the process is largely supranuclear.

In the second group discussed, a single lesion such as a pontine hemorrhage may cause unusual vertical motor abnormalities. This results from the small size and close proximity of the nuclei from which the third and fourth cranial nerves arise.

Chas. A. Bahn.

Braun-Vallon, S., and Hartmann, E. **Retinal correspondence in strabismus.** Ann. d'ocul. 181:321-337, June, 1948.

A brief résumé of the several theories and types of strabismus is followed by a description of the more frequent tests and examinations which involve retinal correspondence. Among these are the red glass test, the Lancaster, the synoptophore, and the recurrent image test. If the abnormality with the recurrent image test is similar on several different weekly tests the lack of retinal correspondence is probably not recent, and therefore the prognosis is less favorable. This is especially true if synoptophore results correspond. If the abnormal retinal correspondence as shown by the Bielschowsky recurrent image test is variable on several occasions the prognosis is better, especially if the abnormality as tested with the synoptophore and red glass tests is constant. The prognosis is best if the recurrent image test on several occasions shows normal retinal correspondence, the other tests, abnormal.

Occlusion, orthoptic exercises and surgical procedures are discussed at some length. Before operation is decided upon, a series of ten to twelve half-hour sessions of orthoptic training are given in the course of three or four weeks. If retinal correspondence is normal at the end of this time the prognosis for surgical procedures is most favorable. When only partial improvement follows, the prognosis for structural and functional cure become less. The progress of 19 patients with strabismus is analyzed and several illustrative cases are presented.

Chas. A. Bahn.

Eyles, Marianne. **Barriers and aids to fusion.** Am. J. Ophth. 31:1147-1151, Sept., 1948. (Discussion by G. S. Campion.)

Gardilčić, A **A new ptosis operation: tucking of the levator muscle.** Ophthalmologica 115:269-282, May, 1948.

Through a skin and orbicularis incision the levator muscle is exposed just above or posterior to the beginning of its aponeurosis. At a level dependent upon the degree of the ptosis three sutures are inserted into the levator. These sutures are now enclosed in the upper tarsus and tied, as a result of which the levator is folded or tucked to a degree that depends upon the places of insertion and final anchorage of the sutures. The operation is easy to perform, easy to repeat in case of under-correction and is relatively atraumatic. Peter C. Kronfeld.

Hornbogen, D. P. **An operation for shortening a rectus muscle.** Am. J. Ophth. 31:1164-1165, Sept., 1948. (4 figures.)

Sedan, J., and Sedan-Bauby, S. **Pathologic physiology of induced diplopias.** Arch. d'opht. 8:233-327, 1948.

The authors describe a prism test designed for the detection and investigation of latent oculomotor deficiencies. The test is performed by placing before the suspected eye a powerful prism of from 30 to 45 degrees. The two eyes are allowed to remain open during the period of study which may be from 30 to 60 minutes. The diplopia must be maintained during this time. In the normal subject the diplopia disappears instantly when the prism is removed, but in the subject having a previous ophthalmoplegia the diplopia persists for an appreciable time (15 minutes to 12 hours). In one case the induced diplopia lasted 60 hours. The diplopias so created are then studied by the usual methods and the offending muscle or muscles identified.

The authors discuss in detail two possible explanations for the phenomenon. The first hypothesis suggests that an atony of the previously paretic muscle is produced by excess of contraction; the second suggests that the atony results from a passive stretching of the muscles. The authors believe the test will render considerable service in neuro-ophthalmologic studies. Phillips Thygeson.

Stein, A., and Bangerter, A. **Orthoptic treatment.** Arch. d'opht. 8:156-168, 1948.

Stein and Bangerter describe in detail the methods employed in the school of orthoptics at the ophthalmological clinic of Saint-Gall in the treatment of amblyopia, strabismus, and heterophoria. Training instruments and apparatus developed at the school are described and illustrated by photographs. The school is divided into two classes, one for monocular education and the other for binocular education. The authors stress that in the treatment of the amblyopia it is not the duration of the occlusion that matters but the intensity of the use of the eye during the occlusion. The children attend the school for one hour three times weekly. The first half hour of classwork is devoted to monocular or binocular work with the various training instruments, and the second half hour is devoted to games designed to develop binocular vision. In addition, home exercises are prescribed. A chart is appended which gives a schematic plan for the management of strabismus from its development to the age of six years when treatment should normally be concluded.

Phillips Thygeson.

Vos, T. A. **Simplified resection of the lateral or medial rectus muscle.** Ophthalmologica 115:22-24, Jan., 1948.

The author's method is essentially a tucking with resection of the tendon-muscle fold. Blaskovics' triple-armed silk suture is used to unite the muscle stumps and to close the capsular and conjunc-

tival wound. According to the author, the advantages of this operation are that it is a quick procedure, requiring little or no assistance, the apposition between muscle stump and original insertion is very accurate, the sutures are deeply and securely placed and the scar is hardly noticeable. Two clear diagrams illustrate the author's technique. Results are not given. Peter C. Kronfeld.

Yasuna, Elton. **A technique for muscle resection without the use of the Prince forceps.** Am. J. Ophth. 31:972-974, Aug., 1948. (4 figures.)

7

CONJUNCTIVA, CORNEA, SCLERA

Ayberk, Nuri F. **Superficial punctate keratitis.** Göz Kliniği 6:43-48, May-June, 1948.

Six cases seen in Turkey, where the disease is generally unrecognized, are reported. There was no relation to other disease; the lesions were limited to one eye and consisted of superficial grayish nodules on the cornea, hyperemia without secretion of the conjunctiva, pain, and photophobia. Bacteriologic examinations were negative. F. H. Haessler.

Barazzoni, Antonio. **An initial corneoconjunctival epithelioma with incipient differentiation towards Poleff's papillomatous type.** Ann. di ottal e clin. ocul. 73: 290-301, May, 1947.

A case of corneoconjunctival tumor in a 52-year-old woman is presented. There had been antecedent trauma. In accordance with Poleff's scheme the tumor was classified, on the basis of its histologic peculiarities, as an initial epithelioma with incipient differentiation towards the papillomatous type. The clinical and histologic characteristics and the classification of neoplasms of the corneoconjunctival epithelium are discussed. (1 illustration, 6 photomicrographs, bibliography.) Harry K. Messenger.

Chavarria, F. A. **Disciform keratitis in the new-born.** Arch. Soc. oftal. hispano-am. 8:607-610, June, 1948.

A case of typical disciform keratitis, in an infant 13 days old, caused by injury with the forceps during delivery, is reported. After the instillation of pilocarpine for four months the dense central opacity in the middle parenchymal layers of the right cornea cleared up sufficiently to permit a view of the fundus. The unusual feature is the recovery, which is attributed to the favorable effect of the pilocarpine on the ocular nutrition and absorption of the exudate.

Ray K. Daily.

Crespi Jaume, G. **Symmetrical dystrophy of the corneas.** Arch. Soc. oftal. hispano-am. 8:603-606, June, 1948.

This is a report of a very unusual case. A woman, 40 years old, had bilateral, diffuse, symmetrical opacities limited to the lower half of the corneas and denser in the center. The upper halves of the corneas were completely transparent. The demarcation between the involved and clear zones was very sharp, and at the level of the edge of the upper lid. The lower half of the cornea had a granular appearance, resembling somewhat Fuchs's dystrophy, or glaucomatous edema. The structure of the iris could be distinguished indistinctly through the epithelial opacity which extended to the limbus in the entire semicircumference. In front of the pupillary area the opacities were larger, denser, more sharply circumscribed, and separated from one another by clear zones. The patient suffered intermittent acute attacks, with pericorneal injection, lacrimation, and superficial vascularization at the limbus which lasted about two

weeks. Visual acuity was 2/3. She had no other disturbances and the family and personal history were negative. Therapy with vitamins, ointments, and occlusion was without effect. (1 figure.)

Ray K. Daily.

Edmunds, Mead, and Beck, Regena. **Rhinosporidiosis of the conjunctiva, case report.** Virginia M. Mo. 75:278-280, June, 1948.

Rhinosporidiosis is a fungus infection primarily of the nasal mucous membranes. It produces a polypoid growth resembling granulation tissue which bleeds readily. The source is unknown. It occurs in young males. It appears on the conjunctiva as a painless reddish mass much like that of a granuloma from a ruptured chalazion. I. E. Gaynon.

Jébéjian, R. **Local penicillin therapy in trachoma.** Ann. d'ocul. 181:359-364, June, 1948.

Seventeen children between the ages of 7 and 12 years who had recent bilateral trachoma were given local penicillin therapy. Small discs containing 250 units were instilled in both eyes twice daily. At the end of two months, 5 were considered cured, 7 greatly improved and 5 only slightly improved or not at all. Three months later the results were practically the same. It is a question whether the apparently favorable results which followed local penicillin in such small doses were due to its action on the causative virus or on secondary bacterial invaders.

Chas. A. Bahn.

Kronenberg, Bernard. **The use of placental extract in the treatment of herpetic keratitis and superficial punctate keratitis.** Am. J. Ophth. 31:1101-1105, Sept., 1948.

Lindsay-Rea, R. **Various forms of conjunctivitis and their treatment.** Medical Press 220:7-8, July 7, 1948.

The treatment of ophthalmia neonatorum, catarrhal, phlyctenular and angular conjunctivitis is discussed. Penicillin (2,500 units per cc.) is recommended for the first two. Calomel powder, yellow oxide of mercury ointment and general care, are advised for the phlyctenular type. Zinc sulfate is specific for angular conjunctivitis. (2 figures.) I. E. Gaynon.

Marín-Amat, Manuel. **The operation of choice for pterygium.** Arch. Soc. oftal. hispano-am. 8:615-621, June, 1948.

The author advises tearing the head of the pterygium from its bed, dissecting the episcleral tissue at the limbus with a fine bistoury, excising the body of the pterygium with straight fine scissors as far as the semilunar fold, and covering the raw surface with conjunctiva brought down from each side. The multiple fine silk sutures that close the conjunctival wound include the episclera, so as to anchor the conjunctiva. The sutures are removed on the ninth or tenth day. The author asserts that tearing the head of the pterygium from the cornea affords a more complete removal than dissection. (5 figures.)

Ray K. Daily.

Mariotti, Lorenzo. **The Weil-Felix reaction in trachoma.** Ann. di ottal. e clin. ocul. 73:302-310, May, 1947.

On the basis of experiments with carefully selected patients and controls so as to avoid errors that may have misled other investigators, Mariotti concludes that the Weil-Felix reaction is of no practical value in the diagnosis of trachoma. While not denying that trachoma may be a rickettsiosis, he finds no reliable confirmatory evidence in this reaction. (3 tables, bibliography.)

Harry K. Messenger.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. James Cheston Ogden, Long Beach, California, died May 25, 1948, aged 45 years.

Dr. George Elmer Strout, Minneapolis, Minnesota, died May 10, 1948, aged 75 years.

MISCELLANEOUS

TORONTO REFRESHER COURSE

The University of Toronto, faculty of medicine, announces a refresher course in the combined subjects of practical ophthalmology and otolaryngology from January 24 to January 29, 1949.

The course will be so arranged that the operative procedures and bedside conferences of the one specialty will be held in the mornings and the didactic conferences or lectures in the afternoons. The reverse of this procedure in the other specialty will make it possible to pick whatever subjects may be of interest to each applicant.

Guest speakers will give lectures and clinics in both subjects of the course. The fee will be $60.00. The course will be given for a minimum of 10 students and a maximum of 20 students. Application should be made to the Medical Office, University of Toronto. The closing date is November 30, 1948.

ORTHOPTIC TECHNICIANS PROGRAM

The seventh annual meeting of the American Association of Orthoptic Technicians was held at the Palmer House, Chicago, October 11th and 12th. Among the papers and discussions presented were: "The Binocular Reflexes," Dr. William C. Owens, Baltimore, Maryland; "Some Practical Aspects of Fusion," Miss Mary E. Kramer, Washington, D.C.; "Divergent Squint—Orthoptic Treatment," Miss Alice L. McPhail, New York City; "Accommodative Convergent Squint—Orthoptic Treatment," Miss Georgia Claussen, Santa Barbara, California; "Blindspot Mechanism in Squint," Dr. Kenneth C. Swan, Portland, Oregon; "Functional Treatment of Orthoptics," Mrs. Jeanie G. Haydock, Cincinnati, Ohio; "Problem Cases," Miss Anita Bargmann (leader), Buffalo; "The Handling of the Amblyopic Patient," Dr. Maynard C. Wheeler, New York City, with discussion by Miss Elizabeth Jackson, Erie, Pennsylvania; "The Learning Process in Orthoptics," Miss Julia Lancaster, San Francisco, California, with discussion by Dr. Peter C. Kronfeld, Chicago; "Degrees of Correction per Millimeter of Surgery," Dr. Richard G. Scobee, St. Louis, with discussion by Dr. Wendell L. Hughes, Hempstead, Long Island.

CAROLINAS POSTGRADUATE COURSE

Taking part in the ophthalmic program of the postgraduate course in ophthalmology and otolaryngology, sponsored by the North Carolina Eye, Ear, Nose, and Throat Society and the South Carolina Society of Ophthalmology and Otolaryngology, at Charleston, September 13th to 16th, were the following guest speakers: Dr. James E. Lebensohn, Chicago, who gave lectures on "Problems of Presbyopia," "Techniques of Manifest Refraction," and "Recent Advances of the Physiology of Vision." Dr. Eugene M. Blake, New Haven, Connecticut, spoke on "Intraocular Foreign Bodies with Illustrated Cases," "Constitutional Factors in Chronic Glaucoma," and "Etiology and Nonoperative Treatment of Senile Cataract." Dr. William C. Owens, Baltimore, presented papers on "Some Aspects of Cataract Surgery," "Analysis and Treatment of Strabismus," and "Treatment of Ptosis." Dr. Harold W. Brown, New York, spoke on "Diagnostic Procedures in Measurement of Ocular Muscle Deviations," "Operative and Nonoperative Treatment of Heterophorias," and "Surgical Management of Heterotropias." Dr. J. B. Workman, Columbia, South Carolina, presented a paper on "Nutritional Retrobulbar Neuritis."

FOUNDATION FOR VISION PLANS

At the Foundation for Vision meeting, at Boston on September 27th, it was decided to repeat the course in basic subjects of ophthalmology under the auspices of the Ophthalmological Study Council in 1949 at Portland, Maine. This course will be known as The Lancaster Course in honor of Dr. Walter B. Lancaster who organized and directed it during the past three years. Dr. Lancaster resigned as director and will be succeeded by Dr. Parker Heath, clinical professor of ophthalmology in charge of graduate instruction at Harvard University.

The foundation is also planning to continue the training course for blind children and their mothers originally organized by the late Dr. Theodore L. Terry. The project is to be known as The Terry Center for Visually Handicapped Children.

ESTELLE DOHENY LECTURE

Dr. Cecil S. O'Brien, professor of ophthalmology at the State University of Iowa College of Medicine, delivered the Estelle Doheny Eye Foundation Lecture on "The Surgical Treatment of Strabismus" at the Los Angeles County Medical Association Building in Los Angeles on November 8th. The first of these annual lectures presented by the

Estelle Doheny Eye Foundation in Los Angeles was delivered by Dr. Alan C. Woods, professor of ophthalmology at Johns Hopkins University and director of the Wilmer Institute, on December 17, 1947.

University of California course

The University of California Medical School is planning a postgraduate course in ophthalmology to be given September 12 through 16, 1949. This will be a continuation of the courses offered in 1947 and 1948 and is intended for specialists.

Societies

Minnesota Academy officers

Officers of the Minnesota Academy of Ophthalmology and Otolaryngology elected for 1948-49 are: president, Dr. A. D. Prangen, Rochester; 1st vice-president, Dr. L. Tilderquist, Duluth; 2nd vice-president, Dr. Joseph Garten, Minneapolis; secretary-treasurer, Dr. Frank Adair, St. Paul; chairman-of-council, Dr. Hugo Bair, Rochester.

New York officers

Dr. Wendell L. Hughes is chairman, and Dr. Isadore Givner, secretary, of the Eye Section of the New York Academy of Medicine.

Reading meeting

The 83rd meeting of the Reading Eye, Ear, Nose, and Throat Society was held September 15th. The speaker was Dr. Lewis K. Elfman, chief in otolaryngology, Philadelphia General Hospital.

South Carolina officers

Newly elected officers of the South Carolina Society of Ophthalmology and Otolaryngology are: president, Dr. Pierre G. Jenkins, Charleston; vice-president, Dr. Murdock H. Walker, Sumter; secretary-treasurer, Dr. Roderick Macdonald, Rock Hill.

West Virginia meeting

The West Virginia section of the Southeastern Surgical Society met on September 4th in Huntington, with Dr. Albert C. Esposito presiding, to hear Dr. Arthur M. Culler, professor and chairman of the department of ophthalmology, Ohio State University, College of Medicine, Columbus, read a paper on "The Cross-Eyed Child."

Mexican society lectures

Dr. Adalbert Fuchs gave a course of 20 lectures on the pathology of the eye from June 24th to July 13th for the Sociedad Mexicana de Oftalmologia.

Brooklyn society officers

At the 105th regular meeting of the Brooklyn Ophthalmological Society, Dr. Adalbert Fuchs presented a paper on "Early Diagnosis of Tumors of the Fundus" and Dr. Ralph I. Lloyd led the discussion. The present officers of the Brooklyn society are: Dr. Frank E. Mallon, president; Dr. Mortimer A. Lasky, vice-president; Dr. Louis Freimark, secretary-treasurer; and Dr. George A. Graham, associate secretary-treasurer.

Sociedad de Oftalmologia del Litoral

The Ophthalmological Society of the Litoral, Rosario, Argentina, has elected the following officers for the term from August, 1948, to August, 1950: Dr. Juan Manuel Vila Ortiz, president; Dr. Juan Maggi Zavalía, vice-president; Dr. Máximo Carlos Soto, secretary; Dr. Benito Bianco, treasurer; Dr. Luis Woelflin, Dr. René Bazet, Dr. Mario Zurbriggen, and Dr. Juan P. Alliani, directors.

Sociedade de Oftalmologia de Minas Gerais

The Ophthalmological Society of Minas Gerais, Brazil, has elected the following officers; President, Dr. C. Laborne Tavares; vice-president, Dr. Odilon Alves; secretary, Dr. Creso Barbi; treasurer, Dr. Angelo Laborne Tavares; historian, Dr. Antonio Isidoro.

Instituto Penido Burnier

The Medical Association of the Instituto Penido Burnier, Campinas, announces the election of the following officers: Dr. João Penido Burnier, president; Dr. Gabriel Pôrto, 1st secretary; Dr. Roberto Barbosa, 2nd secretary; Dr. Leôncio de Souza Queiroz, historian and treasurer; Dr. Guedes de Melo Filho, Dr. F. J. Monteiro Sales, and Dr. José Martins Rocha, directors.

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VOLUME 31 DECEMBER, 1948 NUMBER 12

THE FASCIA OF THE ORBIT*

ITS ANATOMY AND CLINICAL SIGNIFICANCE

RICHARD G. SCOBEE, M.D.
Saint Louis, Missouri

Much of the anatomy of the normal fascia of the orbit has been well known for more than a century and yet the average ophthalmologist is still not entirely familiar with certain portions of it. Various subdivisions of this fascia play a prominent role in the success or failure of the surgical treatment of heterotropia. Some parts may contain developmental anomalies which probably play an important role in the etiology of heterotropia.[1] It would, therefore, seem worthwhile to review and summarize the known facts about the fascia of the orbit and at the same time emphasize the clinical significance of certain sections.

On any map of the nation's highways, each road has a different number, the equivalent of a name. The same road is also part of the system of highways of the nation and connects with other highways which also have numbers or names. Each road is an integral part of the highway system. In similar fashion, many subdivisions of the fascia of the orbit bear different names but nevertheless all comprise the fascia of the orbit and any one part connects with one or more other parts. Since the fascia of the orbit is more or less continuous, in a sense, the apex of the orbit is as good a place as any to begin the consideration.

* From the Department of Ophthalmology, Washington University School of Medicine, and the Oscar Johnson Institute. This study was made under a contract with the Office of Naval Research as Project N6onr-202, Task Order I, NR 141-022.

THE DURA MATER

The intracranial portion of the optic nerve is sheathed in the meninges. As the nerve passes through the optic canal at the apex of the orbit, the meninges are rather closely pressed around it. The orbital portion of the nerve is much more loosely ensheathed.

At the point where the dura mater emerges from the canal of the optic nerve at the apex of the orbit, it divides into two layers. The inner layer continues along the optic nerve to the junction of that structure with the eyeball. The outer layer spreads out to cover the bony walls of the orbit and become known as the *periorbita.*

The function of the periorbita is similar to that of periosteum elsewhere. At the anterior end of the orbit—the orbital margin—the periorbita is confluent with the periosteum covering the bones of the face; at the rim of the orbit where these two differently named but similar layers of fascia meet, they become thickened to form a ridge known as the *arcus marginale.*[2]

This ridge of fascia marks the exact line of the orbital margin and from it arises the *septum orbitale* of the eyelids. This latter structure is also a part of the fascia of the orbit.

THE ANNULUS OF ZINN

Returning to the apex of the orbit where the dura mater of the optic nerve divides into an outer layer—the periorbita—and an

inner layer—the dura of the orbital portion of the optic nerve—there is a roughly circular tendinous cord lying between the two layers immediately after they have become distinct and separate at the apex of the orbit. This tendinous cord is known as the *annulus of Zinn* and it is rather intimately fused with both the periorbita and the dura of the optic nerve. The annulus has a very interesting history.

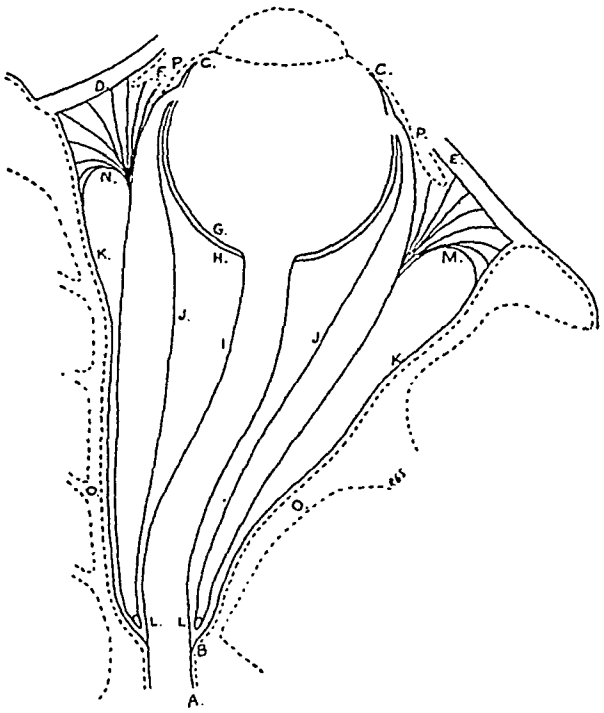


Fig. 1 (Scobee). Diagram showing only the fascia of the orbit (in solid lines). Bone, cornea, and conjunctiva are represented in dotted lines.

A. Meninges of optic nerve in optic canal.
B. Point of division of dura mater into periorbita and optic nerve sheath.
C. Point of fusion of Tenon's capsule with sclera.
D. Medial palpebral ligament.
E. Lateral palpebral ligament.
F. Lacrimal caruncle.
G. Visceral layer of Tenon's capsule.
H. Parietal layer of Tenon's capsule.
I. Dural sheath of optic nerve.
J. Muscle sheath.
K. Periorbita.
L. Annulus of Zinn.
M. Check ligament of lateral rectus muscle.
N. Check ligament of medial rectus muscle.
O. Bone of orbital wall.
P. Conjunctiva.

It is apparently not generally known that Zinn[3] described ". . . a ligament common to the inferior, internal, and external recti" only. He did not describe the entire circular structure as we know it today.

Sappey[4] described Zinn's structure as ". . . a fibrous cord which is attached to a very small fossa situated beneath and external to the optic foramen. This cord speedily divides into three slips—a middle, which goes to the inferior rectus; an inner, to the internal rectus; and an external, to the external rectus. Of these three bands the middle is the largest."

Lockwood[5] added to Sappey's remark that ". . . it may be added that the fasciculus, which belongs to the external rectus, is prolonged up the posterior border of the muscle, and ends by blending with the origin of the superior rectus."

It is obvious that the structure which Zinn described was in reality only the lower half of what is now referred to as the annulus of Zinn. The technique of dissection in the time of Zinn was well standardized in the case of the orbit and consisted in an approach to the orbital contents from above, the roof having been removed.

This external view of the muscle cone from above, the fat having been dissected away, revealed the fibrous appearing orbital surfaces of the superior rectus and the upper halves of the medial and lateral recti; from this approach, these fibrous outer surfaces of the muscles mentioned appeared to blend intimately with the dura mater of the optic nerve.

The technique then called for division of the superior rectus at its origin, followed by division of the optic nerve within its bony canal; both structures were next lifted upward and pushed aside. This maneuver exposed the inner surfaces of the medial and lateral rectus muscles and of the inferior rectus. From this aspect, the tendinous band across the inferior half of the optic foramen was exposed as the obvious point of origin of the three muscles listed.

It remained for Lockwood[5] to obtain a frozen orbit and divide it in a plane passing through the center of the pupil and the center of the optic foramen. When the inferior surface of this upper half of the orbit was inspected and the optic nerve pulled from its bed in the canal, the inner surfaces of the superior rectus as well as of the superior halves of the medial and lateral rectus muscles were then exposed to view and a tendon similar to the one Zinn had described below was easily visualized. This upper tendon has since been correctly called the *upper tendon of Lockwood* while the lower one is known as the *lower tendon of Zinn,* and the two together make up what is somewhat incorrectly but widely known as the *annulus of Zinn.*

The point of nomenclature here is one of purely academic interest and yet the story invites attention because it shows how often inaccuracies have crept into medical literature with the passage of time. A prime example of such an inaccuracy is the widely held notion that Helmholz invented the ophthalmoscope when it was in fact Babbage, an English mathematician, who first conceived the instrument.[6]

The capsule of Tenon

Consider now the dura which ensheathes the optic nerve in its orbital course. This membrane fuses with the fascial capsule which encases the globe—the *capsule of Tenon.*

Tenon[7] discovered the capsule which bears his name in 1803 and reported it in 1806. Surprisingly enough, or perhaps not so surprisingly after all, it was then forgotten for many years and Hyrtl[8] said that Malgaigne[9] finally brought it again to notice but called it by the name of the *orbital aponeurosis.*

In 1841, Bonnet[10] wrote an elaborate description of it and emphasized its surgical importance; his work was so well received that many began to speak of the structure as the capsule of Bonnet. In the same year, Ferrall[11] published a paper on the *tunica vaginalis oculi* in which he rediscovered the original capsule of Tenon; quite obviously, he was familiar with the work of neither Tenon nor Bonnet.

Since that time, many have described the capsule of Tenon, prompting Dwight[12] to observe somewhat cynically that ". . . the complications of this membrane are limited only by the perverted ingenuity of those who describe it."

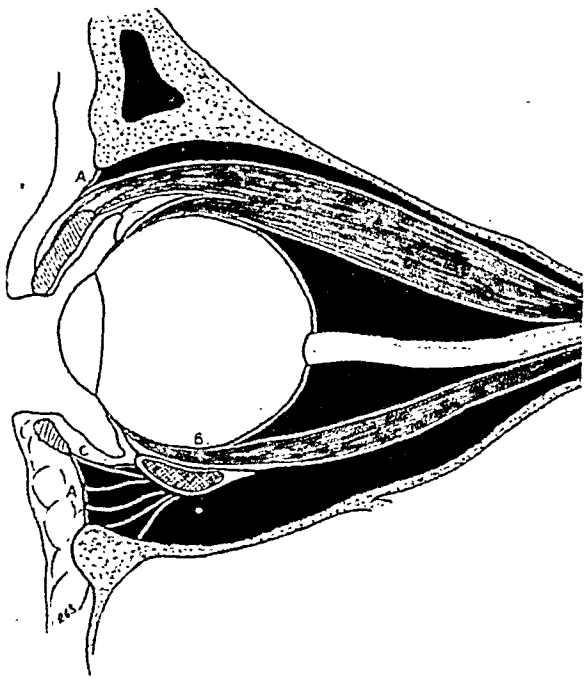


Fig. 2 (Scobee). Schematic vertical section through the orbit. The extensions of the suspensory ligament of Lockwood, particularly the one to the inferior tarsal plate (C), are shown, as is the suspensory ligament (B). The orbital septum is shown (A) superiorly and inferiorly. Note the close association of the levator and the superior rectus throughout most of their course.

The capsule of Tenon encases the globe from the limbus to the optic nerve, has a yellowish color and a closely matted appearance. The anterior third of the capsule is closely related to the bulbar conjunctiva under which it lies but from which it may be easily separated to within about 2 mm. from the limbus. In vertical sections, the anterior

portion of the capsule seems to blend with the superior and inferior conjunctival fornices. At these fornices, the capsule divides into two portions; one goes to the tarsal plate and the other runs to the sclera with the bulbar conjunctiva.

The middle third of the capsule is pierced by the six oculorotary muscles passing toward their scleral insertions. At the point where each penetrates the capsule, a prolongation of the capsule is sent backward along each muscle—*the muscle sheaths.*

The posterior third of the capsule is thinner than the anterior and middle thirds and is in contact with and loosely adherent to the orbital fat.

Whitnall[2] is of the opinion that connective tissue strands, hardened by alcohol or formalin and isolated by dissection from fat and neighboring structures, assume in many regions ". . . unwarrantable distinctions as membranes, ligaments, or capsules." He believes that if a firm body, such as the globe, revolves against a cushion of fatty tissue, the fat will be pressed away and the connective-tissue meshwork supporting it will be condensed into a membranoid surface. He states that this is what has happened in the case of the capsule of Tenon, agreeing that its posterior surface is connected with the meshwork of orbital fat, and that even in his most careful dissections, the posterior aspect of the capsule of Tenon is ragged and perforate. The earlier investigators, however, specifically stated that they used either fresh specimens or frozen ones rather than those which had been immersed in fixatives; hence Whitnall's objections to modern techniques would not seem applicable to the works of the older anatomists.

Schwalbe[13] described the capsule of Tenon as being divided into a visceral and a parietal layer. Of the two, the outer or parietal layer is the thicker and more easily defined and is the portion usually described as the capsule of Tenon. It is also referred to by some as the *fascia bulbi.*

The visceral layer, which covers the sclera and the region about the tendinous insertions of the oculorotary muscles, is thin and delicate. The space between the two layers is known as the *space of Tenon* or the *suprascleral lymph space of Schwalbe.* Delicate connective tissue fibers are found extending directly and obliquely across this space between the two layers.

In tenonitis, Lockwood[5] believed that it was the visceral layer of the capsule which was primarily involved, since the visceral layer is very similar to episcleral tissue.

There is universal agreement that the capsule of Tenon posteriorly is rather firmly adherent to the sclera around the point of exit of the optic nerve and that it fuses with the dural sheath of the nerve at their junction. Lockwood reported that the parietal layer of the capsule is composed of white fibrous tissue and elastic tissue while the visceral layer is mostly loose areolar tissue. Bonnet referred to the visceral layer as *subconjunctival fascia.*

Where the oculorotary muscles enter the capsule on the way to their scleral insertions, there are six visible openings. Each muscle is lightly attached to its own opening by the visceral layer of the capsule of Tenon. Lockwood described a band of fibers embedded in the capsule crossing the posterior edge of each opening and called these bands the *intracapsular ligaments* (fig. 3). There have been some interesting suppositions about these structures.

Ferrall[11] supposed that the intracapsular ligaments acted as pulleys over which the muscles worked, but this seems very doubtful. Whitnall[2] flatly stated that ". . . there are no pulley bars or intracapsular ligaments, and no need for them."

Lockwood,[5] however, described the intracapsular ligaments and said of those of the medial and lateral rectus muscles that their inferior ends were attached to the suspensory ligament (of Lockwood) and thus held firmly in place. He had a particularly interesting observation about the intracapsular ligament of the superior rectus, saying that

". . . it is quite lengthy, its inner extremity being fastened to the trochlea while the outer is attached to the wall of the orbit just above the lateral rectus muscle. Its oblique direction alters decidedly the pull of the tendon of the superior rectus which must turn nasally after passing through its opening in the capsule to reach its insertion in the sclera."

In speaking of the inferior oblique, Lockwood wrote that ". . . its aperture is just behind and lateral to that for the inferior rectus in the capsule, but it is separated from it by the intracapsular ligament which the suspensory ligament forms for that muscle and, in addition, by a small oblique band of fibers which cross the upper surface of the

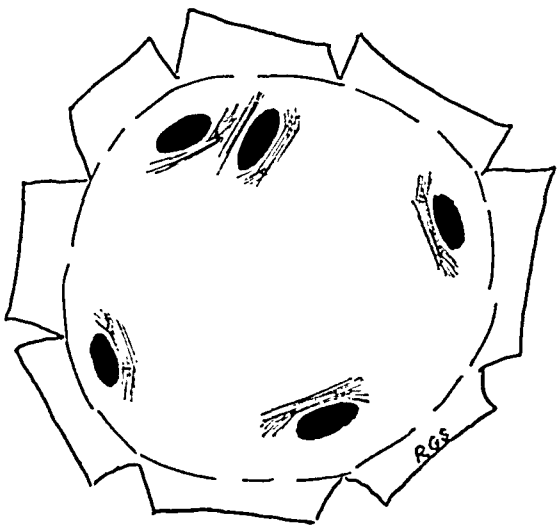


Fig. 3 (Scobee). Drawing showing the inside of Tenon's capsule after the globe has been removed. The points of entrance of all of the oculorotary muscles except the superior oblique are shown as black holes. The thickenings at the posterior margin of each hole are the intracapsular ligaments described by Lockwood.

suspensory ligament." Whitnall[2] is the only investigator who denies the existence of the intracapsular ligaments.

Intermuscular Membrane, Check Ligaments and Muscle Sheaths

It has been previously stated that the middle third of the capsule of Tenon is perforated by the six oculorotary muscles in their course toward their scleral insertions. At the point where each muscle passes through the capsule, the parietal or outer layer is reflected backward along each muscle as a sheath—*the muscle sheath.*

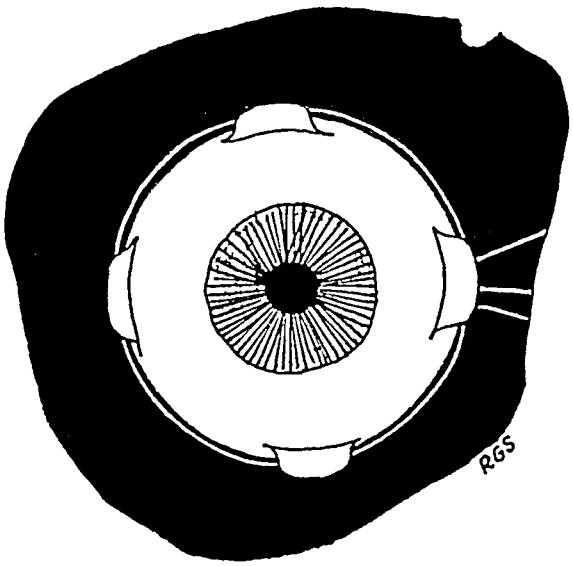


Fig. 4 (Scobee). Diagram showing the intermuscular membrane running between the four rectus muscles. The muscle sheaths are not clearly shown but the three normal check ligaments of the medial rectus muscle are shown fanning out from muscle sheath to periorbita.

According to some investigators, the sheath of each muscle extends all the way back to the point of origin of the muscle, although it is quite true that the sheaths in the posterior half of the orbit become quite thin and difficult to distinguish.

The portion of the fascia of the orbit forming the muscle sheaths is known as the *muscular fascia* and, in addition to ensheathing each muscle completely, the muscular fascia stretches as a membrane between the adjacent margins of the rectus muscles.

This latter structure is known as the *intermuscular membrane* and is usually thickest between the superior and lateral rectus muscles. According to Whitnall[2] the backward extension of the intermuscular membrane is usually greatly exaggerated and practically only extends for a short distance behind the globe.

INTERMUSCULAR MEMBRANE

Poirier[14] described the intermuscular membrane in some detail in 1912 and stated that it separated the fat of the orbit into two layers, one central and the other peripheral, and controlled to a certain extent the progress of any infiltration which might occur in that region. Whitnall objected to Poirier's work on technical grounds and his idea on

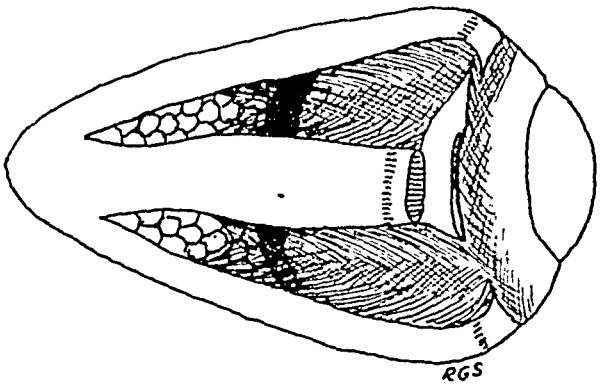


Fig. 5 (Scobee). Drawing showing the method of Jameson in performing what he called "vertical capsulotomy" on the intermuscular membrane. The muscle has been severed from its insertion and is retracted slightly. The intermuscular membrane has been cut vertically from the insertion of the muscle up to the margin of the insertion of the superior rectus muscle.

the posterior limits of the intermuscular membrane has just been cited.

Butler[15] reported a patient with pus confined to the muscle cone; there were proptosis, pain, and rigors but three incisions for orbital drainage failed to locate any purulent material. It was not until enucleation was performed that pus was encountered and it was found within the muscle cone, confined there by the intermuscular membrane. It is perfectly true that in thin and feeble subjects, however, the membrane may be poorly delimited and difficult to demonstrate.

Jameson[16] was one of the first to mention the clinical significance of the intermuscular membrane in the surgical treatment of heterotropia. In performing his operation of recession, Jameson did what he called a "vertical capsulotomy" in which he incised the intermuscular membrane vertically from the superior margin of the medial rectus at its insertion to the superior rectus and from the inferior margin of the medial rectus downward to the inferior rectus.

Lancaster[17] pointed out that when a muscle's tendon is cut at its insertion into the sclera, the muscle and tendon are not left free and unattached to retract indefinitely into the orbit. On the contrary, the cut tendon retracts only from 3 to 5 mm. or even less because the capsule of Tenon which envelops the muscle is attached to the sclera at about the same distance from the cornea as the tendon insertion, and its connection with the muscle (that is, the intermuscular membrane) is sufficiently firm and intimate to serve as a secondary attachment for the muscle.

If the intermuscular membrane is not divided, one gets nowhere near the maximum effect possible from recession of a muscle. The idea of the recession operation is to reduce the mechanical advantage of a muscle by reinserting it posteriorly on the globe and thus reducing not only its tension but also its arc of contact. If there are broad secondary attachments of the muscle, the mere recession of its tendinous insertion alone, leaving the intermuscular membrane intact, will accomplish but little in comparison with what the operation might do potentially.

The direction in which the intermuscular membrane is cut in the recession operation has a definite bearing upon the amount of correction which may be obtained.[1] As has been mentioned, Jameson sectioned the intermuscular membrane vertically. Even more correction will be obtained if the membrane is sectioned parallel to and within a millimeter or two of the borders of the muscle being recessed, and the membrane should be divided as far posteriorly as it extends.

The intermuscular membrane may have an anomalous development in certain parts which seems to play a definite role in the etiology of heterotropia.[1]

For example, in the patient with intermittent exotropia, it is not at all an uncommon finding for the intermuscular membrane between the lateral rectus and inferior rectus muscles to be markedly thickened and very tough; such an anomaly has the effect of giving the lateral rectus a much wider and heavier attachment than is normal and increasing the action of the muscle to that extent. It is extremely important to divide this thickened portion of the intermuscular membrane completely from the lateral rectus muscle when operating on patients with intermittent exotropia.

The muscle sheaths of all six of the oculorotary muscles have offshoots from their outer or orbital surfaces which become attached either directly or indirectly to the periobita, or to some other portion of the fascia of the orbit. These extensions of the muscle sheaths are known as *check ligaments,* but have also been called *fascienzipfel* or *ailerons.*

Check Ligaments

It is interesting that Tenon[7] believed that the check ligaments altered the direction of the muscles to the extent that, during their contraction, they would not exert pressure upon the globe. Cruveilhier[18] raised doubts about this point, and Lockwood[5] pointed out, quite logically, that the check ligaments of the horizontal rectus muscles, for example, leave the wall of the orbit almost exactly opposite the equator of the globe and run backward nearly half an inch before becoming continuous with the muscle sheaths; this union is far behind the place where the arc of contact of the muscles begins so that the check ligaments would be quite inefficient in preventing pressure upon any part of the globe during contraction of the muscle from whose sheath they arise.

All investigators beginning with Tenon have unanimously agreed on the primary action of the check ligaments in preventing or checking undue contraction of the muscle from whose sheath they spring.

A point that does not seem to be recognized at all, however, is that the check ligaments may act to check motion in *two* directions,[19, 1] particularly if they are unusually thick or have some other anomalous character.

Not only may the check ligaments of the medial rectus muscle prevent excessive contraction of that muscle and thus prevent excessive adduction of the eye, but abnormalities of the check ligaments of this same muscle may also prevent its free relaxation when its antagonist, the lateral rectus, is contracting and thus prevent free abduction of the globe as well. Limitation of motion thus produced may well be an important underlying anatomic factor in the etiology of heterotropia.[1]

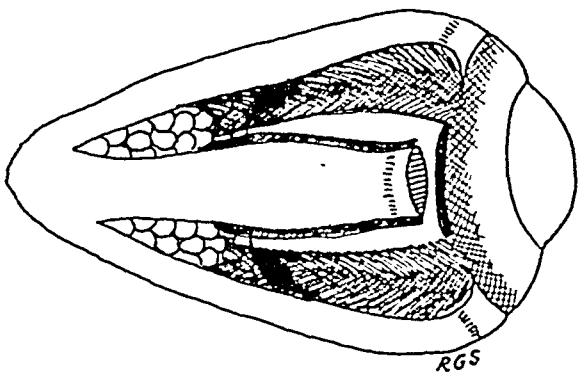


Fig. 6 (Scobee). The intermuscular membrane severed horizontally from the muscle insertion to the posterior extremity of the membrane. It has been divided parallel to the borders of the muscle above and below at a point between 1 and 2 mm. from the muscle borders. This procedure allows a recession to gain its maximum effect.

There are three main types of anomalous check ligaments which are found very commonly in heterotropia:[1] (1) Extra and thickened check ligaments, (2) posterior check ligaments, and (3) fused check ligaments. Any of these types may prevent free abduction of an eye when present on the medial rectus muscle, or free adduction when on the lateral rectus muscle. They must be sectioned at operation if the surgical therapy of heterotropia is to be consistently successful and if the surgeon is to

get the maximum effect desired from the operation of recession.

The check ligaments of the horizontal rectus muscles are not a single simple sheet of fascia as was once thought, but instead there are several sheets fanning out from the muscle sheath to reach insertions in the periorbita. When the check ligaments of the medial rectus, for example, are put on a stretch at the time of surgery, they remind one of the pages of a book fanning out from the binding when the covers of the book are purposely held open with back to back.[19]

The greatest width of the check ligaments anteroposteriorly of the lateral rectus is between 6 and 8 mm. while the distance from the anterior end of their orbital insertion to their point of union with the sheath of the muscle posteriorly measures 18 to 20 mm. The point of greatest thickness lies at a distance of from 3 to 6 mm. from the orbital insertion.

These check ligaments are not particularly dense but are composed of a number of bundles of parallel fibers; the fasciculi are separated by small adipose tissue masses, little veins, and lobules of the lacrimal gland. The tiny veins just mentioned are the source of the relatively profuse bleeding encountered in cutting the check ligaments of this muscle when the surgeon has been careful to avoid cutting the anterior ciliary artery until it has been compressed in the suture placed in the tendon of this muscle.

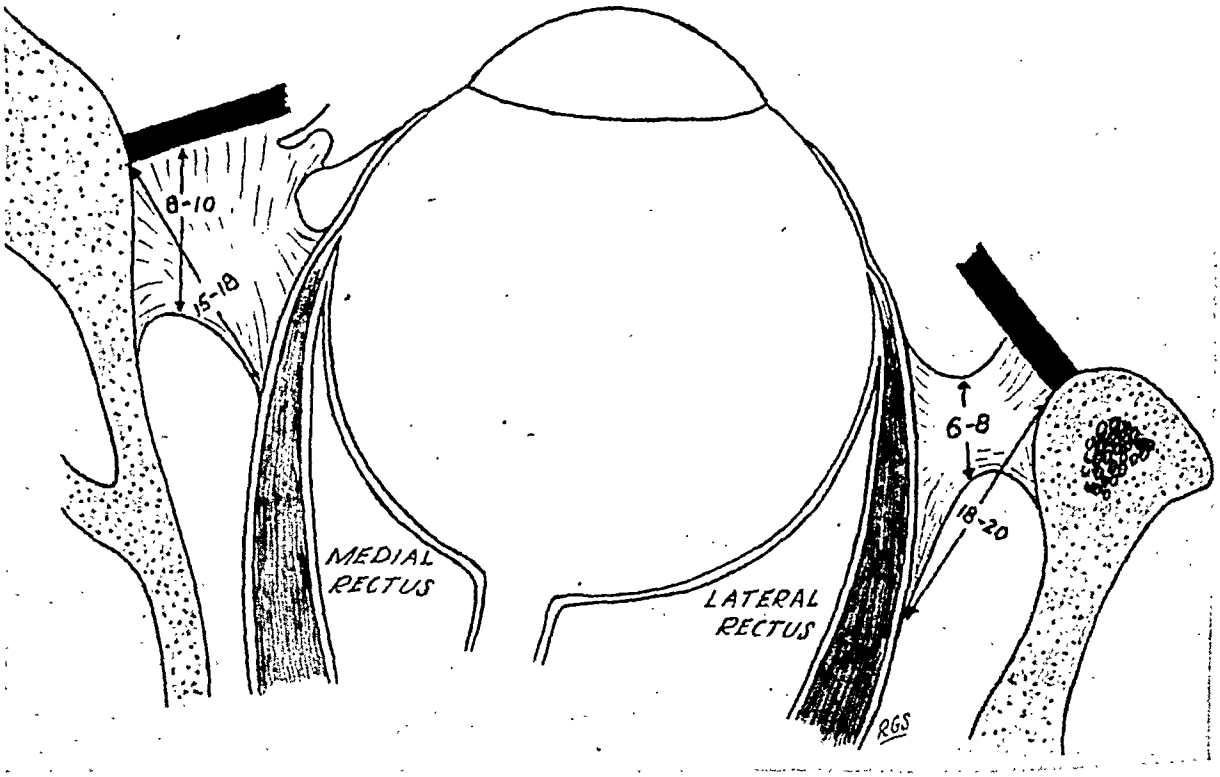


Fig. 7 (Scobee). Diagram showing dimensions of the check ligaments of the horizontal rectus muscles as seen from above.

The check ligaments of the lateral rectus muscle are more easily demonstrated than those of the medial rectus. They form a wedge-shaped structure with the base of the wedge fastened by a vertical attachment to the periorbita over the malar bone, dorsal to the lateral palpebral ligament, in an area about 6 or 7 mm. long; the apex of the wedge is continuous with the sheath of the lateral rectus.[20]

In this posterior two thirds, the check ligaments of the lateral rectus correspond closely with the structure of the muscle

sheath, while their anterior third often contains plain muscle fibers which have been repeatedly demonstrated by many investigators[20] since Sappey[4] first described them. Most of the fibers of the check ligaments of the lateral rectus are elastic tissue.[5]

The check ligaments of the lateral rectus muscle, in addition to their insertion over the orbital tubercle on the lateral wall of the orbit, are also attached to the posterior face of the lateral palpebral ligament (which is also inserted into the orbital tubercle) and into the conjunctiva of the lateral fornix.

The check ligaments of the medial rectus muscle present a similar triangular formation to those of the lateral rectus[20] and are attached to the medial wall of the orbit over the lacrimal bone just behind the posterior lacrimal crest. They are also attached to the septum orbitale behind the pars lacrimalis muscle of Müller, to the lacrimal caruncle, and to the conjunctiva in the medial fornix.

These check ligaments are wider than those of the lateral rectus muscle (8 to 10 mm. as compared with 6 to 8 mm.), but their thickness of 1.0 to 1.5 mm. is less than that of the ligaments of the lateral rectus. They are shorter (15 to 18 mm.) than those of the lateral rectus (18 to 20 mm.).

Sutton[20] described many hairlike fibrous projections from the check ligaments of the medial rectus which unite with the capsules of the adipose masses in that region. There are no interstices similar to those found in the lateral rectus check ligaments. Plain muscle fibers have also been demonstrated in the anterior third of these check ligaments. According to Motais, the check ligaments of the medial rectus have more elastic fibers than do those of the lateral rectus.

Any of the anomalies of the check ligaments previously mentioned may play an important role in the etiology of heterotropia. It is, therefore, essential that the check ligaments be divided from the muscle sheath when a recession operation is done if the surgeon is to get the full and proper effect from this procedure.[19, 1]

The fact that the check ligaments of the medial rectus muscles are attached to the caruncle, to the medial conjunctival fornix, to the posterior surface of the medial palpebral ligament, and to the periorbita of the medial wall of the orbit has been mentioned. If the full effect of a recession operation is to be gained, all of the check ligaments must be severed.

In the past, various writers have strenuously objected to cutting the check ligaments on the grounds that in the case of the medial rectus such a procedure leads to retraction of the caruncle. Quite the opposite is true and for obvious mechanical reasons.[1] The check ligaments prevent excessive contraction of the muscle from whose sheath they arise; this is to say that they prevent undue shortening of the muscle.

A recession operation is the equivalent in one respect to a shortening of the muscle in contraction in that either event places a certain amount of stress upon intact check ligaments. When the check ligaments of the medial rectus muscle are put under stress, since they are attached to the caruncle, there results a retraction of the caruncle. If, however, the check ligaments of the muscle are divided before the muscle is recessed, no strain is placed upon the check ligaments and hence there is no retraction of the caruncle.

The facts speak for themselves and are proved by a series of over 120 patients[1] with esotropia in whom the check ligaments of the medial rectus muscle have been completely severed from the sheath of the muscle prior to a recession of that muscle; there has been not a single instance of retraction of the caruncle postoperatively in the entire series.

A word of caution must be inserted about exercising care when cutting check ligaments from the muscle sheath. This procedure does not involve stripping the sheath from the muscle to leave the latter bare and exposed; it merely entails cutting the check ligaments close to the point where they origi-

nate from the sheath. There are serious objections to stripping a muscle of its sheath because adhesions invariably form between bare muscle and any adjacent tissue and this is very undesirable.

Ledouble[21] first described a fasciculus of striated muscle in the check ligaments of both horizontal rectus muscles and said that they were fairly frequent in occurrence and were presumably offshoots of the muscles themselves. Such offshoots are not uncommon in patients with heterotropia and may play a role in the etiology of the heterotropia.[1]

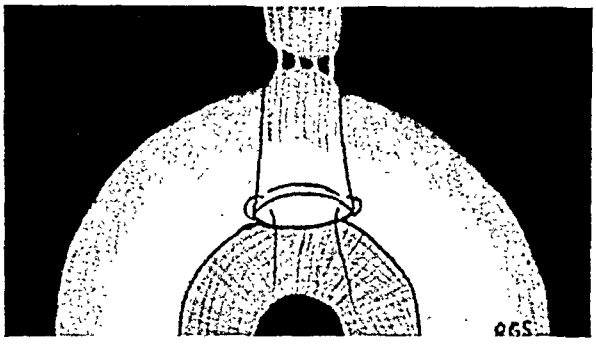


Fig. 8 (Scobee). Schematic drawing of the eyeball showing only the superior rectus severed from its insertion and pulled forward and downward by means of sutures. The levator is shown above and the usual four dentate connections between the two muscles can be seen put on a stretch by this maneuver.

Muscle sheaths

The relations of the sheaths of the rectus muscles are all of the same type; at the point where muscle tendon is inserted into sclera, the sheath passes from the internal or ocular surface of the muscle backward as part of the middle third of the capsule of Tenon. The sheath passes from the external or orbital surface forward to find attachment partly into the fornix of the conjunctiva and partly into the sclera near the limbus. There are certain modifications in the case of each individual rectus muscle. The relations of the superior rectus, for example, are complicated by the presence of the levator.

The muscle sheath of the superior rectus is similar to those of the other recti already mentioned but it has no check ligaments similar to those of the horizontal rectus muscles. Its sheath and that of the levator are rather intimately attached since the two muscles are in close apposition throughout most of their course.

Through its adherence to the levator via their sheaths, the superior rectus gains a form of attachment to the aponeurosis of the levator and to the superior tarsal cartilage in addition to its attachment to the bulbar conjunctiva and the superior conjunctival fornix.

The lateral attachments of the levator to the orbital walls act as check ligaments for that muscle and, according to Cruveilhier,[18] make the tarsal cartilage of the upper lid function like the visor of a helmet. The check ligaments of the levator also function as check ligaments of the superior rectus because of the intimate relationship between the two muscles and furthermore the superior rectus can partially lift the upper lid for the same reason.

If one carefully pulls the superior rectus downward away from the levator, there are usually four fairly thin sheets of fascia running longitudinally between the two muscles, and these sheets, when put on a stretch and viewed anteriorly, have a dentate appearance.

If a recession operation on the superior rectus is to be fully effective, not only must the intermuscular membrane be divided on each side of the muscle as far back as it extends, but the connections between the sheaths of the superior rectus and the levator must be gently divided without stripping either muscle of its sheath and leaving it bare.

If this latter procedure is not done, the effect of a recession will be minimal because the attachments between the superior rectus and the levator will prevent the recessed superior rectus from retracting properly.

Failure to observe this simple precaution is responsible for much of the widespread dissatisfaction with recession of the superior rectus muscle on the grounds that it is a relatively ineffective and always unpredictable procedure. When the operation is properly done, it is neither ineffective nor unpredictable.

The superior oblique in early fetal life has no connection with the wall of the orbit. As the muscle develops, it gradually approaches the wall of the orbit and finally becomes attached to it. In the course of the development, the trochlea is a secondary structure. The attachment of the sheath of the superior oblique to the trochlea is by small sheets of fascia given off both before and after the sheath containing the muscle has passed through the trochlea.[20]

Various authorities disagree about the extent of the muscle sheath of the superior oblique. Lockwood[5] believed that it extended only from Tenon's capsule to the trochlea. Sutton[20] found it extending on backward through the trochlea but did not state how far. Fink[22] found that a recognizable sheath extended some 8 to 10 mm. posteriorly from the trochlea.

Others have stated that it extends about half way backward from the trochlea to the origin of the muscle, while still others claim that it covers the muscle in its entire course from origin to trochlea and from trochlea to the globe. It seems likely that the thick and obvious portion of the sheath runs from the capsule to and through the trochlea and then becomes progressively thinner as it is traced posteriorly until it blends almost imperceptibly with the perimysium.

Berke[23] has effectively demonstrated that the tendon of the superior oblique is intimately attached to its encasing sheath from trochlea to globe by countless tiny trabeculae. If the tendon is divided within its sheath, the cut ends retract a short distance before they are stopped by the anchoring effect of these hundreds of tiny trabeculae.

Because of this fact, Berke has proposed the very effective procedure of intrasheath tenotomy of the superior oblique as a lengthening operation for that muscle in patients in whom it is desired to lessen its action. Gradations of effect may be obtained from the smallest, by simple tenotomy, to the greatest, by actual tenectomy of varying lengths of tendon. The operation is easy to do and is very satisfactory.

The sheath of the inferior rectus is quite similar to that of the other rectus muscles except anteriorly where it divides into two layers: a superior one which joins the capsule of the globe and runs forward to become inserted into the sclera near the limbus, and an inferior layer which is inserted into the posterior border of the sheath of the inferior oblique as well as into the suspensory ligament of Lockwood.

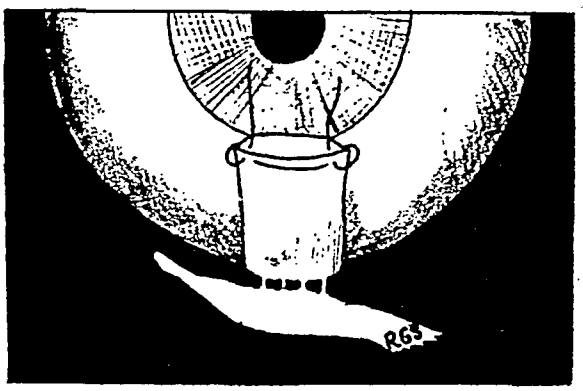


Fig. 9 (Scobee). Schematic drawing of the eyeball showing only the inferior rectus severed from its insertion and pulled forward and upward out of its bed in the suspensory ligament by means of traction sutures. The inferior oblique is represented below and the usual four dentate connections between the inferior rectus and its bed can be seen when put on a stretch by this maneuver.

Once the inferior rectus has passed through its opening in the capsule of Tenon, it runs forward to its insertion lying in a bed formed by the suspensory ligament. If the inferior rectus is lifted carefully upward and out of its bed, it is usual to find four thin sheets of fascia running longitudinally with the muscle and connecting the muscle

sheath to the suspensory ligament; viewed anteriorly when put on a stretch, these have a dentate appearance similar to the same connections found between the superior rectus and the levator.

It is to be emphasized that the sheath of the inferior rectus is attached by fascial sheets only to the suspensory ligament of Lockwood and to the posterior surface of the sheath of the inferior oblique. The bands to these two attachments are the check ligaments of the inferior rectus. Unless they are divided, the recession operation is neither completely successful nor satisfactory.

For many years, one objection to recession of the inferior rectus has been that the procedure leads to retraction or drooping of the lower eyelid. It will be noted that the sheath of the inferior rectus has no direct connection to the tarsus of the lower lid. As will be pointed out in subsequent paragraphs, however, the suspensory ligament of Lockwood is connected to the tarsus of the lower lid and so is the check ligament of the inferior oblique. Thus, the sheath of the inferior rectus has two indirect connections with the lower lid.

If the inferior rectus is recessed and the connections of its sheath with the sheath of the inferior oblique and with the suspensory ligament of Lockwood are not divided, backward tension is placed on both of these structures—tension which is transmitted through them to the tarsus of the lower lid, resulting in retraction or drooping of that lid.

If, however, the sheath of the inferior rectus is divided from its attachments in the operation of recession, no backward tension is created and there is no drooping or retraction of the lower lid.

Again, as in the case of retraction of the caruncle, the simple mechanical facts are obvious and have been proved in a suitable number of cases. Furthermore, unless these attachments of the sheath of the inferior rectus are divided in the operation of recession, the operation will not have its maximum effect and the results will be highly unpredictable, just as in the case of the superior rectus.

As soon as the surgeon stops avoiding the vertical rectus muscles because recession operations on them are "unsatisfactory" and begins to do the operation properly with due regard for the mechanics of the situation, just so much sooner will the surgical therapy of the vertical deviations gain a sound footing on the basis of cases successfully handled.

Ligament of Lockwood

Before considering the sheath and check ligament of the inferior oblique, it would be well to mention the ligament of Lockwood. We shall return to the original work of Lockwood[5] for his own description first. "The suspensory ligament is a band of fibrous tissue stretched, like a sling, from one side of the orbit to the other. The fibers which compose it converge at each end to be inserted into the malar and lacrimal bones; in the middle they diverge to form a shallow cup upon which the eye rests. The widest part of the suspensory ligament is intimately woven with the capsule of Tenon, but not to such an extent as to conceal the identity of its fibers."

Lockwood continued: "The inferior portion of the capsule of Tenon is thickened and has an aperture through which the inferior rectus passes. The posterior part of Tenon's capsule inferiorly is thickest just behind this opening for the inferior rectus and gradually becomes thinner as it passes round the eye; the anterior part looks crescentic and sends a long thin horn backward beneath the inferior rectus, forming the upper layer of the underpart of its sheath, and another forward to become continuous with the ocular conjunctiva and the inferior tarsal cartilage. It is united to the inferior cartilage by a short thick process which it gives off in front. In contact with its lower surface is the sheath of the inferior oblique.

Where the suspensory ligament mingles with the capsule of Tenon, the thickness is slightly more than one tenth of an inch. The most important action of the suspensory ligament is, obviously, to support the eye."

Fink[24] has recently emphasized and carried forward the work of Lockwood. He has shown that both inferior rectus and inferior oblique have attachments of their sheaths to the suspensory ligament which vary tremendously in density and number from one specimen to the next. Fink makes the flat statement that ". . . the inferior rectus apparently has no direct attachment to the orbital septum or margin of the orbit"; Lockwood, on the other hand, made no such statement although he strongly implied that this was the case by merely not mentioning any attachment of the inferior rectus to the orbital wall.

The sheath of the inferior oblique extends from its origin on the floor of the orbit along the muscle to a point where its outer layer fuses rather firmly with the inferior surface of the ligament of Lockwood. The muscle itself, accompanied by the inner layer of its sheath, meanwhile penetrates the suspensory ligament and the capsule of Tenon at a point somewhat posterior and lateral to the site of penetration of the inferior rectus muscle. The inferior oblique passes on through the suspensory ligament and the capsule of Tenon to its insertion near the macula.

Near the insertion of the inferior oblique, its sheath spreads out anteriorly to fuse with the sheath of the lateral rectus muscle; posteriorly, its sheath spreads out to fuse with the dura of the optic nerve.[22] The union between the sheaths of the inferior oblique and lateral rectus is sometimes quite firm and effectively binds the two muscles together while at other times it is very loose.[24]

The posterior extension of the sheath of the inferior oblique usually fuses with the dura of the optic nerve and is pierced by the posterior ciliary arteries and nerves which enter the globe temporal to the optic nerve. Fink[22] has emphasized that effective surgery of the inferior oblique includes division of both of the attachments of its sheath to the lateral rectus muscle and to the optic nerve and a good deal of caution is required in separating the latter.

Motais[25] originally described what he considered to be a check ligament for the inferior oblique, but Whitnall[2] denied the existence of any such structure. The recent work of Fink[24] confirms the general findings of Motais, however, and is detailed enough to leave little doubt that such a structure exists.

According to Fink, the check ligament of the inferior oblique muscle leaves the anterior border of that muscle about 8 or 10 mm. from its point of origin and courses obliquely forward, outward, and downward; it leaves the sheath of the inferior oblique at an angle of about 110 degrees.

The check ligament is about 10 to 12 mm. in length and is probably better described as a broad meshwork of fascial fibers rather than as a definite band or ligament, but it serves as an attachment for the sheath of the inferior oblique to the floor of the orbit at a point 4 or 5 mm. behind the orbital margin. Its width varies at different parts of its course so that it presents the shape of two triangles united by their apexes.

Together with the inferior oblique itself, the check ligament forms a kind of musculoaponeurotic loop, the two ends of which are inserted near the orbital margin, one at the outer angle and the other at the inner angle. Strands from the sheath of the inferior rectus, which might be considered as its check ligaments, embrace the midde portion of this loop so that when the inferior rectus contracts, these attachments stretch the loop.[24]

Motais[25] called the ligament of the inferior oblique a ". . . pulley of reflection," suggesting that when the muscle contracted, its check ligament pulled the middle of the belly outward and laterally, thus making its

line of traction on the globe a little less oblique. This would, of course, result in greater elevation and less extortion, particularly in adduction, and would explain even more fully the observed phenomenon of normal overaction of the inferior oblique.[19]

The septum orbitale

The septum orbitale is another portion of the fascia of the orbit which is a connective and elastic tissue membrane extending from the arcus marginale all around the opening of the orbit centrally toward the palpebral fissure. The septum in the upper lid is inserted into the skin of the upper lid, being carried forward by the levator fibers.

Whitnall[2] has pointed out that when the downward extending septum meets the levator fibers, its deeper layers are carried slightly backward to fuse with the levator's aponeurosis, thus shutting off the orbital contents from the interior of the upper lid.

He has also shown that in the upper lid, the septum orbitale is not fixed in a vertical plane but moves and folds with movements of the lids. The septum orbitale coming from the inferior portions of the arcus marginale is inserted into the inferior margin of the tarsal plate of the lower lid.

The palpebral ligaments

The medial and lateral palpebral ligaments are the final portions of the fascia of the orbit to be considered. They arise as extensions of the ends of the tarsal plates in the upper and lower lids and fuse at the inner and outer canthi to run as single ligaments to the medial or lateral wall of the orbit, as the case may be.

Whitnall[2] has shown that the medial palpebral ligament runs anterior to the dome of the lacrimal sac; immediately after it is formed, however, by a confluence of extensions from the medial ends of the tarsal plates, it gives off a smaller posterior division which runs behind the dome of the lacrimal sac to be inserted on the posterior lacrimal crest and it is to this posterior extension that the check ligaments of the medial rectus muscle become attached.

The lateral palpebral ligament is attached to the orbital tubercle of the zygomatic bone. Injuries which result in complete division of the medial palpebral ligament are quite disfiguring cosmetically because of the sunken appearance of the medial canthus which is produced.

Callahan[26] has recently reported the use of fine steel wire passed from the cut end of such a sectioned medial ligament to the medial wall of the orbit and through small holes drilled in the bone there by means of a dental drill; this results in a very satisfactory repair by abolishing the sunken inner canthus.

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THE VERTICAL ELEMENT IN THE CAUSATION OF SO-CALLED HORIZONTAL CONCOMITANT STRABISMUS*

Surgical principles for the vertical corrections

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Strabismus is an abnormality of the visual axes due to several different etiologic conditions. At this time paralytic lateral strabismus is not being considered but all other forms have a definite relationship to this presentation.

It seems, if one is to speak of a lateral concomitant squint with a vertical component present in that squint, that that case is not purely concomitant. If this is true, then also is it true that the most common form of pure lateral concomitant strabismus is the classical alternating type of strabismus wherein the patient has the same degree or angle of squint for near and for distance, both objective and subjective angles being the same, the refractive error being practically equal and negligible in each eye, and this having no relationship to the degree of squint in any convergence-accommodation ratio relationship. In this type of strabismus the patient frequently uses each eye at will, or one eye for near and the other eye for distance, and in these cases there is alternating suppression with alternate functional central scotomas. It is rather interesting to compare this type of squint (in considering vertical relationship) with a classical case of accommodative strabismus, that specific case also having a vertical component.

It is likely that the greatest etiologic factor in the development of strabismus is in the sensory realm. There is no doubt, however, that a large number of cases have, as a most important factor in etiology, a motor defect. It makes little difference whether this is peripheral (orbital) or central—that is, nuclear. See Figure 1. This patient, with a paralysis of the inferior oblique muscle and the superior rectus muscle, both on the left, could hardly have a peripheral incomplete abnormality. When one adds to that the finding of a unilateral ptosis on the right, then also does it seem certain that her condition must have been a bilateral, central, brainstem (probably internuclear) congenital developmental defect.

Figure 2 shows a frank alternating strabismus with no vertical component whatsoever; the right eye fixing, or the left eye fixing; it also illustrates the results following surgery. Even in this, however, with

* From the Graduate School of Medicine, University of Pennsylvania. Presented before the III Pan-American Congress of Ophthalmology, Havana, Cuba, January 8, 1948.

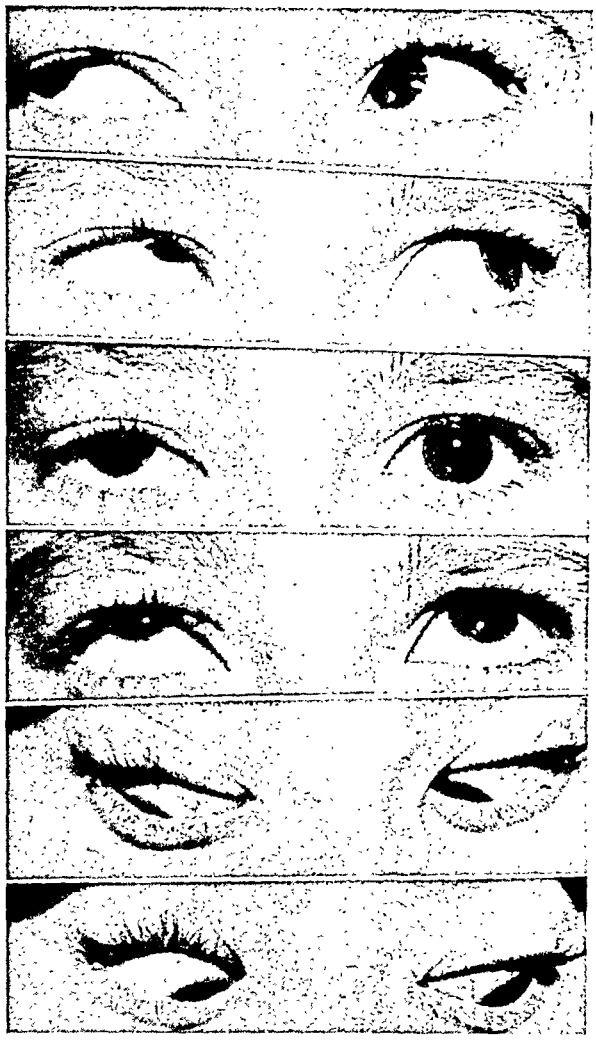


Fig. 1 (Spaeth). Paralysis of the inferior oblique and superior rectus muscles, both on the left. This could hardly have a peripheral incomplete abnormality.

careful study one can see a difference in the palpebral fissures and a bare suggestion of retraction in the right eye; that is, a motor defect. The patient had 6/6 vision in each eye; there were no limitations in ocular motility; he had a negligible equal refractive error of less than plus one (hyperopia), sphere and cylinder combined, bilateral suppression scotomas, and diplopia could not be elicited at any time.

Figure 3 illustrates an almost pure accommodative squint. Vision was 6/12 and 6/6. The refractive error was a plus four, total sphere and cylinder combined, in the right; and a plus two, sphere and cylinder combined, in the left eye. The squint increased at near and disappeared almost wholly under full cycloplegia and with the correcting glasses. There was no doubt that this case had a marked so-called accommodation-convergence relationship, without any lateral oculomotor palsy. The patient showed, however, in right lateral rotations, a definite overaction of the left inferior oblique muscle, the barest amount of overaction of the right inferior oblique muscle, and a slight underaction of both superior oblique muscles. There was no certainty that this child did not have a very moderate elevator palsy of some type. The case was wholly free from strabismus at near, under cycloplegia, and with her full correction.

If a paralysis of a vertical elevator was absent, then this case of practically pure accommodative strabismus must have had, in addition, an accompanying overaction of the inferior oblique muscles. One wonders whether this could be connected in any way with her overconvergence, in this way causing a bilateral inferior oblique spasm. That was simultaneous with the overconvergence and became most manifest when the eye was in a position for the maximum of vertical inferior oblique muscle action; that is, the inferior oblique muscle spasm being at maximum in the left eye with right rotations, and in the right eye with left rotations.

The question of a vertical component as a part of convergent strabismus, in fact of almost any type of lateral strabismus, should give us an inkling as to the causation of strabismus in a certain percentage of cases. This seems especially so when one studies all cases of strabismus, in detail, with the screen test, fixational reflexes, and with prisms in the six cardinal positions. Very few cases of apparently concomitant, nonaccommodative (even of accommodative), monocular lateral squint are found which do not have disturbances in the vertical rotations. The question of cause and effect for each of the two components is at least interesting.

Binocular vision is achieved by the de-

velopment of a conditioned reflex and not because of the presence of an inherent urge that compels the infant or young child to swing into single binocular vision, if this is possible. Fusion as such follows the establishment of this as a conditioned reflex. It (the reflex) is the result of the search and struggle for single binocular vision and the fixation of that, when achieved, and not because of it; that is, fusion or single binocular vision.

Fusion, as a term for an ocular function, is better considered as being quantitative in character, rather than qualitative. The simultaneous use of both eyes, and with this a single cerebral visual concept having certain characteristics (single binocular vision),



Fig. 2 (Spaeth). A frank alternating strabismus with no vertical component whatsoever.

while clumsy as a definition is a qualitative characteristic. The degree of perfection in this function (single binocular vision) as a conditioned reflex is to be measured in terms of fusion.

There are two factors which permit the formation of a perfectly conditioned reflex wherein the child obtains a single cerebral visual concept. They are the synchronous use

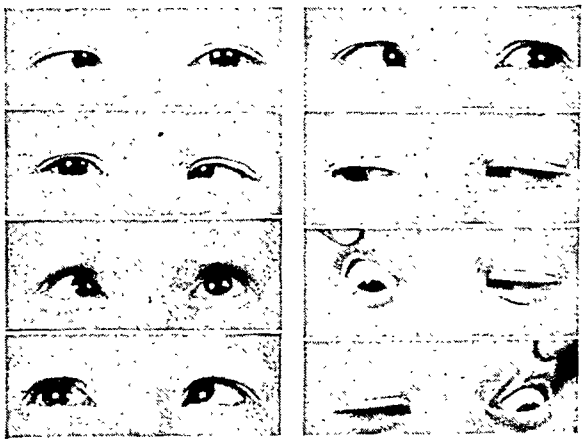


Fig. 3 (Spaeth). An almost pure accommodative squint.

of the two cerebral hemispheres and, at the same time, the simultaneous use of the two eyes. This, of necessity, implies the presence of two attributes or essentials; one is in the motor sphere, the other is in the sensory realm. If there are neither sensory nor motor obstacles present, the patient should progress normally to single binocular vision and this should be well established by the 4th or 5th year of life.

Motor obstacles may include such conditions as temporary to permanent anatomic disturbances from birth injuries, defects affecting the orbits and the globes, faulty insertion of muscles, fibrosis of a muscle (as one sees in the Duane syndrome) which is probably an imperfect mesodermal development of an ocular muscle, aplasia of an oculomotor nucleus, and contracture of the antagonist of a muscle imperfectly exercised.

Sensory obstacles must include not only the many possible peripheral sensory retinal situations, but also possible conflicts between the occipital lobe involuntary accommodational reflex, the frontal lobe voluntary accommodation-convergence reflex, and the internuclear brain stem accommodation-convergence reflex—normally of greatest importance in conditioning binocular single vision. An abnormal convergence innervation consequent to disturbances in these three is probably the greatest of the faults in the sensory realm. Such defects are either an

excess in convergence or a deficiency in convergence. A discussion of these is not relevant at this time, except to take recognition of the role they play. Also, one must not



Fig. 4 (Spaeth). A case of alternating divergent strabismus of a moderate degree of severity, with marked inferior oblique muscle overaction.

overlook the fact that the convergence excess of accommodative squint, with full correction (refraction), frequently shows a convergence insufficiency.

As the infant strives to develop single binocular vision, as a result of his awareness to diplopia, he may fail in meeting and overcoming sensory or motor obstacles and so he also fails to obtain normal single binocular vision. Instead, strabismus of some type develops through the conflict between a normal sensory situation and a faulty motor balance; or a faulty sensory state and a normal motor condition; or the not uncommon condition wherein both are faulty although to dissimilar degrees.

Faulty vertical function is an outstanding motor obstacle. It is not necessarily limited to convergent strabismus but it is for some reason somewhat less common in divergent strabismus. Divergent strabismus, except the monocular type, is not an attribute of very early childhood, and the incidence of divergent squint is rare, as compared with convergent squint. One might suspect that diverging visual axes discourages an overaction of the oblique muscles. This, however, seems to reverse the order of cause and effect. Disturbances in the vertical element nevertheless do appear frequently.

Figure 4 is a case of alternating divergent strabismus of a moderate degree of severity. The child in the upper photograph is fixing with the left eye. (See position of the pupillary reflexes.) Movements up and to the right and up and to the left show a marked overaction of the contralateral inferior oblique muscle. There were no disturbances

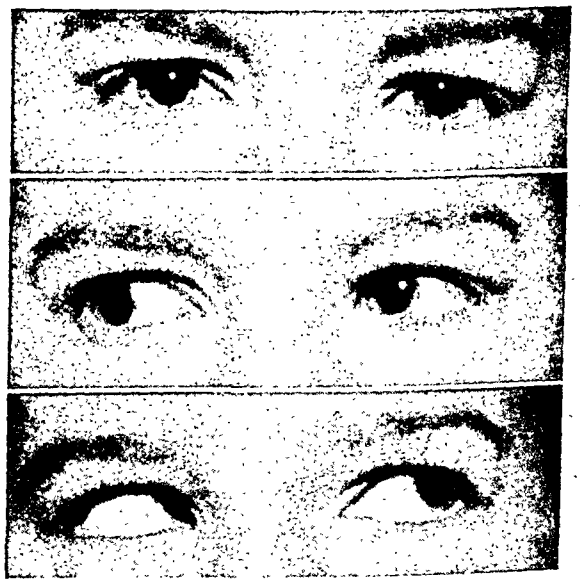


Fig. 5 (Spaeth). A unilateral case in which the inferior oblique muscle is rotating normally in amplitude but its conjugate yoke muscle is rotating to a limited degree.

in visual acuity. This is the type of case which will certainly continue to advance into more and more pathologic divergence.

In this paper, the term "overaction" is being used rather loosely. It is not always applied upon pure physiologic principles, but only in terms of an increase in the amplitude of excursions of the eyeball as the re-

sult of the action of a certain muscle. In addition, inhibitional palsy is not being considered for it is not relevant here.*

The vertical component is not necessarily the result of the overaction of an inferior



Fig. 6 (Spaeth). A bilateral case of the inferior oblique muscle rotating normally in amplitude but its conjugate yoke muscle rotating to a limited degree.

oblique muscle. There is no doubt that in many instances one can state definitely that there is limitation in the field of action of a superior rectus muscle and, therefore, the contralateral inferior oblique muscle is overacting secondarily. This can be explained upon the basis of two possibilities.

The first of the two is that the inferior oblique muscle is rotating normally in amplitude but its conjugative yoke muscle is rotating to a limited degree. The action of the inferior oblique muscle is relatively greater now only because of its normal nerve and muscle anatomy. This would be



Fig. 7 (Spaeth). A true overaction is caused when a greater than normal innervational effort is put forth in the attempt to obtain a maximum amplitude of movement in a paretic muscle, causing overstimulation of the conjugate yoke muscle.



Fig. 8 (Spaeth). A relative underaction of the right inferior rectus muscle and an overaction of the left superior oblique muscle. A congenital ptosis with a possible involvement of the superior rectus muscle is also present.

purely a peripheral situation and would exclude any effect from a desire for binocular single vision. Figure 5 seems to be such a case, unilaterally, and Figure 6 bilaterally. Neither of these patients had any lateral strabismus when under the cycloplegia, as photographed.

The second likely and certainly more frequent situation, as seen, for instance, with a paretic superior rectus muscle, occurs as follows. A greater than normal innervational effort is put forth by the patient in his attempt (or wish) to obtain a maximum amplitude of movement in this paretic

* This applies, in the vertical disturbances, in cases in which the patient is using, for fixation, the eye with an involved vertically acting muscle. The inhibitional involvement will then appear in the opposite eye. In such instances, considering the basic purposes of this presentation, both horizontal deviation and vertical inhibition might be seen in the same eye.

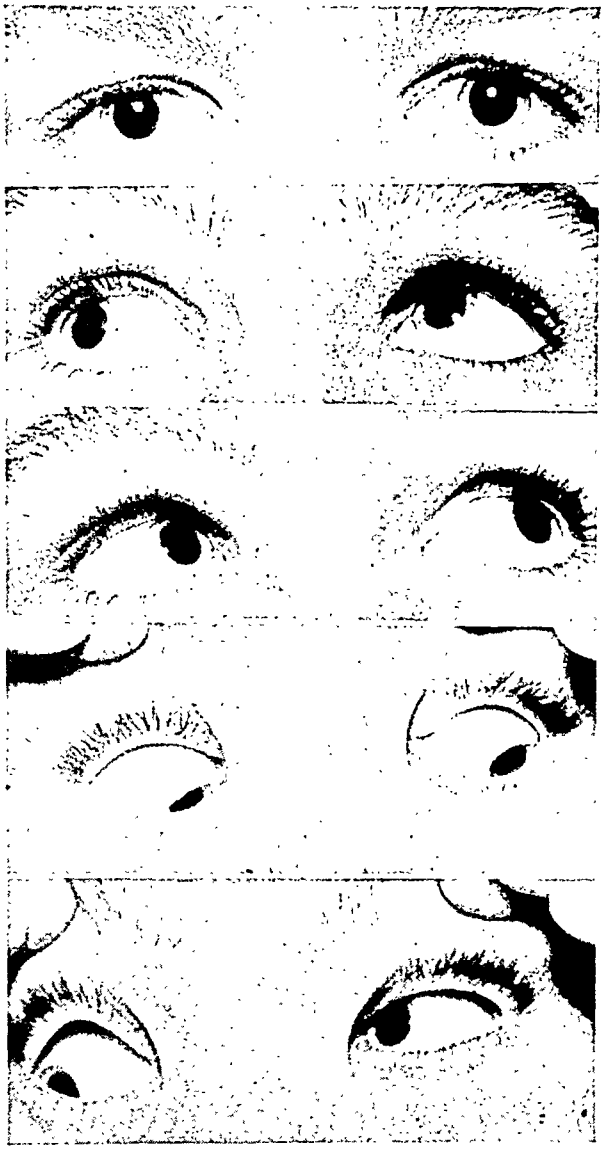


Fig. 9 (Spaeth). An accommodative strabismus, the horizontal component of which was eliminated by cycloplegia.

muscle, and perhaps to hold binocularity (distaste for diplopia) and because of that, the conjugate yoke muscle, cerebrally controlled and from a nuclear source, has a true overstimulation, and thus a true overaction. Figure 7 illustrates this condition and shows especially the overaction in the right eye.

Similarly, one should see this same relationship between an overacting superior oblique muscle in one eye and an underacting inferior rectus muscle in the contralateral eye. In these instances true limitation of the ocular rotations are picked up more rapidly.

Figure 8 shows, in downward movements to the right, a relative underaction of the right inferior rectus muscle and an overaction of the left superior oblique muscle. This was not present in left lateral rotations in which the depressors of both eyes were equal and balanced in the extent of their motility. The comparison of the maximum possible action of each inferior rectus, separately, is the important diagnostic criterion as to laterality in this case.

Figure 8 illustrates another complexity. This complication is that of a congenital ptosis of the left eye with a possible involvement of the left superior rectus muscle. Repeated studies in this child did suggest the possibility of a primary or essential overaction of the left superior oblique muscle in the presence of a normal right inferior rectus muscle. This was based upon a comparison in degrees of the rotations of the two inferior rectus muscles in the two eyes. The patient thus has a possible limitation in the action of the left superior rectus muscle, the left levator muscle, possibly the inferior rectus muscle in the right eye, and an overaction of the superior oblique muscle in the left eye. These muscle details are emphasized to illustrate the complexities in the diagnosis of the primary and the secondary deviations, as well as the effect of unilateral vertical muscle antagonists.

Another possibility which must be seriously considered is not a true or even relative overaction of a conjugate yoke muscle (primary paretic pathologic process in one eye; overaction in the other eye) but the relative overaction of the direct monocular muscle antagonist to a paretic muscle. In considering any one of the vertically acting muscles as, for instance, the superior oblique muscle, the question (fig. 9) is not one of a probable nuclear aplasia of the fourth-nerve nucleus or of any type of possible fourth-nerve involvement; it is specifically the consideration of a frankly underacting superior oblique in one eye with a strongly overacting inferior oblique in that same eye, the eyeballs being rotated for this demon-

stration into the position of greatest vertical action for the oblique muscles under consideration.

The child in Figure 9 has an accommodative strabismus (O.D.), the horizontal component of which was eliminated by cycloplegia (as can be seen in the upper of these photographs) wherein downward rotations to the right showed the paresis of the left superior oblique muscle, while upward rotations to the right brought out the overaction of the inferior oblique muscle of the same eye, the result of a direct monocular antagonist.

Another matter is relevant at this point. It is the all too frequently heard statement of a vertically acting "weak muscle." This adjective can be applicable only in cases of faulty muscle-tendon insertions, or of mesodermal maldevelopment. All other anatomic and hence functioning causes are more likely defects within (and in) innervation; hence, truely paretic in nature.

Figure 10 shows a similar but even more convincing case, although it is not a pure lateral concomitant strabismus. The patient had an almost complete paralysis of the superior division of the left third nerve. Marked secondary overaction of the right inferior oblique muscle is seen, mild underaction is present in the left inferior oblique muscle (perhaps the result of a subtotal paralysis of the left third nerve), and with it an overaction in the two direct monocular antagonists—the inferior rectus on the left, the result of the superior rectus paralysis; and the superior oblique on the left, the result of the underaction of the left inferior oblique muscle.

Figure 11 is a case in which both levators of the left eye were involved; that is, an evident impairment of the left inferior oblique muscle and a lesser degree of impairment of the left superior rectus muscle, suggested as such because of the overaction of the right inferior oblique muscle. It is interesting that in this patient there is no overaction in either of the monocular

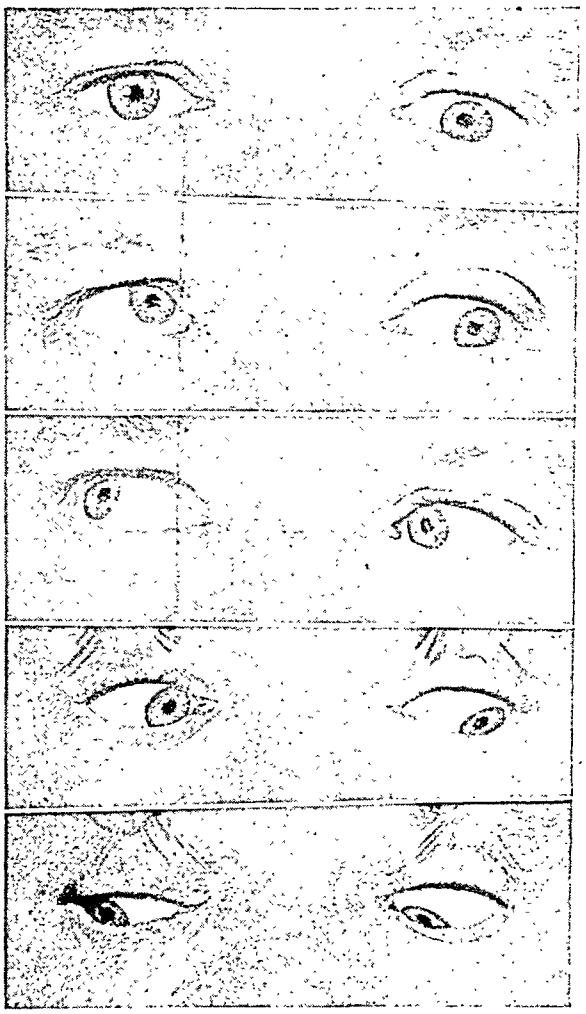


Fig. 10 (Spaeth). An almost complete paralysis of the superior division of the left third nerve.

direct antagonist muscles. This case illustrates well the fallacy of orthoptics in this type of case, except for those exercises to combat the amblyopia. This patient had had many months of exercises in another city, and the mother stated "without changing the cross-eye in any way." One wonders whether the vertical element was considered at the time the ophthalmologist outlined the orthoptic treatment.

Figure 12 presents a mild monocular convergent strabismus in the left eye, with a marked amblyopia. There is a marked increase in the convergent strabismus present when the patient is compelled to use the paretic inferior oblique muscle on the left. There is, however, no gross overaction of

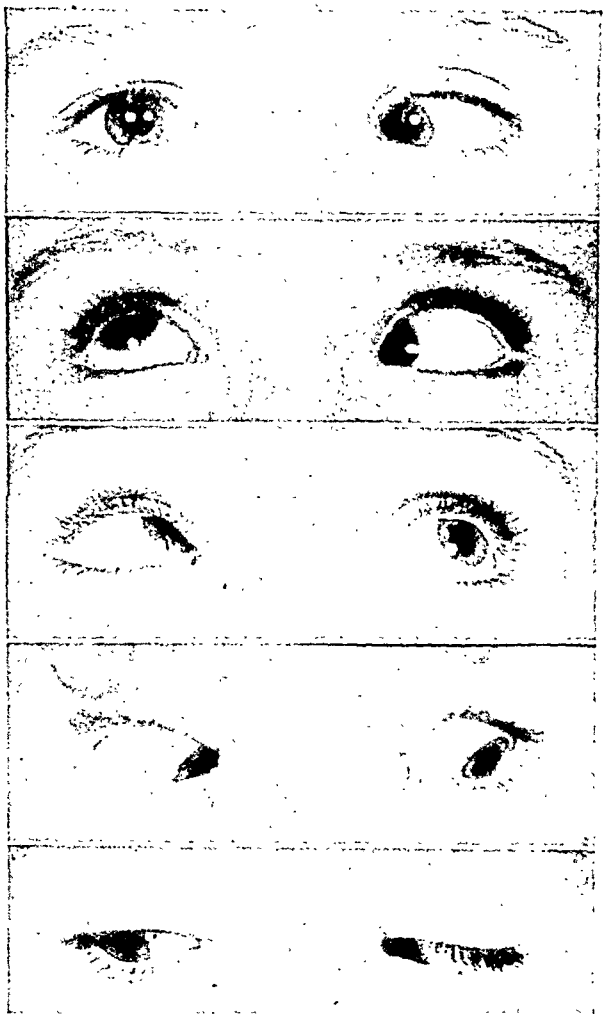


Fig. 11 (Spaeth). Impairment of both elevators of the left eye.

his conjugate muscle; in this instance, the superior rectus muscle on the right. Also, in his case there is little, if any, overaction of the monocular antagonist, the superior oblique muscle of the left eye. His vertical rotations to the opposite left side were normal and balanced. Here, certainly, one can see a *spasm* of an internal rectus muscle consequent to a vertical muscle disturbance.

Figure 13 is a case of bilateral limitation of equal degree in the field of the inferior oblique muscles.

This patient, aged four years, had a transient convergent strabismus, present when fatigued but with some amblyopia already established, showing the sensory suppression put forth for physiologic ocular comfort. There was neither contralateral synergist nor homolateral antagonist muscle overaction. There may have been some underaction of the left superior oblique muscle. The condition illustrated is essentially one of bilateral hypophoria. The patient is suppressing in one eye only; he has good stereopsis; and the inferior oblique muscles are both faulty. Torticollis was present and was constantly toward the right.

The problem of differentiating an overacting inferior rectus muscle with a contralateral relatively (comparative) underacting superior oblique muscle from an underacting superior rectus muscle with a contralateral relatively overacting (again comparative) inferior oblique muscle appears occasionally for solution in any certain case. Both of these conditions, frequently, have a marked degree of lateral strabismus.

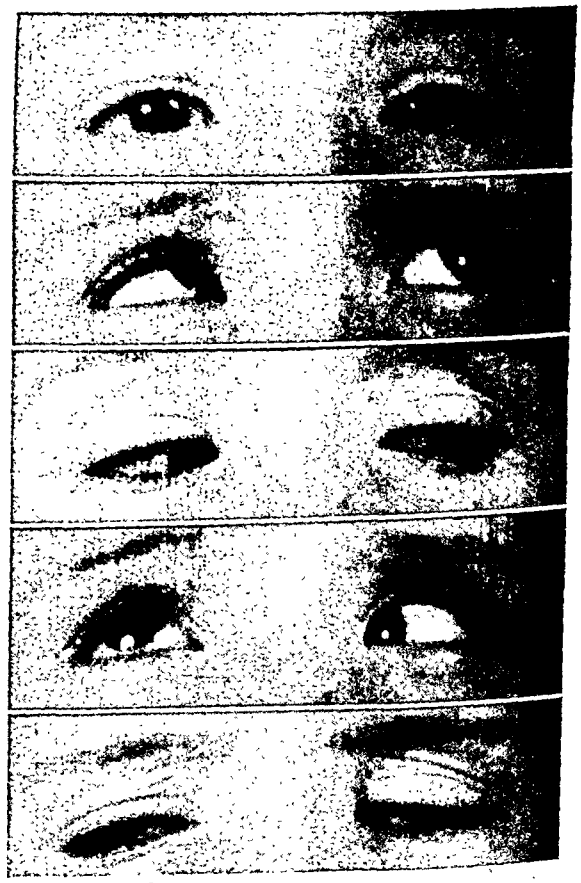


Fig. 12 (Spaeth). A mild monocular convergent strabismus with a marked amblyopia. There is a marked increase in the convergent strabismus present when the patient is compelled to use the paretic inferior oblique muscle.

Figure 14 illustrates this. The child has a monocular convergent strabismus on the left with vertical movements to the right practically equal and balanced. Vertical movements, however, downward and to the left show an overaction in the field of the left inferior rectus muscle with normal and balanced rotations in the fields of the left superior rectus muscle and the right inferior oblique muscle. This permits one to feel that the right superior oblique muscle is paretic rather than the left superior rectus muscle being in essential underaction. The presence of torticollis in such a case would be of great assistance in confirming a diagnosis as to which muscle is involved. Also,

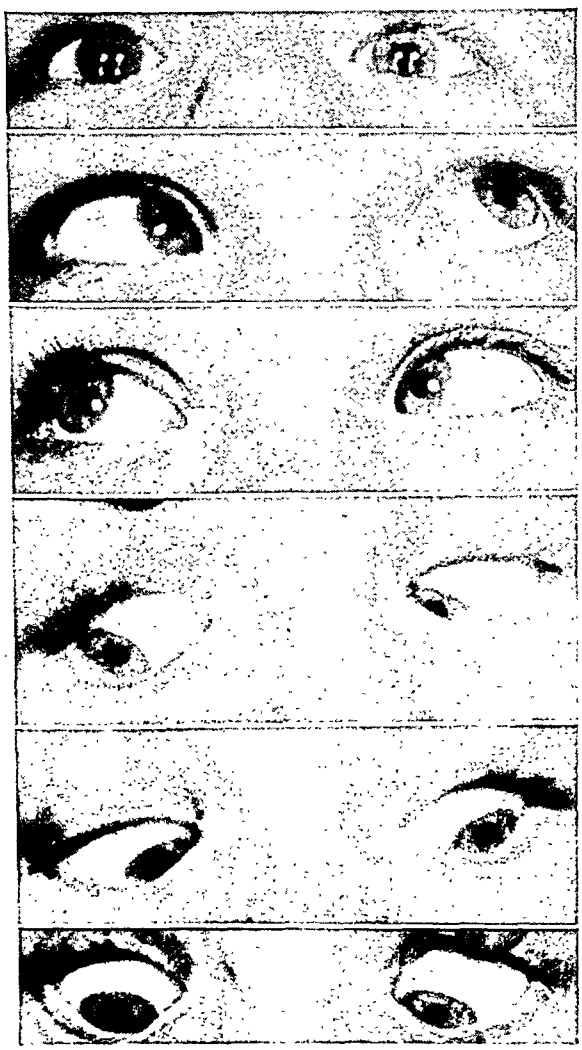


Fig. 13 (Spaeth). Bilateral limitation of equal degree in the field of the inferior oblique muscles.

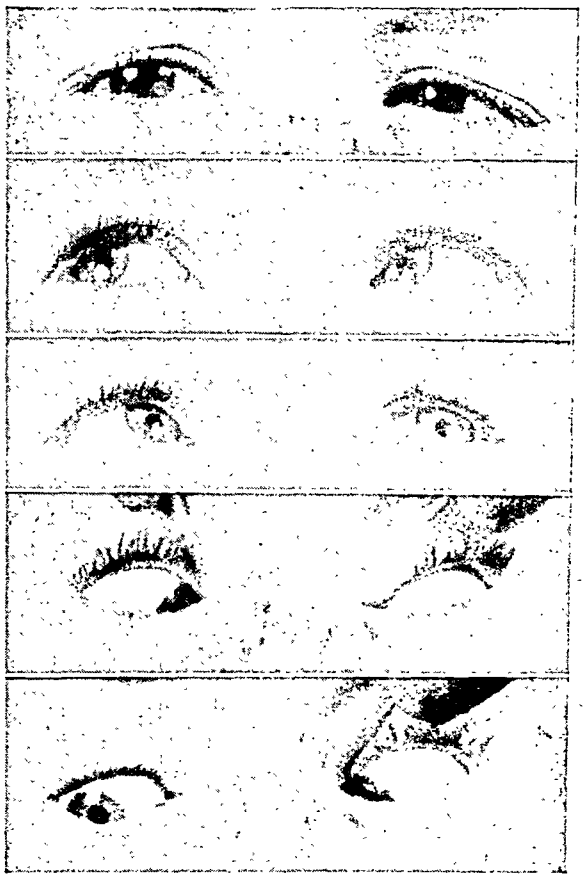


Fig. 14 (Spaeth). A monocular convergent strabismus on the left with vertical movements to the right practically equal and balanced.

if suppression and amblyopia are not present, a compensatory movement of the eye can be seen (as first noted by Bielschowsky) when the observer straightens that torticollis manually. The problem, of course, is the differential diagnosis between a paresis of a superior rectus muscle and of a superior oblique muscle. These cases (fig. 14) do not have diplopia because of suppression and, hence, amblyopia results. If that were not so, differential diagnosis would be a simpler problem. An acquired vertical muscle paralysis, by contrast, without suppression and without concomitant strabismus offers relatively few difficulties in differential diagnosis.

Figure 15 is a somewhat similar problem except here one must differentiate between a paresis of the right superior rectus muscle, the right inferior oblique muscle, and the



Fig. 15 (Spaeth). In this case it was necessary to differentiate between a paresis of the right superior rectus muscle, the right inferior oblique muscle, and the left inferior rectus muscle.

left inferior rectus muscle. The vertical deviation in the left eye could be secondary to a right inferior oblique muscle palsy. The frank limitation of movement, however, in the field of the left inferior rectus muscle with possibility of a direct antagonistic overaction of the left superior rectus muscle makes the diagnosis rather conclusive.

The differentiation of a primary and a secondary action is rather important, because surgery when necessary for a vertical



Fig. 16 (Spaeth). A frank hyperactivity (bilateral) in the contralateral rotations of the inferior oblique muscles without any lateral deviation present at any time.

component is at times successful only when applied to the conjugate overacting muscle (secondary deviation) and not to the primary underacting paretic muscle; at other times the reverse is true.

Vagaries and inconsistencies in the vertically acting muscles are not too uncommon. Figure 16 shows frank, bilateral inferior oblique muscle hyperactivity in the contralateral rotations without any lateral deviation present at any time. The refractive error was equal in both eyes. The patient may have had bilateral minimal paralyses of the two superior recti but, if so, these were equal in amount, for the measurement of the maximum contralateral hyperphoria was exactly the same in prism diopters and diplopia could not be elicited at any time. Even more significant was this, the vertical muscle situation did not result in any lateral strabismus nor in the development of subjective ocular symptoms.

Another instance follows. A patient was seen very recently with an ordinary, apparently congenital, sixth-nerve palsy on the left and without limitation of upward gaze in the midline (fig. 17). When left lateral rotations were demanded, not upward but on the horizontal level, the overaction of the internal rectus muscle on the right, consequent to the paralysis of the external rectus muscle on the left, was accompanied by an overaction of the right inferior oblique muscle (bottom view, fig. 17).

This overaction of the right inferior oblique muscle increased with attempted upward gaze to the left, even though the paralysis of the left external rectus muscle prevented the left eye from rotating into the field of the greatest vertical action for the conjugate yoke muscle of the right inferior oblique; that is, the left superior rectus muscle. One may say, therefore, that in this case a true spasm was present in the inferior oblique muscle. Normally this muscle should not be affected, in this overaction, by left lateral rotations on the horizontal level. It

seems as if the overaction of the inferior oblique muscle must be connected with the simultaneous overaction of the right internal rectus muscle. This has been suggested before in considering overconvergence.

It must be remembered, in these cases, that the patient should develop the horizontal strabismus in the eye with the greater refractive error, accompanied by sensory inhibition and amblyopia, but the vertical element connected with the case, and responsible, in part, for the lateral squint may be in either of the two eyes. This disturbance in the vertical may be found, although not as frequently, in the nonstrabismic eye as in that with the manifest squint.

Clinical experience seems to suggest that when the involved vertically acting muscle is on the eye which has the higher refractive error, then, also, one will find that the vertical component present in that case will be greater than the lateral component.

Figure 18 is a case with accidental alternating strabismus, the greater deviation being in the left eye. The vision in the right eye was 6/7.5, and in the left, 6/60, with correction. The refractive error, plus sphere and cylinder combined, was greater in the left eye. The horizontal deviation was largely present in the left eye. Nevertheless, the vertical muscle pareses were in the right superior rectus muscle and the right inferior oblique muscles. The greatest overaction present, and as a secondary deviation, was in the left inferior oblique muscle.

Figure 19 is one of a child with a paresis of the right inferior oblique muscle. The lateral deviation is seen in the right eye and it is not marked. The vertical deviation is the greater of the two. The right eye has developed amblyopia in this child and the patient consistently fixes with the left eye. The light reflexes, corneal, of the three upper photographs of Figure 19 are rather conclusive. In this case of lateral concomitant



Fig. 17 (Spaeth). A sixth-nerve palsy with normal upward gaze in the midline.

strabismus the vertical component is appreciably greater than is the lateral. This is a logical sequence of events.

One must be sure, however, not to confuse the fixing eye in such instances with a possible secondary manifest deviation, such a



Fig. 18 (Spaeth). An accidental alternating strabismus.

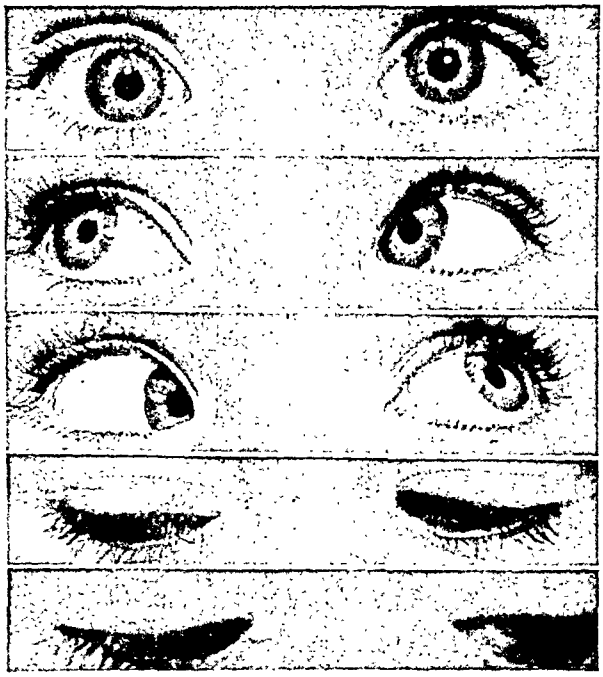


Fig. 19 (Spaeth). A paresis of the right inferior oblique muscle.

deviation being the result of fixation with the eye having the vertically paretic muscle. Figure 20 is another interesting deviation from that which one might expect. The child had a paresis of the superior rectus muscle on the right and some levator involvement as well, with a divergent strabismus on the right. There was no appreciable left inferior oblique muscle overaction, neither was there any right-sided superior oblique overaction in downward gaze. There was, however, in the rotations directly downward, a marked overaction of the right inferior rectus muscle. In this case if a levator had not been simultaneously involved on the right, one would be suspicious of an inferior rectus fibrosis limiting the upward excursions of the right eyeball in a manner similar to a lateral retraction syndrome. Surgical examination of the inferior rectus muscle revealed a perfectly normal muscle.

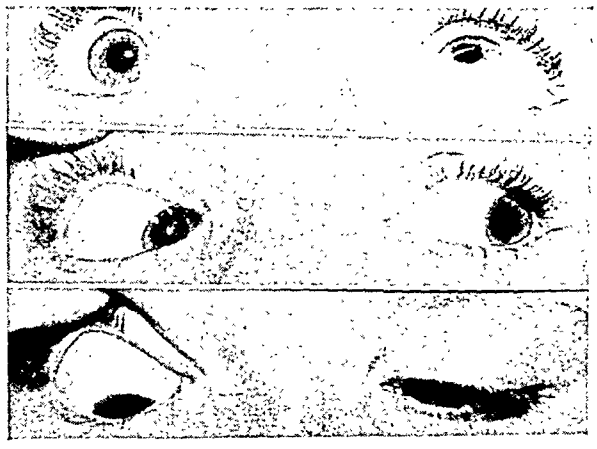


Fig. 20 (Spaeth). A paresis of the superior rectus muscle and some levator involvement, with a divergent strabismus.



Fig. 21 (Spaeth). A monocular convergent strabismus with torticollis toward the left.

These cases, if carefully observed, will frequently show torticollis to varying degrees—sometimes moderate in amount, at other times quite marked. The presence of torticollis suggests a fair prognosis for the reëstablishment of postoperative single binocular vision because it is a defense mechanism for escaping diplopia.

Figure 21 is a monocular convergent squint with a rather marked torticollis toward the left, with underaction of the right superior oblique muscle, and with normal vertical movements to the right. It was this head tipping which occasioned the patient's first visit to the oculist. (He was referred by an orthopedist.)

The various essential factors connected with and related to these cases can be uncovered only by accurate prism measurements. These should be done with screening and with prisms in the six cardinal positions, before and after cycloplegia, checked for certainty, and carefully noted upon a spider graph (that formerly suggested by Duane or the more recent one of White's are equally satisfactory). Amblyopia and suppression must be broken down so that measurements are obtained with an approximation to macular fixation, for extramacular fixation tends to exaggerate conjugate yoke muscle secondary deviations, as it changes the prism measurements of the objective and subjective angles of squint.

Recapitulation

The entire problem of a vertical component in so-called concomitant strabismus must be considered from the following standpoints.

1. *Congenital disturbances.* The likelihood that congenital disturbances in the levators, or the depressors, frequently play a profound role in the development of convergent and divergent lateral strabismus of all types, probably excepting true or essential alternating strabismus. It seems that the absence of this is an attribute of a correct diagnosis of that type of squint.

2. *The uncovering of a vertical element* in a case under consideration and the diagnosis of the primary and the secondary deviations are basic. Not only is it necessary to make a diagnosis of the type of muscle condition present but also to identify the muscle or the muscles involved. It is well to remember that when a left superior oblique muscle palsy is confused with a possible right superior rectus muscle palsy, or a left inferior oblique muscle palsy with a possible right inferior rectus muscle palsy, that the torticollis is always toward the side opposite from the eye involved. Supression of vision and amblyopia are the patient's means of fighting the cause of the torticollis, hence torticollis is not as constant a sign as it might be.

3. *Accommodative strabismus* can be complicated by an inferior oblique muscle hyperaction without demonstrable paresis of the contralateral synergist.

4. *Oblique muscle overaction* is not unusual, inferior or superior, and is due either to a paresis of the contralateral synergist yoke muscle, to a paresis of the homolateral direct antagonist, or to some mechanical defect in the orbit itself—probably connected with fibrotic bands in and to the check ligaments.

5. *A similar overaction* occurs in the inferior and superior rectus muscles as in the oblique muscles, consequent to similar factors. These cases are perhaps less common.

6. *The greatest vertical deviation* need not be present in the amblyopic eye. The horizontal squint, however, is present in that eye and this is the primary lateral deviation.

7. *Lateral concomitant deviation.* It is not always possible to state that the lateral concomitant deviation is due: (a) to the paresis of a vertically acting muscle; or (b) to the secondary deviation of a synergist to a paretic muscle; or (c) to the overaction of the direct antagonist to a paretic muscle. All three may be of significance together or at different times. Because of that the next paragraphs are perhaps the most significant in surgical therapy.

8. *The surgical therapy* for these situations is important. The results of clinical experience (and as such it should be seriously considered) has resulted in the following conclusions.

a. It is wasted time and an unnecessary expenditure of money to attempt the cor-

rection of these cases by orthoptics for they are certainly pure surgical conditions. The surgical correction should be done, if possible, before the age of four years.

b. If the vertical deviation is greater in amount than the lateral (horizontal) deviation it should be handled surgically first.

c. If the lateral deviation is the greater in degree, then that should be operated as the initial procedure. Lateral deviations tend to diminish in degree following corrective surgery to a vertical component, but vertical deviations may decrease or increase in any amount following the surgery to the lateral muscles, when that should be the primary operative procedure.

d. As the vertical component approaches the lateral component in degree or amount of deviation, then also will it be necessary to use surgery for the vertical element, either as a primary, a secondary, a simultaneous, or a subsequent operative procedure.

e. Satisfactory single binocular vision with good working fusion can never be obtained as long as a vertical component is present to an appreciable degree.

f. Minimal residual amounts of a vertical deviation lend themselves well to surgery. Surgery is only successful when applied to the proper deviation, either the primary or the secondary deviation, as indicated in any given case. Three surgical procedures are available, and at times necessary. Either the paretic muscle must be augmented in its effect, or the overacting conjugate yoke muscle limited in its overaction, or the direct antagonist to the paretic muscle in the same eye limited in its relative overaction. The following are good working rules.

Habitual fixation with the paretic eye needs surgery to the conjugate yoke muscle.

Marked torsional defects in the image, as manifested by torticollis, extensive paralysis of a muscle, and secondary overaction of the direct antagonist need surgery to the paretic muscle. This is also so when the eye without the vertical palsy is the fixing eye.

Surgery to the conjugate yoke muscle is indicated in spasm of the conjugate yoke muscle, in the lesser degrees of paralysis, and as an additional procedure to augment the effect of surgery to the paretic muscle whenever that becomes necessary because of residuals.

Surgery to the direct antagonist of a paretic muscle is indicated when spasm is present in that muscle, and as an adjunct procedure with an after surgery to the paretic muscle.

An extensive recession of a superior rectus muscle is seldom if ever indicated, and a tenotomy of that muscle is never permissible.

9. In general, *the sequence of surgical procedures for the vertical muscles* seems to give best results when applied as follows: First, (a) a recession of the overacting synergist, or (b) a resection or advancement of the paretic muscle. Second, a reversal of the sequence of a, and of b. Third, recession of an overacting direct antagonist. This is especially significant in considering the obliques. For example, the recession of an inferior oblique muscle, when overacting, will give a rather poor postoperative result, if, in the case under treatment, the proper procedure should have been the resection of the superior oblique muscle, directly antagonistic to the inferior oblique muscle being discussed. It is important that one select the proper oblique muscle for surgery in any case under consideration.

Conclusions

This presentation with the cases shown has but one purpose—to emphasize a relationship which exists between so-called concomitant strabismus and disturbances in the action of the vertically functioning extraocular muscles. This suggests a factor in the etiology of squint and, by a reversal in the sequence of events, a means for the better correction of the condition. The cosmetic appearance is not the best result obtainable in a case. Single binocular vision, or as close an approach to this as is possible, is the end result desired.

1930 Chestnut Street (3).

HISTOLOGY OF THE RETINA IN A CASE OF TAY-SACHS'S DISEASE*

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Comparatively few eyes have been examined histologically in cases of Tay-Sachs's disease, or the infantile type of amaurotic family idiocy. Werncke[1] states that not over 15 were examined up to 1939. Since then, Hagedoorn[2] and Hassin[3] have each reported the retinal findings in one case of the disease. To these I should like to add another.

Although the clinical features of the disease are well known there is still uncertainty regarding the histologic changes. Coats,[4] in particular, found only changes in the ganglion-cell layer of the retina and stated that the histologic changes found in the other layers of the infantile type were of a postmortem nature. While the delay in fixing the globe after death was in some of the reported cases so great that postmortem changes influenced the findings to a degree that conclusions could not be drawn, in others, especially in Hancock's and Coats's[5] case, where the eyes were examined immediately after death, and in Verhoeff's[6] case, where the eyes were removed 15 minutes after death, postmortem changes could not have occurred.

In the case here reported, five hours elapsed before the eyes were removed and placed in fixing fluid but the body was kept in refrigeration from immediately after death. Further, the changes were so definite that we feel they were certainly a part of the pathologic condition present and therefore add more evidence to prove that the changes are not entirely limited to the ganglion-cell and fiber layer but also that there are changes in the inner nuclear layer of the retina.

It is for this reason, and the fact that these changes lend themselves so well to reproduction, that we thought it of value to report our findings. Moreover, confusion has arisen from the use of the term "ganglion cell," which in this paper refers only to the ganglion cell of the ganglion-cell layer. While the bipolar cells of the internal nuclear layer are ganglion cells they are not usually referred to as such.

Hancock and Coats[5] state that the changes in amaurotic family idiocy are absolutely confined to the ganglion cells and their corresponding nerve fibers, yet later on they say that the ganglion cells which normally occur in the inner nuclear layer are also degenerate. This is ambiguous, but it would appear that they meant by this the Dogiel ganglion cell, or those found normally at times in the inner layer of the internal nuclear layer. The changes in the internal nuclear layer (fig. 1B) appear through its whole depth and therefore are not limited to the Dogiel cells.

The name "Tay-Sachs" is derived from Warren Tay,[7] who, in 1881, published a report of a case of symmetrical changes in the region of the yellow spot in each eye of an infant, and from Bernard Sachs,[8] who, in 1887, gave a clinical pathologic account of a similar case under the heading of "Arrested Cerebral Development." The familial characteristics of the disease were established in 1896, when Sachs[9] reported on a sister of his original patient and suggested the name "amaurotic family idiocy." Tay,[10] however, in 1884, had also reported on a third instance in the same family of symmetrical changes in the yellow spot of each eye in an infant.

The disease is defined by Duke-Elder[11] as a familial disease of early life due to

* From the Department of Ophthalmology, Royal Victoria Hospital. Presented before the III Pan-American Congress of Ophthalmology, Havana, Cuba, January, 1948.

primary lipoid degeneration of the ganglion cells of the entire central nervous system, in which the ganglion cells of the retina participate, characterized by unique bilateral fundus appearances and invariably terminating in blindness, paralysis, idiocy, and death.

These are several forms of disease due to widespread lipoid degeneration—Tay-Sachs's disease of the infantile type of amaurotic family idiocy; a late infantile type described by Bielschowsky;[12] the juvenile type also known as Batten-Mayou disease in England, Spielmeyer-Vogt, or Spielmeyer-Stock, disease in Germany; while, in America, Oatman called it familial maculocerebral degeneration.

Other diseases due to lipoid degeneration are Gauthier's disease and Neimman-Pick's disease. The last named may involve the retina as well as practically all the structures throughout the body. In an effort to simplify the various lipoid diseases in which retinal changes may be found, I have constructed Table 1.

TABLE 1

LIPOID DEGENERATION OF THE GANGLION CELLS OF THE RETINA FOUND IN AMAUROTIC FAMILY IDIOCY*

Infantile Type	Late Infantile Type	Juvenile Type	Neimman-Pick Disease
Tay-Sachs About 6 months	Bielschowsky 3–5 years	Batten-Mayou Spielmeyer-Vogt Spielmeyer-Stock Oatman Familial maculocerebral degeneration	Or Lipoid splenohepatomegaly Or Lipoid histiocytosis
Cherry red spot Jewish Female 3-1	Pigment change Nonracial	Second dentition Pigment change Nonracial	

* Also congenital type (Norman and Wood, 1941); and adult type (Kufs, 1929).

CASE REPORT

The case here described is that of a Jewish boy, who died at the age of 17 months, with all the typical signs and symptoms of Tay-Sachs's disease, including the gray area in the posterior pole and a cherry-red spot in the macula of each eye. The eyes were removed five hours after death, hardened in formalin, embedded in celloidin, and sectioned. The following stains were employed: Hematoxylin-eosin, Van Gieson, Bielschowsky, silver carbonate for oligodendroglia and microglia, gold chloride sublimate, phosphotungstic acid, hematoxylin, Nissl, Loyez, Bodian, and osmic acid.

The microscopic findings show a great reduction in the number of ganglion cells in the ganglion-cell layer of the retina (fig. 1). Most of those remaining, especially in the posterior pole, are greatly swollen and the cell bodies show many small vacuoles surrounded by slightly granular cytoplasm (fig. 2).

The cells have lost their multipolar form due to the swelling and are round in shape with the periphery of the cell clearly demarcated. In some the cell bodies cannot be made out and only nuclei can be seen but it could not be determined whether these are nuclei of the nerve cells or of neuroglia.

The nuclei of the swollen ganglion cells occupy an eccentric position in the cytoplasm and stain so densely that nucleoli are not visible. These changes are most marked in the posterior pole of the retina and, as one approaches the ora serrata, the ganglion cells are reduced in number in comparison with the normal and their cytoplasmic outline tends to be stellate rather than globular. The nuclei are not as pyknotic as those in the

posterior pole but Nissl bodies cannot be identified in the cytoplasm.

A finely granular reticulum can be made out about small vacuoles in the cytoplasm as in the nerve cells of the macular region. The nerve-fiber layer is markedly reduced in thickness but, nevertheless, a few nerve fibers are shown by the Bodian stain. There vacuolated. The vacuoles are surrounded by delicate reticular network as in the nerve cells of the ganglion cell layer.

These swollen cells are found in different levels of the internal nuclear layer (fig. 1); that is, in the inner layer where the amacrine cells, and the occasional Dogiel cells, are normally located. They are also found in the

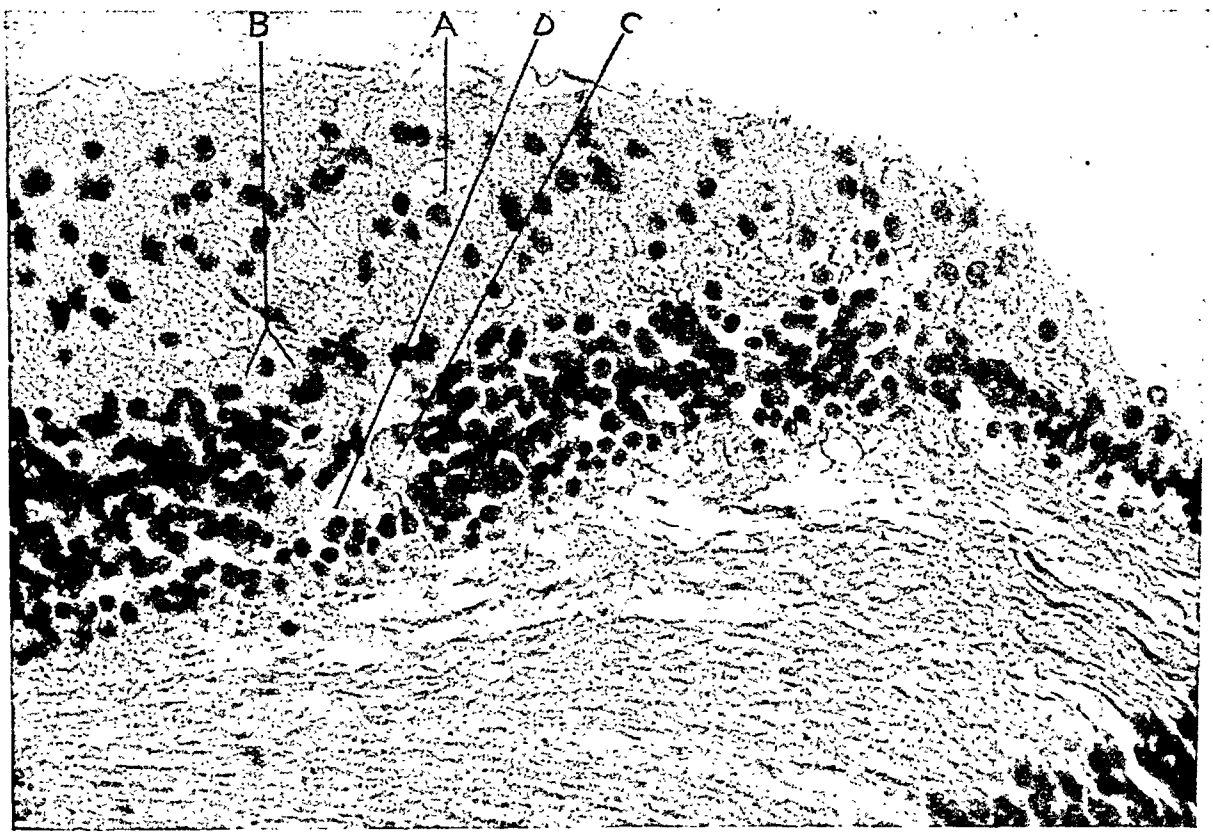


Fig. 1 (MacMillan). MARGIN OF MACULA showing inner layers of the retina. (A) Swollen ganglion cell. (B) Swollen cells in inner part of internal nuclear layer. (C) Swollen cell in middle part of internal nuclear layer. (D) Swollen cell in external part of internal nuclear layer.

is an increase in the number of nuclei in this layer which are undoubtedly glial.

There is nothing abnormal in the internal plexiform layer of the retina. The internal nuclear layer appears of about normal thickness and the cells are so packed together that only nuclear details can be made out. There are in places, however, swollen cells which resemble the swollen ganglion cell above described (fig. 3). These cells also have eccentric nuclei and their cytoplasm is middle portion which is occupied by the bipolar cell and again in the external part of this layer, the normal position of the horizontal cells.

While the bipolar cells are true ganglion cells, the term ganglion cells here is used only for those cells which are in the ganglion-cell layer.

As one approaches the periphery of the retina, the globular cells cannot be identified in this layer. The other layers of the retina;

that is, the pigment epithelium, rods, cones with their nuclei, and the external plexiform layer, are quite normal.

The nuclei in the optic nervehead are greatly increased in number and in sections the nervehead is raised above the retinal level. Nevertheless, the nerve bundles are small in diameter. In the optic nerve the nerve bundles are small, the number of nuclei in the septa is increased, the septa are thickened, and there are clear spaces between the nerve bundles.



Fig. 2 (MacMillan). Higher magnification of (A) in Figure 1.

Comments

The changes in the ganglion cells of the ganglion cell layer and of the nerve cells of the internal nuclear layer are similar, although they are fewer in the internal nuclear layer and they are found only in the posterior pole of the eye. The question can be raised as to whether they are nerve cells. Their location in these two areas is presumptive evidence in a patient with amaurotic family idiocy. They cannot be cells of the reticuloendothelial system or microglia as morphologically they differ greatly. The vacuoles are numerous and small with wide bands of delicately granular cytoplasm surrounding them, while the microglia in the "gitterzellen" phase show large vacuoles, delicate trabeculae and irregularly shaped pyknotic nuclei. The nerve cells of the cerebral cortex and spinal cord show identical globose swelling of their cell bodies. However, in many of these cells in the central nervous system, nuclear detail can be made out.



Fig. 3 (MacMillan). Higher magnification of (B) in Figure 1.

The marked atrophy of the optic nerve, as seen by the small nerve bundles, the disturbed architectural pattern, the apparent connective-tissue increase, and the increased nuclei in the glial septa and the spaces between the bundles in the nerve, is the typical picture of optic-nerve atrophy which is the result of atrophy of the axis cylinders from the abnormal ganglion cells.

Summary

For years it has been generally accepted that lipoid deposits occur in the ganglion cells in amaurotic family idiocy. There are many types of ganglion cells in the central nervous system and in the retina. Among these the bipolar cells of the retina must be classed as neurones or ganglion cells. The globular cells of the internal nuclear layer must be changed bipolar cells because of their location. It is admitted that some may be changed horizontal neurones and others changed displaced ganglion cells or so-called Dogiel cells. The point is that these swollen cells are found in all depths of the internal nuclear layer—inner, middle, and outer layers. It is the changes in this layer which, although described before, because of their clarity and readiness of illustration justify this report. It is not surprising that changes should occur in this layer as the cells are neurones in the same sense as the ganglion cells in the ganglion cell layer.

Cytologic studies of the retina are difficult; we have adhered to methods which do not lend themselves to detailed cytologic

study. New methods of fixation of the retina and improved technical methods must be devised. In this particular case we regret that more detail could not be given of the cell changes. Many of the stains carried out were disappointing because the proper fixative necessary for different stains had not been used.

We should not stop at histologic description of the lesions in amaurotic family idiocy, important though they be, but we should look for metabolic abnormalities in the disease. We ordinarily think that ganglion-cell activity pertains only to nerve impulses and often forget that ganglion cells, like other cells, must carry on cell metabolism. Many neuro-histologists feel that myelin is formed by the neurones when their axis cylinder processes are to be insulated. If this be so, myelin, a complicated lipoid, is synthesized by metabolic processes going on in the nerve cell. Theoretically then, all nerve cells, even though their axones be unmyelinated, may be suspected of some such metabolic activity. It would seem that the abnormal material in the ganglion cells must be the result of an inherited metabolic dyscrasia.

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I am deeply indebted for the coöperation supplied by Dr. William V. Cone, whose knowledge of the cytology of the central nervous system has made this presentation possible.

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THE EFFECT OF EXPOSURE TO SUNLIGHT ON NIGHT VISION*

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I. NATURE OF PROBLEM

Reports from North Africa and the South Pacific during the last war suggested that night vision deteriorates after exposure to very strong sunlight, particularly on coral islands. Derman[2] (also reference 7) reported 50 cases of night blindness in the Turkish army, apparently due to bright light. In view of the military importance of this problem, it was decided to investigate the effects of sunlight in a quantitative manner. The problem is a three-fold one. First, is the onset of dark adaptation delayed after exposure to bright sunlight? Second, is the process slowed up so that the threshold is still above normal even after an hour or two in darkness? Third, is the effect of daily exposure cumulative?

The first question has already been answered. The speed of dark adaptation is strongly influenced by the brightness of the preceding light adaptation.[3, 4, 10] Thus, after light adaptation to 100 millilamberts (ml.), the rod portion of dark adaptation appears almost at once, whereas after exposure to 40,000 ml. it does not become evident for 12 minutes.

Previous work[4] also showed that after adaptation to high intensities the final threshold may be delayed out of all proportion to the delay in onset of dark adaptation. For instance, 40 minutes after exposure to 40,000 ml. the eye is still about 0.5 log unit above its normal final threshold. No quantitative data on the cumulative effect of sunlight were known. Our aim, therefore, was to find out how long the threshold remains above normal after exposure to sunlight, and whether such effects accumulate when people are exposed day after day.

II. APPARATUS AND METHODS

The measurements were made with two Hecht-Schlaer adaptometers, model 3. The binocular threshold of a retinal area 7° above the fovea and 3° in diameter was measured. One instrument used blue light of dominant λ 480 mμ., the other used white light. Since the intensities are given in micro-microlamberts in terms of photopic brightness, the thresholds on the two instruments will differ because of the Purkinje phenomenon. Many comparisons showed the average threshold to be 1.20 log unit higher on the white instrument, with little individual variation. All measurements were referred to the blue instrument. Each subject was measured consistently on the same instrument.

In determining a threshold the operator controls the brightness of the stimulus with a neutral wedge, while the subject operates a shutter that gives reproducible 0.2 second flashes. The wedge is first set to give a brightness about 1 log unit above threshold, and the brightness is then reduced in steps of 0.5 to 0.2 log unit, until he fails to see even a faint flash of light. With the threshold thus roughly determined, the operator varies the

* From the Laboratory of Biophysics, Columbia University, New York City, and the Medical Field Research Laboratory, Camp Lejeune, North Carolina. Part of this work was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and Columbia University. The measurements were made at the Medical Field Research Laboratory, Camp Lejeune. Opinions expressed here are those of the authors and are not official with the Navy Department. This work has been reported to the Committee on Medical Research on March 24, 1945.

† Due to the untimely death of Professor Hecht on September 18, 1947, this report has been prepared by his collaborators.

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brightness in a random way above and below the threshold, always by even tenths of a log unit. The point at which about 3 out of 5 exposures are detected as flashes of light is the threshold. After a minute's rest the procedure is repeated. Almost always, the thresholds agree to 0.1 log unit. When the difference was greater, more determinations were made after a longer rest, until a satisfactory threshold was obtained.

III. The course of dark adaptation following bright outdoor light

Experiments were conducted in New York on the effect of exposures to bright sky on dark adaptation. The subjects looked at the sky for periods of from four minutes to an hour. The brightness varied from 3,000 to 12,000 ml., the limiting factor being the subject's ability to look at the light without undue pain. In the final stage of light adaptation, one eye was closed to reduce the discomfort and to make it possible to look at a brighter part of the sky. Both rod and cone adaptation were followed, using the Hecht-Shlaer model 1 adaptometer,[6] with monocular observation.

At Camp Lejeune, a further study of comparatively short exposures to bright light was made, the sky brightnesses ranging from 3,500 to 16,000 ml., and the time of exposure from 2 to 35 minutes. For comparison, dark-adaptation curves were obtained after exposure to 5 and to 50 ml. In each case, the threshold after one hour of dark adaptation was obtained before the start of the light-adaptation experiment. If the subjects had to be outdoors before this initial measurement, they wore red goggles to prevent uncontrolled exposure to bright light.

TABLE 1

The delay in dark adaptation following exposure to bright sky

Subject	Time of Preliminary Light Adaptation	Time of Final Light Adaptation	Brightness of Sky During Final Light Adaptation millilamberts	Rise in Rod Threshold ½ hr. in the dark	1 hr. in the dark	2 hrs. or more in the dark
A.E.	3 hours	4 minutes	3,000 to 10,000	0.28	0.10	0.12
M.Y.	3 hours	4 minutes	3,000 to 10,000	0.45	0.09	0.04
B.L.	6 hours	none	none	0.09	0.00	0.00
B.L.	4 hours	4 minutes	3,000 to 10,000	0.55	0.16	0.16
D.H.	23 minutes	9 minutes	1,000 to 4,000	0.27	0.08	
C.H.	2½ hours	5 minutes	10,000	0.20	0.00	0.00
C.H.	30 minutes	5 minutes	10,000 to 12,000	0.43	0.38	0.32
C.H.	20 minutes	10 minutes	10,000 and over	0.61	0.23	0.34
Y.H.	25 minutes	5 minutes	3,000 to 10,000	0.19	0.17	0.17
Y.H.	25 minutes	5 minutes	5,000	0.40	0.33	0.11
Y.H.	25 minutes	7 minutes	3,000 to 6,000	0.23	−0.04	
S.H.	none	20 minutes	not determined	1.2	0.15	0.05
W.N.	7 minutes	4 minutes	6,500	0.55	0.25	
W.N.	10 minutes	8 minutes	5,000	0.35	0.10	0.00
W.N.	none	30 minutes	3,500	0.70	0.34	0.20
W.N.	15 minutes	15 minutes	6,000	0.65	0.20	0.00
W.N.	10 minutes	10 minutes	9,000	0.60	0.19	0.00
W.N.	none	10 minutes	5,000	0.60	0.16	0.00
G.L.	none	30 minutes	8,000	0.30	0.30	0.02
G.L.	none	37 minutes	9,000	0.48	0.25	0.20
A.C.	none	25 minutes	16,000	1.05	0.84	0.57
Average				0.48	0.20	0.1

Table 1 summarizes the main features of the experiments. Since different subjects were used in the various tests, and there is considerable individual variation, the results for different times and brightnesses are not directly comparable. However, it is clear

enough that, after exposure to bright skylight, dark adaptation is considerably delayed. The significant parts of four representative dark-adaptation curves are shown in Figure 1.

IV. Preliminary experiments on prolonged exposure to sunlight

In these experiments each subject had his threshold measured in the morning after one hour of dark adaptation. The group then spent several hours on an ocean beach in the sunlight. After 2 to 5 hours the group returned to the dark room, and was tested after various lengths of time in the dark. Four groups were also measured the next morning after one hour of dark adaptation. Table 2 gives the results. It is clear that exposure to sunlight delays the course of dark adaptation. There seems to be some residual effect after several hours, and perhaps even overnight.

V. Final experiments at Camp Lejeune

A. Procedure

A series of systematic experiments were set up to determine whether or not daily exposures to sunlight produced any cumulative effect on night vision. We worked with 51 young men with normal night vision. The control group of 20 men was kept at indoor tasks to prevent exposure to bright light. They wore red dark-adaptation goggles whenever they went outdoors during the day. The experimental group of 31 men was sent every day except Sunday to the beach.

On sunny days near noon, the illumination was about 10,000 foot-candles, but because the sand was rather dark—having a reflectance of 0.3 at most—the brightness of the beach was less than 3,000 ml. Viewed from the beach the water was darker than the sand. The sky varied from about 500 to 15,000 ml.

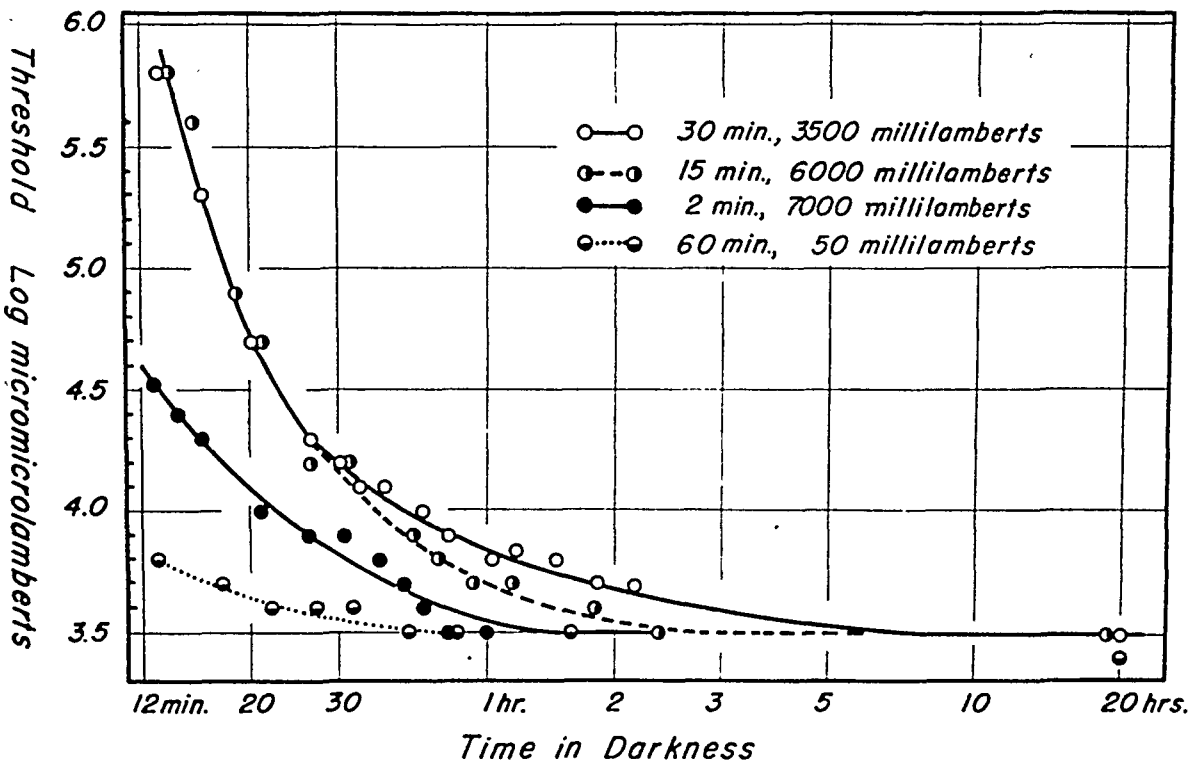


Fig. 1 (Hecht, Hendley, Ross, and Richmond). Dark adaptation after exposure to bright sky.

TABLE 2

EFFECT OF SUNLIGHT ON NIGHT VISION*

No. of Subjects	Hours Exposure	Threshold Rise—Log Units Hours after Exposure				
		⅓	¾–1	1½	4½–5	16+
6	2		+0.25	+0.20		−0.02
6	5	+0.85	+0.25		+0.09	
4	2		+0.27		+0.27	+0.16
6	2½		+0.23			
11	2½		+0.19			+0.09
10	5		+0.12			−0.05

* Sky Brightness 3–5×10³ ft. lamberts
Water Brightness 1–3×10³ ft. lamberts
Sand Brightness 1–2×10³ ft. lamberts

At the beach the men were instructed not to close their eyes, or protect them from light in any way. During the first 2 weeks the men were exposed to the sun for about 4 hours, of which two were spent in an open boat going to and from the beach. Later the subjects had about 6 hours of continuous exposure, of which only one was spent in transit. The subjects were dark adapted for one hour before their thresholds were measured.

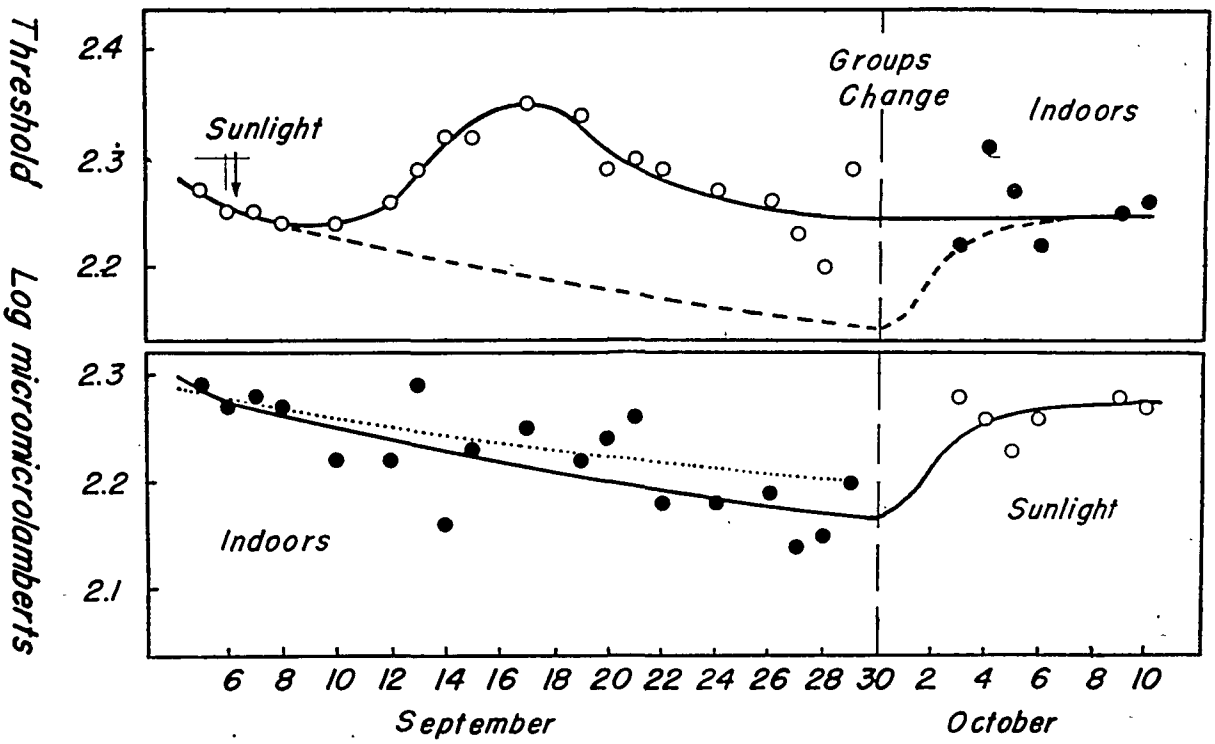
These procedures began September 5th and continued through September 30th. Af-

TABLE 3

MORNING THRESHOLDS AFTER ONE HOUR IN DARKNESS

Date	X-1	X-2	X-3	Average of X Groups	C-1	C-2	C-3	Average of C Groups
Sept. 5	2.27	2.25	2.30	2.27	2.29	2.26	2.31	2.29
6	2.23	2.24	2.29	2.25	2.29	2.22	2.29	2.27
7	2.30	2.20		2.25	2.26	2.29		2.28
8		2.23	2.25	2.24		2.28	2.27	2.27
9			2.24				2.21	
11	2.24			2.24	2.23			2.22
12	2.26	2.27		2.26	2.23	2.20		2.22
13		2.32	2.25	2.29		2.28	2.31	2.29
14	2.32		2.32	2.32	2.16		2.16	2.16
15	2.36	2.29		2.32	2.18	2.28		2.23
16		2.25				2.26		
18			2.44	2.35			2.24	2.25
19	2.22		2.47	2.34	2.18		2.25	2.22
20	2.27	2.31		2.29	2.23	2.25		2.24
21		2.28	2.32	2.30		2.32	2.21	2.26
22	2.27		2.31	2.29	2.17		2.18	2.18
23	2.25				2.14			
25		2.28		2.27		2.23		2.18
26		2.24	2.29	2.26		2.21	2.16	2.19
27	2.12		2.34	2.23	2.13		2.16	2.14
28	2.17	2.22		2.20	2.09	2.21		2.15
29		2.27	2.32	2.29		2.28	2.12	2.20
30			2.36				2.15	
Oct. 1	X Groups come indoors; C groups go out to beach.							
2	2.27				2.16			
3	2.22	2.22		2.22	2.25	2.31		2.28
4		2.28	2.35	2.31		2.31	2.20	2.26
5	2.14		2.40	2.27	2.22	2.28	2.19	2.23
6	2.18	2.25		2.22	2.27	2.29	2.23	2.26
7		2.22			2.29			
9	2.15		2.38	2.25	2.29	2.39	2.17	2.28
10	2.16	2.26	2.36	2.26	2.24	2.33	2.23	2.27

ter the morning measurements on September 30th, the indoor and sunlight groups changed places. The X (experimental) group, which had been outdoors every day, remained indoors. The C (control) group, on the other hand, took off their goggles and went outdoors on the beach. This continued until October 10th when the experiment had to be ended.



Sunlight Group ..... Control group curve adjusted to level of sunlight group at start
Indoor Group - - - - Randolph Field Cadets

Fig. 2 (Hecht, Hendley, Ross, and Richmond). Effect of sunlight on morning threshold.

B. Cumulative effects

Table 3 shows the morning one-hour thresholds after a night's sleep and before any exposure to sunlight. There are several ways in which the measurements may be treated, from following each small group to making weekly averages of all groups. We find the results are much the same any way the data are examined. The data are summarized graphically in Figure 2.

Initially the two groups were chosen to have almost identical average thresholds. Actually they differed by only 0.02 log unit. During the course of the experiment, the control group threshold decreases gradually; while the sunlight group threshold rises and then seems to return about to its original level. The decrease in the control group represents the improvement which comes with practice in untrained individuals. It occurs regularly, and is of the same order of magnitude as found here. For comparison, the data for 37 aviation cadets at Randolph Field are shown in Figure 2.

When the two groups were reversed the old control-group threshold (now the sunlight group) began to rise. After three days the rise was almost 0.1 log unit and further exposure caused no significant further rise. The original sunlight group (now indoors) showed practically no change for the 10 days they were protected from light.

In making a quantitative estimate of the changes caused by sunlight, we must include

the improvement shown by the control group. There is no reason to suppose that the sunlight group did not improve in a similar way. Indeed, this group did show a slight decrease in threshold the first few days. Thus the control data provide a base line for the sunlight data. This is indicated by the dotted line under the sunlight measurements in Figure 2.

Another way to show the cumulative effect of exposure to sunlight is to compare the distribution of thresholds before the experiment with those after the two groups diverged. In Figure 3 those comparisons are made, and as before the sunlight group shows a small rise in threshold after 9 days outdoors, even though 4 of these days were overcast. The outdoor group was lower than the control by 0.02 log unit at the start, but is 0.12 log unit higher after exposure. This change is 4.3 times the standard error of the difference between the two means after exposure, and the difference is certainly significant by this test.

C. Daily effects

For 9 days, between September 25th and October 5th, for each group that was exposed to sunshine, we measured the threshold after one hour of dark adaptation in the morning before the exposure, in the afternoon after returning from the beach, after supper, and early the next morning. Each indoor group was measured at the same time. The averages of these nine series of determinations are shown in Figure 4. The one-hour threshold is raised by 0.14 log unit due to sunlight, and this rise does not completely disappear until some time in the night. By the next morning the one-hour threshold is practically the same as the day before.

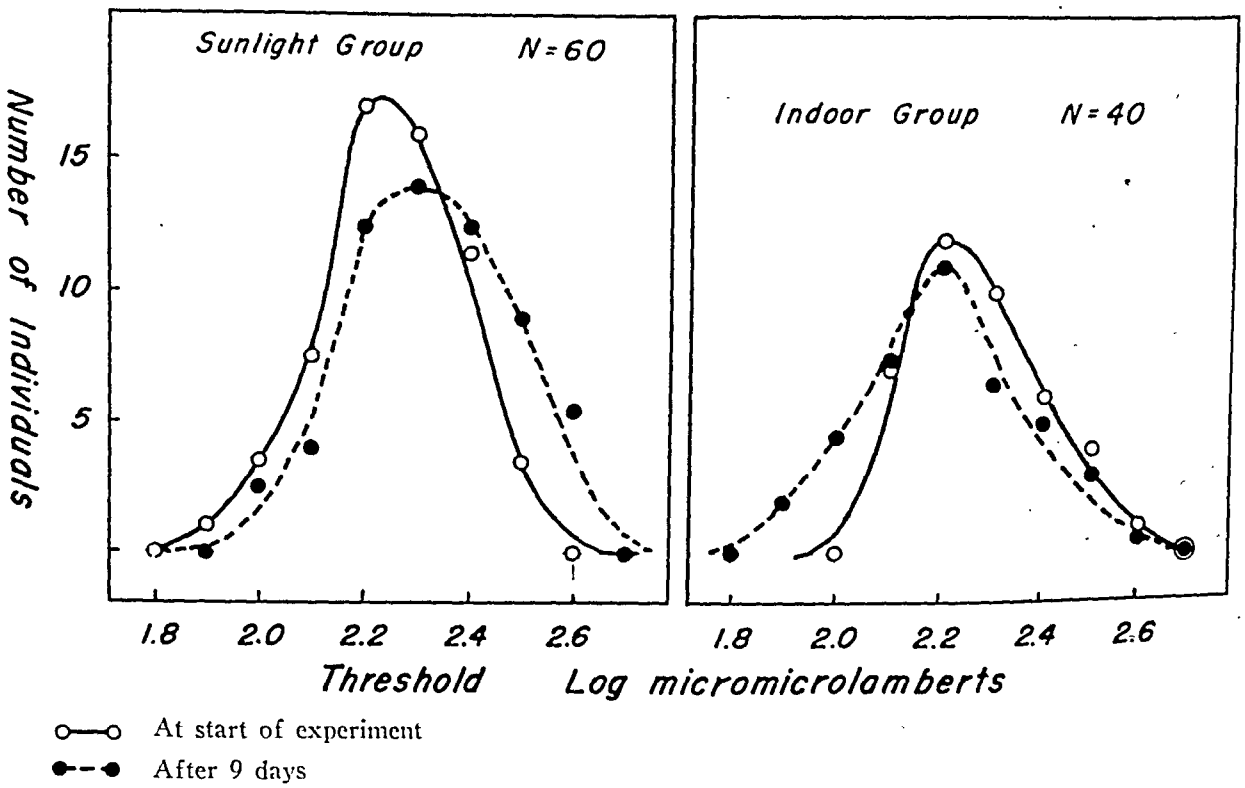


Fig. 3 (Hecht, Hendley, Ross, and Richmond). Distribution of thresholds.

VI. Discussion

From all these experiments we may conclude that night vision is interfered with significantly but not drastically for a period of several hours after a single prolonged exposure to sunlight. Our work also showed that daily exposures to sunlight produced a

cumulative chronic effect on night vision which after 10 days had about the same magnitude as the maximal temporary effect of a single exposure.

This second conclusion has been called into question by two later reports. Clark, Johnson, and Dreher,[1] working at Pensacola, Florida, confirmed the temporary effects of sunlight, and found a threshold elevation of about 0.13 log unit even after a night of dark adaptation. However, they found that "the threshold returns to normal after one day's protection from the sun." Ross, Mueller, and Richmond,[9] at Camp Lejeune, also found temporary effects that did not, however, persist overnight.

In both the Camp Lejeune studies we were handicapped by cloudy weather and by the low reflectance of the beach. The Pensacola workers did not run into these difficulties and, although no brightness measurements are reported, they state that "the bright sunlight and high reflectivity of the sand on the beaches closely approximate conditions of illumination found in the islands of the South Pacific." In view of the importance of determining for certain whether bright sunlight can cause prolonged deterioration in night vision, we feel that further investigations should be made, in tropical or arctic regions.

We may state with assurance, on the basis of the work to date, that daily exposure to bright sunlight for 3 hours or more causes a rise in threshold which is of the order of 0.2 log unit, on the average, during the succeeding night. Such a rise has a substantial influence on night visual performance. It has been shown[5] that a person so affected by sunlight has his night visual acuity cut in half, his range decreased to half, and the contrast which he can just recognize increased by 50 percent by comparison to his normal self. This deterioration in visual function is of about the same order of magnitude as that suffered by an aviator flying at night between 12,000 and 15,000 feet without oxygen.

While is it not our object in this paper to inquire into the physiologic mechanisms involved, we are inclined to believe that it is the visible part of the radiation that is effective. Ultraviolet forms only a small part of the radiation reaching the cornea, and while it can burn this part of the eye, as in snow blindness, it does not reach the retina to any appreciable extent, because of the great absorption of the lens and eye media. Nevertheless, if any further sunlight studies are made, it might be well to exclude the ultraviolet, merely to have the information. Infrared rays, although they comprise over half the radiation on a sunny day and do get through to the retina, are probably also not responsible. We know of no evidence that infrared radiation is harmful unless many times as intense as it is in the brightest daylight. There are cases reported of retinal burns from staring at the sun, but this did not occur in our experiments.

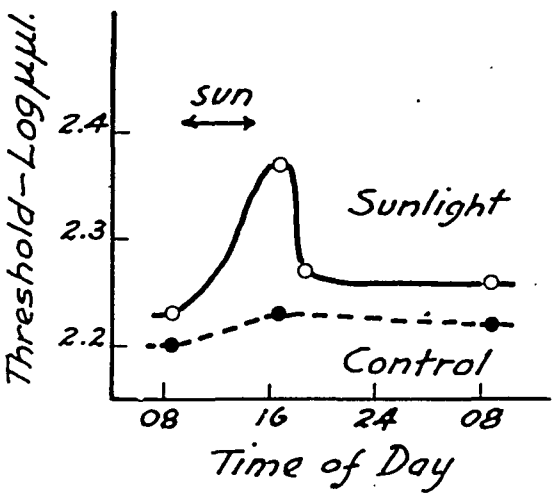


Fig. 4 (Hecht, Hendley, Ross, and Richmond). Thresholds after one hour in darkness.

There exists an extremely simple preventative for avoiding the ill effects of exposure to sunlight, namely adequate sunglasses. Many of the best known and most expensive sunglasses now available are designed for maximum transmission of visible radiation, while cutting out as much as possible of the ultraviolet and infrared. As a result, they trasmit 50 or even 75 percent

of the light. Such sunglasses would be of little value in preventing injury to night vision. It was recommended[5] that glasses should transmit at most 10 percent of the light. The Navy did issue sunglasses that came close to this specification, having a transmission of about 12 percent (Sun, N-1, Contract No. NXsX-66884).[8] Clark *et al.*[1] found that these glasses did indeed protect against the deleterious effects of sunlight on night vision.

VII. Summary

1. Exposures to ordinary sunlight produced temporary and cumulative effects on night vision. A single exposure of 2 or 3 hours delayed the onset of rod dark adaptation by 10 minutes or more, and slowed the process itself so that the normal night vision threshold was not reached for several hours afterward.

2. After repeated daily exposures to sunlight, the delay in reaching the normal threshold persisted overnight, and the threshold after complete dark adaptation rose higher each day for about 10 days and remained at a higher level.

3. This elevated threshold corresponds to an average deterioration of about 50 percent in visual acuity, range of visibility, contrast discrimination, and in the frequency of picking up a target when it is barely visible. The effect shows considerable individual variation, but the average loss in night vision is nearly the same as is suffered by flying at 12,000 feet at night without oxygen.

4. It is strongly recommended that sunglasses transmitting 10 percent or less of visible light be used by all persons who, while working in bright sunlight during the day, will be expected to perform critical night duties soon afterward.

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UVEOPIGMENTARY SENSITIZATION*

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SYMPATHETIC OPHTHALMIA

Although anaphylaxis as a cause of sympathetic ophthalmia had been discussed earlier, Elschnig[1] was the first to present a clear description of a workable theory supported by experimental facts. In 1910, he advanced the idea that sympathetic ophthalmia was the result of an anaphylactic reaction in which uveal pigment acted as the antigen. His theory assumed that a perforating wound involving the uvea may cause liberation, dissemination, and absorption of the pigment. Since the uvea is the only structure containing this pigment, he postulated that its absorption produced hypersensitivity to it of the uvea of both eyes. He maintained that further absorption acted as a shocking dose, causing an anaphylactic intoxication of the sensitized uveal tissue of the uninjured eye, and resulted in the clinical picture of sympathetic ophthalmia.

ALLERGIC THEORY

Elschnig's theory was based on complement-fixation studies indicating that the pigment of the uveal tract was the uveal constituent responsible and that it was capable of acting as an antigen in the homologous animal, and that it was organ specific but not species specific. These findings were confirmed by Weichardt and Kummel,[2] and later by Kummel,[3] but were questioned by Rados,[4] Fuchs and Meller,[5] and von Szily.[6] In 1916, Woods[7] repeated Elschnig's work, and, with one minor exception regarding species specificity, confirmed his original results. These experiments were again repeated and confirmed by Nakamura,[8] and later partially confirmed by Kodama.[9] In studies of the mode of absorption of uveal pigment in man, Henton[10] offered further proof of its organ specificity.

Since 1916, Woods has taken the dominant role in the investigation of the antigenic properties of uveal pigment, and the present status of the allergic theory is largely due to the results of his studies. The immunologic properties of uveal pigment have been substantiated, and it has been established that after an injury to the uveal tract, the pigment may be absorbed and produce an immunologic reaction. Woods[11] showed that it was possible to produce uveitis in the fellow eye after intraocular sensitization of dogs with uveal pigment and subsequent inoculation by intraperitoneal injection. He also found that antibodies specific for uveal pigment were usually present in patients whose eys healed normally, but were absent when the inflammation was prolonged and when sympathetic ophthalmia developed.[12] These findings were not entirely confirmed by Fodor[13] who, while he demonstrated the occurrence of such antibodies in many cases, did not concur as to their appearance in specific conditions. He agreed as to their absence in sympathetic ophthalmia, but he found them only irregularly in eyes that healed uneventfully, and also found them in some cases of retinitis pigmentosa and in other diseases of the uveal tract. Gifford[14] failed to find antibodies in four patients, two of whom had sympathetic ophthalmia. With the development of more modern immunologic ideas, Woods[15] later concluded that he had exaggerated the significance of the appearance of antibodies in his earlier studies.

INTRADERMAL SENSITIVITY TEST

Because of the technical difficulties and the delay in the appearance of the antibodies in the complement-fixation reaction, Woods[16] supplanted it by the less complicated and

* Read at the III Pan-American Congress of Ophthalmology, Havana, Cuba, January 8, 1948.

quicker acting intradermal sensitivity test. Using uveal pigment as an antigen, Woods and Little[17] revealed several significant features. They found that true hypersensitivity to uveal pigment occurred only after penetrating wounds of the uveal tract, and that in such cases an unfavorable prognosis could almost always be expected. The response in patients with sympathetic ophthalmia was generally positive, but occasionally a negative reaction was found during acute exacerbations. This led the authors to assume that there may be periods showing a negative phase similar to those found in certain stages of acute tuberculosis, in which the reaction to tuberculin may be negative.

"False positive" test

It has long been noted that occasionally patients with severe traumatic uveitis, who do not develop sympathetic ophthalmia, show a positive cutaneous pigment reaction, the so-called false positive test.[16] Some eyes from such patients have been removed because of the fear of sympathetic inflammation, and others because of pain due to severe uveitis. The pathologic picture in such eyes differs somewhat from that of sympathetic ophthalmia. Nevertheless, at one time consideration was given to the possibility that sympathetic uveitis might have occurred if the eyes had not been removed.[16] Later, it became apparent that this condition did not necessarily predispose to sympathetic ophthalmia, for in cases in which the affected eye was not removed, the fellow eye did not become involved. Woods[16] has long been impressed by the clinical similarity of these cases and he and Little[17] suggested that the condition appeared to be a clinical entity, the characteristics of which are the development of a delayed, severe, recurrent, and chronic postoperative or traumatic uveitis associated with the synchronous development of allergy to pigment.

Histologic studies

The evidence of relationship of uveal pigment allergy to sympathetic ophthalmia received considerable support from Jonas Friedenwald's histologic studies.[18] Since, according to the Elschnig-Woods theory, uveal pigment is the antigen responsible for the pathologic reaction in sympathetic ophthalmia, Friedenwald speculated that pigment granules within the phagocytic cells should be found in the centers of the lesions; for if the disease is allergic, the specific antigens should be demonstrable in the specific lesions.

In his investigation, he found that not only were the epithelioid cells and giant cells of the uveal tract filled with stainable granules, but so were those in episcleral and retinal nodules. The retinal findings were particularly significant, for the picture was quite different from that found in other pigmentary disturbances of this tissue. The characteristic feature was the fact that whenever melanin pigment was deposited in the retina, the granules were engulfed by epithelioid cells and giant cells and surrounded by an inflammatory infiltration which had all the characteristics of the specific lesions of sympathetic ophthalmia.

The presence of these nodules raised the question as to how far the characteristic inflammatory reaction of sympathetic ophthalmia might be considered as due solely to an allergic reaction to the pigment granules. The question was answered by studying histologically the reaction in the skin to a local injection of a suspension of uveal pigment. Friedenwald found that two weeks after injection the histologic picture of the excised skin was identical to that of the ocular reaction in patients with active sympathetic ophthalmia. On the other hand, in normal and insensitive individuals, the picture was quite different. He concluded that the disease had been reproduced in the skin of a susceptible individual by the local injection of the presumed specific antigen. He further concluded that the characteristic pathologic changes found in this disease are compatible with the allergic hypothesis. Alexseev[19] made similar histologic examinations of the excised cutaneous segments in 6 cases, 5 of

which showed clinically positive skin tests. The one clinically negative case proved to be positive histologically.

Desensitization

On the assumption that allergy to uveal pigment is at least a fundamental factor in the production of sympathetic ophthalmia, Woods[16] presumed that, theoretically, this factor should be removable by desensitization with the specific allergin. Using uveal pigment injected intramuscularly he sought to specifically desensitize patients with sympathetic inflammation. As the result of many years' observation involving a comparatively large number of patients, he believes the therapy to be specific and of true value.[17] However, uveal pigment is an insoluble and feeble antigen, and its absorption is slow so that desensitization is a long-drawnout process.[20] Friedenwald[18] obtained a more rapid desensitization by exposure of the skin of the body to ultra-violet light. His purpose was to produce a proliferation of the melanophores of the skin, so that the body might be provided with a readily available and widely distributed supply of pigment antigen.

Comment

Thus, it appears that the proponents of the allergic theory have built up a strong case in support of their contention that uveopigmentary sensitization is the essential element in the production of sympathetic ophthalmia. However, this evidence is not quite as formidable as it first appears. Its cornerstone is the assumption that uveal pigment is the antigenic substance involved in the process. But, in spite of extremely strong evidence that this is true, the fact that some investigators have been unable to confirm its immunologic reaction cannot be ignored.

Even if one accepts the organ-specific properties and antigenic action of uveal pigment, consideration must be given the possibility that the immune response is not specific, but may be due to the absorption of a foreign protein. It is possible that some substance other than the pigment is the antigenic agent. The isolation of uveal pigment is an exacting and complicated process and there is always the chance that it may not be free from other tissue substances or that changes may occur during its preparation.

Moreover, it is a well-known fact, as pointed out by Berens,[21] that allergic individuals give a reaction to certain, sometimes many, antigens, and that those who are nonallergic react negatively to the same antigens. The possibility arises that the former group may have a tendency to react positively and the latter group negatively to uveal-pigment injections.

Whatever the reasons, some investigators[14, 19, 22-25] have not found the uniform clinical results, in using the skin test, noted by the Wilmer group and by Gill.[26] It is possible that this inconsistency may be due to differences in technique or to the use of old pigment. Nevertheless, it clouds the issue regarding uveopigmentary sensitization.

Woods,[15] in presenting the evidence favoring the allergic hypothesis, admitted that his production of experimental uveitis was open to question, and that while he strongly believed the therapeutic response to uveal pigment was specific, it could not be definitely proved. Examination of the published protocols of Woods's animal experiments, and a review of his reports on the therapeutic use of uveal pigment, indicates that the former showed encouraging but inconclusive results, and that the latter left slight doubt as to its specificity.

However, regardless of objection to certain features in the uveopigmentary sensitization hypothesis, the overall evidence is imposing. This theory readily explains the long incubation period of sympathetic ophthalmia, the failure to find any specific organism, and the rather uniform presence of hypersensitivity to uveal pigment. It also explains the infrequent occurrence of the disease, since only a relatively small number of individuals have an allergic tendency.

CRITICISMS OF ALLERGIC THEORY

On the other hand, several factors are frequently cited in the literature as not harmonizing with this hypothesis, and which indicate that something besides allergy enters the picture. As a matter of fact, not all of these factors necessarily conflict with the allergic theory. An example is the appearance of papillitis as an early and prominent symptom of sympathetic ophthalmia, particularly in cases which show little or no uveal involvement. A possible explanation of the participation of the optic nerve in these cases may be the occasional presence of pigment in its anterior regions.[27]

The dissimilarity of the histologic picture of sympathetic uveitis and that of known allergic reactions has been frequently cited as conflicting with the allergic theory. It is true that the histologic changes appearing in sympathetic ophthalmia resemble those produced by infectious agents. However, as pointed out by Friedenwald,[18] allergic reactions play a greater or lesser part in the histologic changes which take place in infected tissue. Although in some instances the tissues are directly injured by the toxin, in others, such as tuberculosis, an allergic reaction dominates the process, and it is this reaction which determines the characteristic histologic picture. If this is true in tuberculosis, it is conceivable that it may also be true in sympathetic ophthalmia. Further evidence of the similarity of allergic reactions and sympathetic disease is provided by Friedenwald's histologic skin studies, and by the fact that a pathologic picture of allergic origin closely resembling sympathetic ophthalmia has been obtained by injection of horse serum into the opposite eyes of sensitized rabbits.[28]

One of the chief criticisms of Elschnig's original theory was his contention that one of the body tissues was capable of acting as an antigen. This was in conflict with the immunologic rule that an animal cannot be sensitized against his own protein, the "horror autotoxicus" of Erlich. However, in the light of our present knowledge of immunology it is conceivable that the organ specific uveal pigment may have an antigenic action in an homologous animal.

The second phase of this hypothesis has also received much criticism. According to Elschnig, after sensitization has occurred further absorption produces the shocking dose causing anaphylactic intoxication. It has been argued that if this were true there would have to be an interval between the sensitizing and shocking doses in which no antigen was in circulation, on the assumption that the state of anaphylactic shock can occur only when the whole of the sensitizing dose has disappeared.[29] This would mean that uveal pigment must be set free from the injured eye a second time, but not until the pigment produced by the original injury has completely disappeared from the circulation: and this would seem to be a most unusual circumstance to occur during the course of traumatic uveitis. This objection is based on the false premise that there must be an antigen-free period between the sensitising and shocking doses. That this is not true may be demonstrated by such conditions as serum sickness, the positive reaction to tuberculin in active tuberculosis, and many other conditions.

Another argument against the allergic theory is that prophylactic enucleation of the exciting eye would be of no value once sensitization had occurred. Instead, the resultant trauma might be sufficient to act as a shocking dose in causing the disease. To me, this argument does not seem valid. Enucleation of the exciting eye should act to prevent the further absorption of uveal pigment from it and thus tend to prevent the occurrence of the shocking dose. Even admission that the trauma caused by enucleation might stir up the uveal pigment enough to produce it, does not necessarily conflict with Elschnig's

contention. For it would seem to be an unusual circumstance, and it could account for the not infrequent occurrence of sympathetic ophthalmia after prophylactic enucleation.

Factors supporting criticisms

There are two factors which provide quite definite proof that sympathetic involvement is not a purely allergic reaction. These are: first, the fact that sympathetic inflammation does not follow nontraumatic uveitis and other conditions in which there is uveal disturbance; and secondly, the occasional occurrence of hypersensitivity to uveal pigment in patients who do not develop the disease.

The occasional appearance of this "false positive" skin reaction led Woods to modify Elschnig's original theory. His present conception is that the development of allergy to uveal pigment apparently sets the stage for the production of sympathetic ophthalmia by disturbing the immunologic defense mechanism, and that it determines the histologic picture, but that some other unknown factor must be present to initiate the onset of the disease.[20]

The most perplexing feature in this theory is the direct inciting cause. The most generally accepted opinion is that an exogenous infection enters the blood stream and becomes localized in the sensitized uninjured eye. It has been suggested that some unidentified organism or virus may be the infecting agent, or that tubercle bacilli become lodged in the eye, or that the reaction is tuberculo-toxic. However, the whole matter is entirely speculative and it is possible that the inciting factor is entirely nonspecific.[30]

Theory of intraocular melanophores

Friedenwald[18] has suggested the novel theory that the additional factor necessary to initiate the inflammatory reaction is a proliferation of the intraocular melanophores which releases the uveal pigment and makes it available for allergic reaction. He explained his hypothesis as follows:

"In some cases following an injury to the eye, the body becomes hypersensitive to uveal pigment. This alone is not sufficient to elicit the disease, for cells containing melanin granules show no abnormal reaction, in their resting state, to the presence of allergic antibodies. When, however, such cells proliferate, they become vulnerable to the antibodies, and undergo autolysis, releasing their melanin granules, which, in time, elicit the allergic inflammatory reaction."

The pathogenic effect of the melanin granules, and especially of the precursors of melanin, was investigated by Spyratos,[31] who concluded that they act as virulent proteins. However, it is improbable that melanin is the actual inciting agent since it is not thought to contain lipoids or fatty acids[32] which are believed to be essential to the production of the type of granulation tissue found in sympathetic ophthalmia.[33]

Variations of Elschnig-Woods theory

Several variations of the Elschnig-Woods theory have been proposed. Oguchi[34] expressed the belief that liberated chromatophores are responsible for sympathetic inflammation. According to his conception, trauma of the uvea frees immune bodies which attack and destroy the neighboring chromatophores until this change takes place in the entire uvea. The liberated and wandering chromatophores, which act as antigen and as allergen, produce an allergic infiltration when they are in sufficient quantity, or the tissue is electively sensitized. If the liberated chromatophores pass on to the other eye, sympathetic ophthalmia ensues. The pathway may be the blood stream, the optic nerve, or the orbital facial venous system.

Marchesani[35] apparently believes that nonspecific bacterial protein absorbed from the eye produces a paired organ sensitivity of the two eyes, making it possible for the bacteria to localize in the second eye. He based

his conclusions on rabbit experiments in which he produced a histologic picture somewhat resembling sympathetic choroiditis in the fellow eye by repeated intravitreal injections of broth cultures of Bacillus subtilis. However, his conclusions are open to serious doubt, for his assumption that the reaction was allergic has been challenged by Iga[36] and Kiyosawa[37] who, separately, repeated the experiments and concluded that the reaction was due to bacterial metastasis. Their contention receives support from the fact that Friedenwald and Rones[38] found lesions almost identical to those described by Marchesani in eyes of patients who had died of general septicemia.

Riehm[39] reported experiments in which he found that repeated intraocular injections of foreign protein (horse serum) produced sensitivity of the fellow eye in pigmented rabbits, but caused no reaction in albinos. He considered the process to be an elective sensitization of paired organs rather than sympathetic disease. He expressed the belief that sympathetic ophthalmia following perforating wounds was due to an unknown infective agent which acts as an antigen only in human uveal tissue, and sensitizes the uvea of both eyes—an anaphylactic inflammatory reaction to a bacterial antigen. On the other hand, he regarded the reaction as purely allergic, with elective sensitization of the fellow eye, in sympathetic inflammation following such conditions as intraocular melanoma and subconjunctival scleral rupture.

Schlaegel[40] repeated Riehm's experiments but used smaller and fewer doses of horse serum. He found a minimal response in the fellow eye and an equal reaction in pigmented and albino rabbits. However, he did not consider that the results of his investigation had discredited the pigment-allergy theory.

In evaluating animal experiments the biologic and immunologic differences between animals and man must be remembered. Samuels[41] has pointed out the dissimilarity of the rabbit and human choroid. In rabbits, apparently, it is constitutionally more resistant and the circulation more active in carrying away toxins. As a result, irritative lesions cause lymphocytes to appear, but pus cells are notable for their absence. It is not difficult to make a mistaken histologic diagnosis of sympathetic ophthalmia in rabbits, due to the fact that groups of capillaries and endothelial buds in the dense lymphocytic infiltrations may simulate epithelioid cells.

Discussion

Allergy to uveal pigment is only one hypothesis concerning the pathogenesis of sympathetic ophthalmia, but time does not permit discussion of other theories, some of which are built on firm foundations. I have endeavored to review some of the progress and the present status of what up to now is probably the most complete and most carefully worked out theory of this disease. It seems probable that sensitization to uveal pigment plays at least some part in the production of sympathetic ophthalmia but to what extent, time and future studies alone will tell.

Vogt-Koyanagi Syndrome and Harada's Disease

The occasional occurrence of alopecia and poliosis in sympathetic ophthalmia and in other types of uveitis has long been noted. Nettleship, many years ago, suggested that similar pathologic processes were probably present in sympathetic disease and in destructive iridocyclitis with poliosis.

Two types of bilateral nontraumatic uveitis possessing most of the characteristics of sympathetic ophthalmia have been identified. These two conditions are probably related, and according to many authors they comprise a single entity. In one, the Vogt-Koyanagi syndrome, the uveitis is associated with alopecia, poliosis, and, frequently, pigmentary changes of the skin and auditory disturbances. The other milder syndrome, Harada's disease, is characterized by a ser-

ous choroiditis which produces temporary detachment of the retina.

Only a few eyes of patients with the Vogt-Koyanagi syndrome have been examined histologically. These have shown a similarity to sympathetic uveitis, but with the exception of the case studied by Matsuoka[42] there has been an absence of epithelioid cells and giant cells. Because Harada's disease is apparently self limiting, histologic material has been available in only one case in which there was secondary glaucoma necessitating iridectomy.[43] Pathologic examination showed giant cells of the Langhans type. However, the disease has been reproduced in rabbits' eyes by the injection of cerebrospinal fluid and other substances from patients with this condition. The histologic picture resembled sympathetic ophthalmia except for the absence of giant cells.[44]

Because of the histologic and clinical resemblance of these two conditions to sympathetic uveitis, attempts have been made to explain them on an allergic hypothesis. The basis for this idea was Elschnig's[45] contention that alopecia and poliosis in association with sympathetic ophthalmia resulted from the antigenic effect of uveal pigment, the hair being involved because of its richness in pigment.

Peters[46] speculated that the disturbance of hearing in the Vogt-Koyanagi syndrome might be due to sensitivity of the pigment in the basilar membrane of the labyrinth, and Cramer[47] attempted to explain the hair disturbances on the same basis. However, the dearth of pigment in the basilar membrane and the lack of knowledge of its physiologic function caused Koyanagi and others to object to Peters' explanation. Koyanagi[48] explained further, that hearing defects usually occur before uveal pigment can have exerted its antigenic action. Weskamp[49] suggested that it might be possible to explain all of the symptoms of the syndrome by anaphylaxis, since the majority of them originate in tissues rich in pigment. Oguchi[34] impressed by the similarity to sympathetic ophthalmia expressed the belief that the syndrome might be the result of liberated and wandering chromatophores which act as allergens.

Rosen,[50] who is apparently strongly convinced that the Vogt-Koyanagi syndrome and Harada's disease are a common entity and are due to allergy to uveal pigment, suggested that these two conditions probably represent different degrees of involvement in individuals of variable sensitivity. He speculated that in Harada's disease an immunity is soon developed to a severe allergic reaction; whereas, in the Vogt-Koyanagi syndrome the allergic reaction is much less acute, with practically no immune response except when stimulated.

In the four cases of the Vogt-Koyanagi syndrome in which cutaneous sensitivity tests to uveal pigment have been made, a positive reaction occurred in only one.[51, 52] It was assumed that the negative reactions were due to desensitization, as all of these cases had already passed the acute stages when the test was done. However, as pointed out by Rados,[53] this explanation is not entirely adequate since the positive case was also of rather long standing.

It is apparent that an allergic basis for the production of the Vogt-Koyanagi syndrome and Harada's disease is far from established. In spite of the clinical and histologic similarity of these diseases to sympathetic ophthalmia, it is possible that the etiologic causes are entirely different. Beauvieux and Bessiere[54] concluded that rather than indicating a common etiology, it suggests that different viruses may have similar tissue affinities. While it is tempting to speculate that allergy to uveal pigment at least enters the picture, further proof must be provided.

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THE ETIOLOGY, SYMPTOMATOLOGY, AND TREATMENT OF JUVENILE GLAUCOMA*

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It is the purpose of this paper to present the etiology, symptomatology, and treatment of juvenile glaucoma. This condition has been usually regarded as entirely familial; however, I now have five patients between the ages of 15 and 26 years, in whom there is no history of familial tendency. With the introduction of gonioscopy and goniotomy the condition can now be properly diagnosed and operation, when indicated, carried out under direct observation.

To Troncoso and Barkan[1] we owe a debt of gratitude, since it is through them that our knowledge and understanding of glaucoma has been greatly increased with the introduction to ophthalmology of the routine and simplified use of the gonioscopic examination. Now that we can see directly the angle of the anterior chamber, its trabecula, and any obstruction to the outflow of aqueous, our understanding of the filtration angle has been increased. With the gonioscope lens we can view the block of the angle in congenital glaucoma. Likewise, with a clear view of the angle, adult cases can now be classified anatomically into narrow- and wide-angle glaucoma, instead of being classified according to the previous clinical groupings.

ANATOMY OF ANTERIOR CHAMBER

Gonioscopy is so thoroughly an anatomic examination that a review of the anatomy of the anterior-chamber angle is in order. As the cornea passes into the sclera, its inner surface makes an angle with the anterior surface of the iris. Approximately at the apex of this angle in the cornea is normally located the canal of Schlemm. The canal is separated from the anterior chamber by the trabecula, the interstices of which are lined with endothelium. The corneal endothelium, according to Reese,[2] as well as some of its cuticular product, is continued from the cornea to cover the interstices of the trabecula. The structure of a trabeculum, therefore, is a central collagenous fibrous strand around which, as a thin glass membrane, is a cuticular product and this in turn, is covered by the endothelium, which fills the interspaces and/or forms a Descemet's-like membrane along the inner surface of the angle.

With the gonioscope lens in place, as one approaches the anterior-chamber angle from the corneal side, a prominence is first seen which is the anterior border ring of Schwalbe. This constitutes the termination of Descemet's membrane. Between this and the next landmark, which is the white line of the scleral spur, can be seen the individual fibers of the trabeculum running in meridional and circular directions. This zone of Schlemm's canal appears as a faint grayish or occasionally pinkish band. In deeply pigmented eyes, the trabecula is seen to be coated with pigment granules, and the trabeculae then appear dark brown.

As so well described by Barkan,[3] lying directly on this surface there can be seen a few very delicate branching trabecula, which are an extension of the anterior surface of the iris and extend to the posterior corneal surface. These represent that filamentous portion of the network of the angle which anatomists describe as the uveal meshwork. If the iris is removed from the ciliary body in the wet specimen, the anatomist refers to that portion of the meshwork which remains connected to the ciliary body as the scleral mesh, and the very thin portion remaining attached to the iris as the uveal meshwork.

* Presented before the Mexican Association for the Prevention of Blindness, Mexico City, August, 1947.

Teased preparations also show these fibers. Still following around the chamber angle, there is normally seen the dark granular band of the ciliary body, only visible with a wide-open angle. Adjoining this is the anterior surface of the iris.

In juvenile and congenital glaucoma the normal appearance is considerably altered, and none of the usual landmarks can be seen. With the gonioscope lens in place, the anterior chamber is of normal depth, but the angle is everywhere seen to be filled with tissue obstructing the view of even the anterior border ring of Schwalbe. This anomalous filtration angle network is normally present in the fetus until the sixth month and is known as the pectinate ligament. The word pecten means "comb" and refers to the fact that its strands are like the teeth of a comb which has been bent into a circle with the teeth pointing inward. These strands are best developed in horses, seals, and other animals (Walls),[4] where there may be teeth-like processes in several meridians forming a fan somewhat like the situation in reptiles. In horses they are continuous with and identical to the material of Descemet's membrane.

Microscopically in the human eye are seen strands of trabecular tissue or even a mass of considerable density stretching across and blocking the angle of the anterior chamber (Parsons, 1904).[5] This is a persistence of the fetal condition wherein both the sclera and the uveal portions of the trabecula persist, according to Duke-Elder.[6] The etiology of the condition is, therefore, due to the deformities of the angle of the anterior chamber—a persistence of the prenatal or prehuman condition—preventing the free drainage of the intraocular fluids, and thus leading to increased pressure in the eye. This is a developmental abnormality of the mesoderm in the region of the corneoscleral junction. Verhoeff[7] examined two cases of juvenile glaucoma, microscopically, and found in each a defective filtration angle similar to that found in hydrophthalmia.

Hereditary factors

Stokes[8] writes that if it is true that congenital glaucoma (hydrophthalmia) and glaucoma of the hereditary type are essentially the same disease with the same underlying pathogenesis, then the former variety should arise commonly among the offspring of glaucoma patients. There is as yet little evidence that such a sequence is potential. When it does occur it is of interest because it links up the two types.

Lohlein[9] reports a family in which the youngest of the four sisters had hydrophthalmia and the three others had juvenile glaucoma. Scheerer[10] and Korte[11] report families having hydrophthalmia and juvenile glaucoma, and glaucoma simplex with hydrophthalmia, respectively. These cited relationships between the two groups point to an underlying genetic cause leading to a failure (more or less complete) of development of the filtration angle. If the failure is complete, congenital hydrophthalmia results. If it is incomplete, the drainage will be maintained for a variable time, until the sclerosing changes of adult life can no longer be compensated.

Stokes[8] found that when hydrophthalmia is transmitted it appears as a simple recessive; that is, it will not develop unless two conductors of the disease have offspring. Hereditary glaucoma appears as a simple dominant in practically all published pedigrees. Either parent who transmits the disease is usually affected. The chance that an offspring of a glaucomatous person would be similarly affected is in theoretical ratio of 50:50. The chance that an offspring of normal persons would be affected appears to be negligible. Consanguinity does not seem to be a factor.

Age of onset

The age of onset of increased pressure varies in reported pedigrees. The onset of the disease may occur in infancy (hydrophthalmia), early in youth (juvenile glau-

coma), or in adult life. The importance of heredity in glaucoma is as yet not known. Therefore, in these congenital glaucoma types it behooves us to be on the alert for the occurrence of other cases in the family. Keerl[12] analyzed the cases of the University of Leipzig and found heredity to be a factor in 18 percent of cases of juvenile glaucoma. The age grouping was as follows: from 6 to 15 years, 14.8 percent; from 16 to 25 years, 37 percent; and from 26 to 35 years, 48.3 percent. The age of onset in the reported pedigrees varies from 16 to 30 years in families reported by Stokes,[8] Shumway,[13] Calhoun,[14] Courtney and Hill,[15] Bell,[16] and others. According to Allen,[17] 30 years appears to be the upper limit of age of onset.

Regarding the lower age limit for juvenile glaucoma, Anderson[18] uses distention of the eyeball. Thus he writes that due to glaucoma a congenital defect may be classified as juvenile, if it fails to develop until the eye is no longer distensible. The corneal measurements in juvenile glaucoma are all within the limits of normal.

Date of onset

The date of onset of juvenile glaucoma is, in many cases, indeterminate. Thus the reduced age of onset in the younger patients reported could be due to more prompt diagnosis, and must not be taken as a proof of a general tendency to anticipation of the disease, although some anticipation has been reported (Allen[17]). Anderson[18] states that in 87 percent of cases of hydrophthalmia the diagnosis was made before the age of one year.

Cases of juvenile glaucoma are usually chronic; however, the author has seen one patient, aged 26 years, with an acute attack, and a second with a history of a recent acute attack. Allen[17] reports that 18 percent of cases of juvenile glaucoma have acute episodes. He states also that juvenile glaucoma tends to occur more frequently in patients with dark irises.

Relation to myopia

It is still uncertain whether the myopia found in hereditary glaucoma is entirely secondary to the increased intraocular pressure or whether the relation is one of a correlated inheritance similar to that between myopia and other ocular anomalies. According to Stokes,[8] a high intraocular pressure no doubt is a factor in the production of myopia because of the elasticity of the eyeball. The onset of the myopia could even prove compensatory to the high tension changes of glaucoma. Myopia is seldom present in senile glaucoma, but is common clinically in juvenile glaucoma. According to Duke-Elder high degrees of myopia and even hypermetropia are frequently found.

Myopia, according to Parsons[19] is due to the following causes:

1. Decreased corneal convexity.
2. Decreased convexity of lens due to stretching of the suspensory ligament.
3. Displacement of the lens backward—could be due to elastic sclera.

The incidence of myopia in hereditary glaucoma, which averages about 60 percent in all reported families, is sufficiently great to suggest that the hypertension has been influential in producing the bulbar distention and the altered refraction. The occurrence is certainly more than normal and cannot be accidental or incidental.

Influence of race and sex

Stokes[8] found that females are affected a little earlier than males, which is also true of patients with nonhereditary adult glaucoma.

There is no definite racial factor in these cases according to Courtney and Hill.[15] The predisposition of the more nervous or unstable races to acute glaucoma does not seem to hold for the juvenile disease, which is usually of the chronic type.

It is certain that the age limits in glaucoma vary from person to person, as well as in different periods of life. This is even

more true of juvenile than adult glaucoma, and may partly explain the lack of sustained and fixed manifestations of this disease.

Symptoms

By far the most frequent complaint is headache, which is very severe, frequently recurring, usually quite persistent, not relieved by aspirin, present more often in the mornings, and which leaves upon retiring.

Another early symptom, according to McKee,[20] is colored rings around lights—seen first at intervals, then present constantly. Later a sense of fullness or pain in the eye develops. Often these patients give the history that for years they have noticed that their pupils are abnormally large. In the examination, the cornea is usually clear and lustrous; or rarely, if the tension is high, it is steamy. The anterior chamber is always deep, and the pupils are moderately dilated. The disc is usually normal, but may appear slightly pale. No cupping has been seen by me.

Visual fields

The visual fields often show contractures resembling adult glaucoma.[21] The intraocular pressure is rarely found to be elevated, but shows considerable fluctuation, often varying 10 mm. Hg (Schiøtz) from examination to examination. A high intraocular pressure finding is the exception rather than the rule, thus the diagnosis lies entirely with the use of the gonioscope lens. In megalocornea a large expanse of ciliary body is seen, and the normal appearing drainage angle is clearly visualized. This is in contrast to the juvenile glaucoma angle in which the landmarks are covered with dense tissue.

Duke-Elder[6] stated that the condition could stabilize itself in early youth, which could be explained by a stretching process opening up the trabeculae of the angle of the anterior chamber, or by the atrophy of the persistent embryonic tissue in this region. However, this tissue, in most cases, produces embarrassment to drainage.

Verhoeff[7] stated that in juvenile glaucoma the outflow was not completely cut off, at least at first, and, therefore, in early life there is not enough increased intraocular pressure to enlarge the globe; whereas, in hydrophthalmia the pressure is sufficient to do this. Different grades of hydrophthalmia are often present in the same patient, as the condition in one eye may be considerably more advanced than in the other eye. Thus juvenile glaucoma and hydrophthalmia could simply represent differences in degree of the same condition, and Lohlein stated that juvenile glaucoma is a form of hydrophthalmia in which the congenital anomaly of the chamber angle is not sufficient to produce a full-blown hydrophthalmia.

Case reports

At this time I wish to present the case histories of three patients which are in addition to the cases of two patients, aged 15 and 26 years, previously reported.

Case 1

History. M. Q. K., a Chinese physician, aged 26 years, was first examined on December 20, 1946, with the history of an acute attack of glaucoma in the right eye in April, 1945. The present attack began three hours previously with pain, headaches, halos, and blurring of vision of the right eye. He had started using miotics intensively since the onset. There was no history of glaucoma of any type in the family.

Examination. O.D.: Vision, uncorrected, was counting fingers at 3 feet, corrected to 20/70 with a −8.25D. sph. ⌒ +1.25D. cyl. ax. 85°. Tension was: 25 mm. Hg (Schiøtz). The disc showed good color. Fields were normal. O.S.: Vision, uncorrected, was counting fingers at 3 feet, corrected to 20/25 with a −8.0D. sph. ⌒ +2.0D. cyl. ax. 93°. Tension was 28 mm. Hg (Schiøtz). The disc showed good color. Fields were normal.

Gonioscopic examination. The angle was everywhere seen to be blocked with tissue

and very heavily pigmented. No normal angle landmarks were visible.

Diagnosis. Juvenile glaucoma, bilateral, subsiding acute attack in the right eye.

Operation. Under morphine-hyoscine anesthesia and novocaine, locally, a goniotomy was performed as described in a previous paper.[21] More than one fourth of the circumference of the trabecular area was incised on the nasal side of the right eye.

Note. Eight months after this operation an additional acute attack occurred with subsequent goniotomy. Three months afterward a fourth attack of glaucoma suddenly appeared, again following an entirely normal intervening period. A more extensive goniotomy was done following which the tension has remained below 20 mm. Hg. The patient is using miotics only at bedtime. Between the 3rd and 4th operations on the right eye, a goniotomy was done on the left eye as a prophylactic procedure since the tension had occasionally risen above 20 mm. Hg and the gonioscopic appearance of the angles of the two eyes were identical. The corrected vision remains 20/20 in each eye with full fields and normal size of blindspots.

This patient has now been under observation for six months. The tension averages 16 mm. Hg (Schiøtz) in each eye. There have been no further glaucoma symptoms. Premature presbyopia is present, requiring a +1.0D. sph. reading addition.

CASE 2

History. B. O., a white girl, aged 19 years, was first examined on March 8, 1947. She complained of very severe headaches for the past five years. There had been occasional blurring of vision of the right eye for the past two years; however, recently the blurring had been followed by intense headaches. For the past three months the headaches occurred daily. She had never noted any halos. There was no history of glaucoma of any type in the family.

Examination. O.D.: Vision, uncorrected, was 10/200 corrected to 20/20 with a −2.5D. sph. Tension was 21 mm. Hg (Schiøtz). The disc showed good color and the fields were normal. O.S.: Vision, uncorrected, was 10/200 corrected to 20/20 with a −2.25D. sph. Tension was 19 mm. Hg (Schiøtz). The disc showed good color and the fields were normal.

Gonioscopic examination. In each eye, about one third of the circumference of the chamber angle was seen to be occluded with tissue, and none of the normal landmarks could be seen in that area. The rest of the angle was normal with only scattered areas of pectinate ligament occluding the angle.

Course. On a later visit the tension, after using prostigmin, was: O.D., 10 mm. Hg; O.S., 19 mm. The patient was continued on prostigmin (2½ percent) twice daily in each eye, and the tension averaged 16 mm. Hg, examined at different times of the day. One headache occurred three weeks after the original examination. Since then there have been no further headaches and no blurring of vision. She has been followed for five months without any recurrence of symptoms.

CASE 3

History. M. L. B., a white girl, aged 15 years, was first examined on February 8, 1947. She complained of headaches and dizziness for the past year. Recently the vision had been blurred in the left eye, and there was also pain over the left eye which had been accompanied by vomiting. There was no history of glaucoma of any type in the family.

Examination. O.D.: Vision was 20/30, not improved with any lens. Tension was 16 mm. Hg (Schiøtz). The disc showed good color. The blindspot was slightly enlarged; the periphery was full. O.S. Vision was 20/25, not improved with any lens. Tension was 19 mm. Hg (Schiøtz). The disc showed good color. The blindspot was about twice normal size; the periphery was full.

Gonioscopic examination. The nasal half of the circumference of each eye was filled

with tissue, and scattered areas were present in the temporal portion.

Course. Prostigmin (5 percent) was prescribed to be used morning and night in each eye. She returned in one week without any ocular complaint, not even headache, and she has been comfortable since the first visit. The vision is 20/20 in each eye and there is no refractive error. The tension has averaged 14 mm. Hg in each eye. The blindspots have returned to normal size and there have been no further glaucoma symptoms. The medication was reduced to prostigmin (2½ percent) at bedtime.

Comment

In one patient with acute glaucoma, the eyes have remained normalized following bilateral goniotomies. The two other cases, both young girls, have maintained normal tensions and have been relieved of symptoms with the use of prostigmin. Vision improved in one case and the blindspots returned to normal size. This recovery of field loss was also present in the two previously reported cases, both patients having maintained normal intraocular pressure following bilateral goniotomies.

Confirming Barkan's recommendation, I have repeatedly found that, in the treatment of juvenile and congenital glaucoma, prostigmin is the drug of choice and that pilocarpine and eserine are regularly without effect in normalizing intraocular pressure. Postoperatively in one patient,[21] prostigmin caused an elevation of pressure, and Allen[17] reports a similar case, also postoperatively.

Discussion

When the diagnosis of glaucoma has been made, especially in the juvenile and congenital types, careful family history and investigation should be carried out, as the condition can be definitely diagnosed with gonioscopic examination. In none of my cases was there any familial history of glaucoma. One must be constantly on the lookout for juvenile glaucoma in young adults, especially in myopic individuals who complain of severe headaches. It is to be noted that two of these three patients were myopic. Often a history of blurred vision with the headaches is obtained.

I have been unable to find previous reports of the successful use of goniotomy in juvenile glaucoma. It would seem to be indicated in cases with acute rise in intraocular pressure, or in patients in whom symptoms and/or tension is not completely controlled with prostigmin.

No report of the gonioscopic examination of the angle in juvenile glaucoma was published before Allen, in 1942,[17] described fine iris processes with fingerlike or weblike projections extending anteriorly toward the limbal portion of the cornea.

As Reese[2] has stated, the corneal epithelium is capable of producing a cuticular product or glass membrane as exemplified by Descemet's membrane. The endothelium retains its ability to produce the cuticular product throughout life, but does not manifest this potentiality except under certain provocations.

For instance, as a sign of senescence, excrescences of Descemet's membrane are frequently produced in the periphery, as Henle's warts; also, as a senile change, Descemet's membrane may become thickened. The excrescences and the thickening may occur in an aggravated form over the entire membrane and produce the conditions of cornea guttata and dystrophia endothelialis corneae.

We also know that a variable amount of pectinate ligament may be congenitally present in eyes. Therefore, is it not safe to assume that in some adult eyes, with the angle partly filled with remnants of embryonic tissue, the deposition of the cuticular produce as a senile change overcomes the final pressure compensatory mechanism in an already somewhat embarrassed angle, and glaucoma results? The formation of the cuticular product thus is the secondary change super-

imposed on a congenital malformation.

Or, might it not be entirely possible that in other cases this tissue in the chamber angle in an adult eye suddenly contracts producing a large area of narrow or even occluded chamber angle, thereby causing embarrassment of the drainage system? Certainly, this is not the answer to the etiology of many cases in which narrow-angle glaucoma occurs. In some instances we can follow the formation of adhesions with the gonioscopic lens. Any glaucoma, Reese states, with increased pressure, will develop anterior synechias, and thus the later stages, which are the ones usually studied pathologically, could entirely mask the primary condition.

Anderson,[18] in 1939, stated that no absolute distinction can be made to separate juvenile glaucoma from hydrophthalmia (congenital glaucoma), on the one hand, and senile glaucoma on the other. It is probable that at one end of the scale—that is, in early life, an innate defect in structure was the cause of hypertension and that degeneration was merely a secondary phenomenon. At the other end of the scale, raised tension could be due, almost entirely, to various degenerative changes associated with old age, and inherited defects would play a minor part.

There could be then an intermediate group in which both factors would be at work in varying degrees. One wonders then how much of the shallowness of the anterior chamber seen in congestive glaucoma and in glaucoma of old age is due to secondary inflammatory and degenerative changes and is, therefore, a sequel to rather than a cause of increased pressure.

I feel certain that juvenile glaucoma is due to the same etiologic condition as congenital or infantile glaucoma; that is, a congenital remnant of pectinate ligament blocks the anterior-chamber angle and thereby produces increased pressure. That varying amounts of pectinate ligament do occur congenitally and persist in eyes is well known. Therefore, it is logical to conclude that juvenile glaucoma cases are those in which congenital tissue remnants are present, but in which the tension had remained normalized or nearly so for years, at least to adolescent life. At this time, some, as yet unknown, event occurs and the chamber angle becomes blocked, or at least partly so, and glaucoma ensues. By this time, of course, there can follow no globular enlargement as the tissues are now no longer distensible. In the adult with congenital tissue remnants of smaller amounts, it would be safe to assume a similar mechanism could be at work with the same end result, glaucoma.

Although my patients have shown no familial tendency to glaucoma, most cases of juvenile glaucoma have been reported as hereditary glaucoma with long family histories. The outcome has heretofore been almost universally poor with conservative or operative treatment. With the reintroduction of goniotomy and the utilization of prostigmin, the outlook has considerably improved. I now have five cases with tension completely normalized.

The technique of goniotomy was reported by Barkan[22] and modified by me[21] with the introduction of a new direct-contact operating lens. Using this method, an incision can be made into the area of the trabeculum under direct observation. Good results were obtained in both juvenile and congenital glaucoma when the operation was performed early in the disease, while the glaucoma was still in the compensatory stages; that is to say, before irreversible secondary anatomic and pathologic changes had occurred.

Thus we now know the underlying etiology, symptomatology, and treatment of this disease. The only gap in our knowledge is the full understanding of the factor that finally upsets the compensatory mechanism and produces the actual onset of the condition.

The eyes of youth ordinarily contain an adequate pressure compensatory mechanism

but once that compensatory mechanism fails, secondary anatomic changes result, which in turn lead to further rises in tension and an amazingly rapid progression of all features in this disease.

The term juvenile glaucoma has been comparatively rarely used in the literature, and this paper is a plea for the clearer understanding and proper recognition of these cases. With the increased, widespread use of the gonioscope lens these patients will receive the correct diagnosis and early treatment, thereby preventing acute attacks in most cases, with the result that many eyes will be saved from blindness.

SUMMARY

Juvenile glaucoma is due to a congenital remnant of pectinate ligament, which can be clearly seen with the gonioscopic lens, blocking and covering over the angle of the anterior chamber, the same tissue that causes hydrophthalmia or congenital glaucoma. Its possible relationship to adult glaucoma is discussed. Goniotomy and/or prostigmin have been found to control this condition adequately. No familial tendency to glaucoma in the cases herein presented was observed. A plea is made for early recognition of this disease.

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SYMPATHETIC NERVOUS SYSTEM AND INTRAOCULAR PRESSURE*

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Within recent years much effort has been exerted in implicating the sympathetic nervous system in the causation of glaucoma. It has been known that alterations in the sympathetic pathways will produce fluctuations in the intraocular pressure.

At one time cervical sympathectomy was the vogue in the treatment of glaucoma.[1] Some have claimed success with irradiation of the cervical sympathetic ganglia. Bloomfield[2] showed that the aqueous of the eyes of glaucomatous patients showed a "parasympathetic deficiency" when exposed to an isolated frog's heart. This may be termed a "sympathetic excess." Schoenberg and Lowenstein[3] have attempted to show with the aid of pupillography that central autonomic structures are involved in glaucoma. Demonstration of this derangement has proved to be of considerable value in the early detection of glaucoma.

It is well known that an attack of glaucoma may be initiated by some emotional upset. Many patients with glaucoma are said to be sympathicotonic. Parasympathetic stimulation and parasympathomimetic agents are efficacious in the therapy. None of the proof may, as yet, be considered undeniably positive. It seems fairly certain, however, that the intimate association between the sympathetic nervous system and intraocular pressure is more than mere coincidence and its role in the etiology of glaucoma, although vague at present, is especially formidable.

The sympathetic nervous system may alter the intraocular pressure in any one of three ways:

1. Effect on general blood pressure.
2. Effect on the minute intraocular vessels.
3. Effect on the unstriped palpebral, ocular, and orbital muscles.

Sympathetic nervous stimulation combined with the subsequent hormonal mechanism (adrenalin) will cause an increase in blood pressure. However, associated with this there is a marked generalized vasoconstriction. Some regions respond with a more profound constriction than others. The skin vessels represent the ultimate in this vasoconstriction. For some reason the ocular vessels exhibit a relatively weak response and consequently offer a poor barrier to the increased tension in the general vascular bed. This accounts for the initial passive rise in intraocular pressure as a result of an increase in general blood pressure.

However, after more prolonged or pronounced sympathetic stimulation the blood-adrenalin level increases still further. Vasoconstriction now becomes effective and the intraocular pressure begins to fall. Thus the pressure will not fall until the intraocular arterioles respond to the increased circulating adrenalin.

The effect on the unstriped musculature must also be considered. It is certainly true that this factor assumes more prominence in an experimental animal, such as the cat, than in a human being. Nevertheless, the effect of stimulation or paralysis of Müller's palpebral muscle in a human being is not without important consequences concerning variations in intraocular pressure. The greater development of the smooth peribulbar musculature and the unstriped muscle in the floor of the orbit in the experimental animal make this consideration more prominent in alterations of ocular tension due to sympathetic nervous-system factors.

In studying the effect of adrenalin on the intraocular pressure, Duke-Elder[4] devised a method of divorcing the arterioles of the eye

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from the effects of the generalized increase in blood pressure. He used the perfused head of a laboratory animal. He noted that small doses of adrenalin (1:10,000) caused an increase in intraocular pressure due to capillary dilatation. Larger doses (1:1,000) produced a variable effect. There was a fall due to effective vasoconstriction or a rise due to contraction of Müller's muscle. The latter usually occurred first and was relatively short lived. The vasoconstriction was more prolonged and consequently there was a drop in tension. It is repeated that these are the effects when the influence of the general blood pressure is made nonexistent.

It has been shown by many [5-8] that stimulation of the cervical sympathetic in animals will cause a sharp rise in intraocular pressure due to smooth muscle contraction. This is followed by a fall in pressure due to vasoconstriction. Section of the cervical sympathetic, on the other hand, has not been so clear cut. Some[9-11] have said there is a fall in pressure; others,[12] a rise. At any rate, it may be safely stated that the sympathetic tonus regulates the pressure of the eye in such a way that factors which ordinarily influence the tension will exert a more marked effect when the sympathetic tonus is eliminated.

Adler, Landis, and Jackson[13] showed that increases in general blood pressure cause an increase in intraocular pressure in the normal eye and a more marked increase in the eye devoid of its sympathetic supply (cervical sympathectomy). They refer to this as the "protective action of the cervical sympathetic." Adler[14] states that after cervical sympathetic section there is a transitory dilatation of the ocular blood vessels. He attributes the fleeting nature of this response to an increased sensitivity of the denervated blood vessels to the adrenalin normally present in the blood. It is probable that the dilatation is transitory but it can hardly be due to sensitization since the law of denervation does not manifest itself for several days after severing the nerve supply.

Adler remarks further that after section of the sympathetic it might be supposed that the intraocular pressure would be increased due to the initial dilatation, yet it is almost impossible to demonstrate this in the experimental animal. In addition, Adler points out that in human beings, after the nerve has been injured, there usually results a lasting diminution in the tension together with the other commonly observed ocular signs (miosis, ptosis, and so forth). He attributes the hypotony to the loss of tone in the unstriped muscle around the globe.

Experimental procedures

The following experiments demonstrate the intricate relationship between the sympathetic nervous system and intraocular pressure.

Experiment 1

The intraocular pressure was measured in each eye of seven normal cats. Four cats were subjected to right cervical postganglionic sympathectomy and three cats to right cervical preganglionic sympathectomy. In each case the tension was measured immediately after the operation. It was also recorded at 12-hour intervals during the first postoperative day and then at daily intervals for the next three days. Each cat showed an immediate postoperative Horner's syndrome. In no instance was the law of denervation[15] manifest during the four postoperative days. This means that there was no exaggerated response to adrenalin, excitement, and so forth. The results are shown in Table 1 which shows that in all cases the intraocular pressure on the operated side dropped immediately postoperatively. The fall ranged from 5 to 7 mm. Hg. The average drop in tension was 6 mm. There was no significant change in the tension in the left eye (unoperated side).

However, in all cases there was a rise in pressure back to the preoperative level. In almost all cases the return to normal was completed by the second postoperative day.

TABLE 1

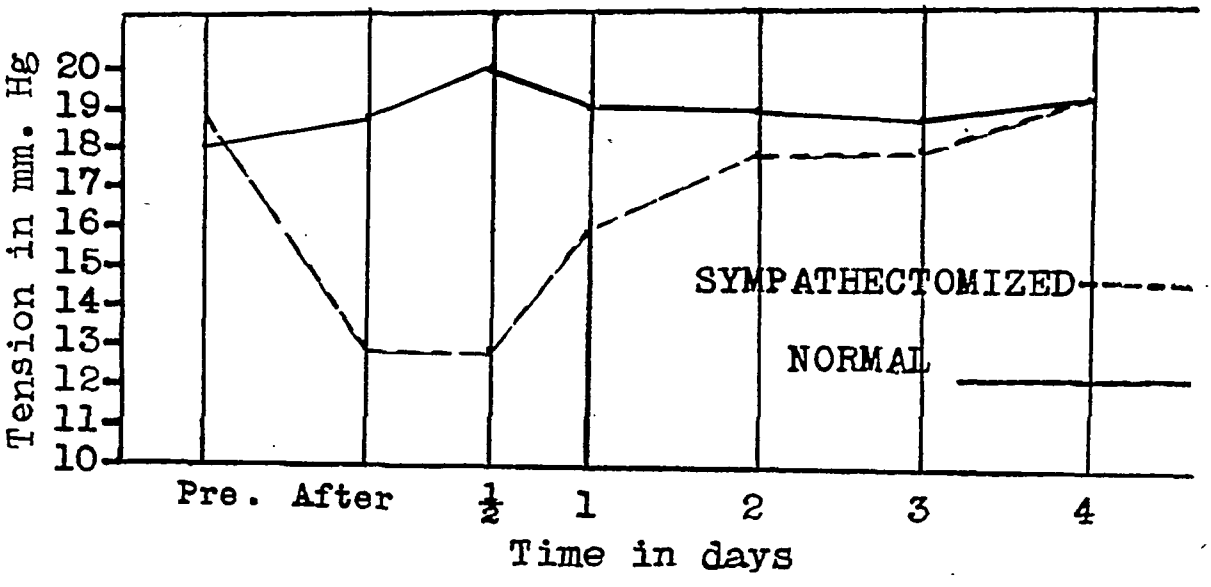
EFFECT OF RIGHT CERVICAL SYMPATHECTOMIES ON INTRAOCULAR PRESSURE OF CATS

Cat	Operation	Preoperative Tension O.D./O.S.	Postoperative Tension					
			Immediate	Days ½	1	2	3	4
24	Postgang.	20/18	15/20	14/20	17/20	20/20	20/20	19/20
25	Postgang.	18/18	11/20	12/20	15/20	15/20	17/17	17/17
26	Postgang.	17/17	12/18	12/20	16/18	18/18	17/17	18/19
27	Postgang.	20/20	13/20	15/20	15/18	20/20	20/20	20/20
28	Pregang.	18/17	11/18	12/18	16/17	17/17	18/18	18/18
29	Pregang.	19/18	14/18	14/19	17/19	19/19	18/19	19/19
31	Pregang.	19/19	13/20	15/20	14/22	18/20	18/19	20/19

During the subsequent two days there was no variation. Graph 1 is a composite record of these results.

EXPERIMENT 2

Seven cats, which had been subjected to right cervical sympathectomy 2 to 4 months before the present experiment, were used. Four of the cats had postganglionic sections and the other three had preganglionic sections. In every case a Horner's syndrome was readily apparent. There was no regeneration in any of the cats, since the iris of the postganglionic sympathectomized animals still showed an exaggerated response to excitement while the preganglionic sympathectomized cats showed a less marked, but exaggerated response.[16]



Graph 1 (Jaffe). A composite record of the results in Experiment 1.

TABLE 2

INTRAOCULAR PRESSURE IN CATS TWO TO FOUR MONTHS AFTER SYMPATHECTOMIES

Cat	Operation	Tension O.D./O.S.
20	Pregang.	20/18
15	Pregang.	20/18
21	Pregang.	20/20
16	Postgang.	18/20
18	Postgang.	15/20
22	Postgang.	18/20
9	Postgang.	16/20

Intraocular pressure was measured in both eyes of each of the seven cats. The results are shown in Table 2.

It is seen that the cats which had a preganglionic sympathectomy showed a normal or a slightly increased tension on the operated side; whereas, those subjected to a postganglionic sympathectomy exhibited a lower tension on the operated side.

EXPERIMENT 3

The seven cats used in Experiment 1 were used here. The present experiment was performed in each case more than three weeks postoperatively so that the sympathetically denervated right iris would exhibit the phenomenon of denervation—that is, extreme sensitivity to stimuli which cause adrenalin liberation.

The tension was measured in the two eyes. Then ether was administered to the animal until it passed through the excitement stage (stage II) and into plane ii of the third stage of anesthesia. The ether was discontinued and the tension was taken. It was then recorded every 15 minutes for two hours (table 3).

The results in Table 3 show that the excitement effect of ether anesthesia caused an initial rise in pressure in all animals. The tension then approached normal at the end of 15 to 30 minutes. After this time it continued to fall. This fall was completed at the

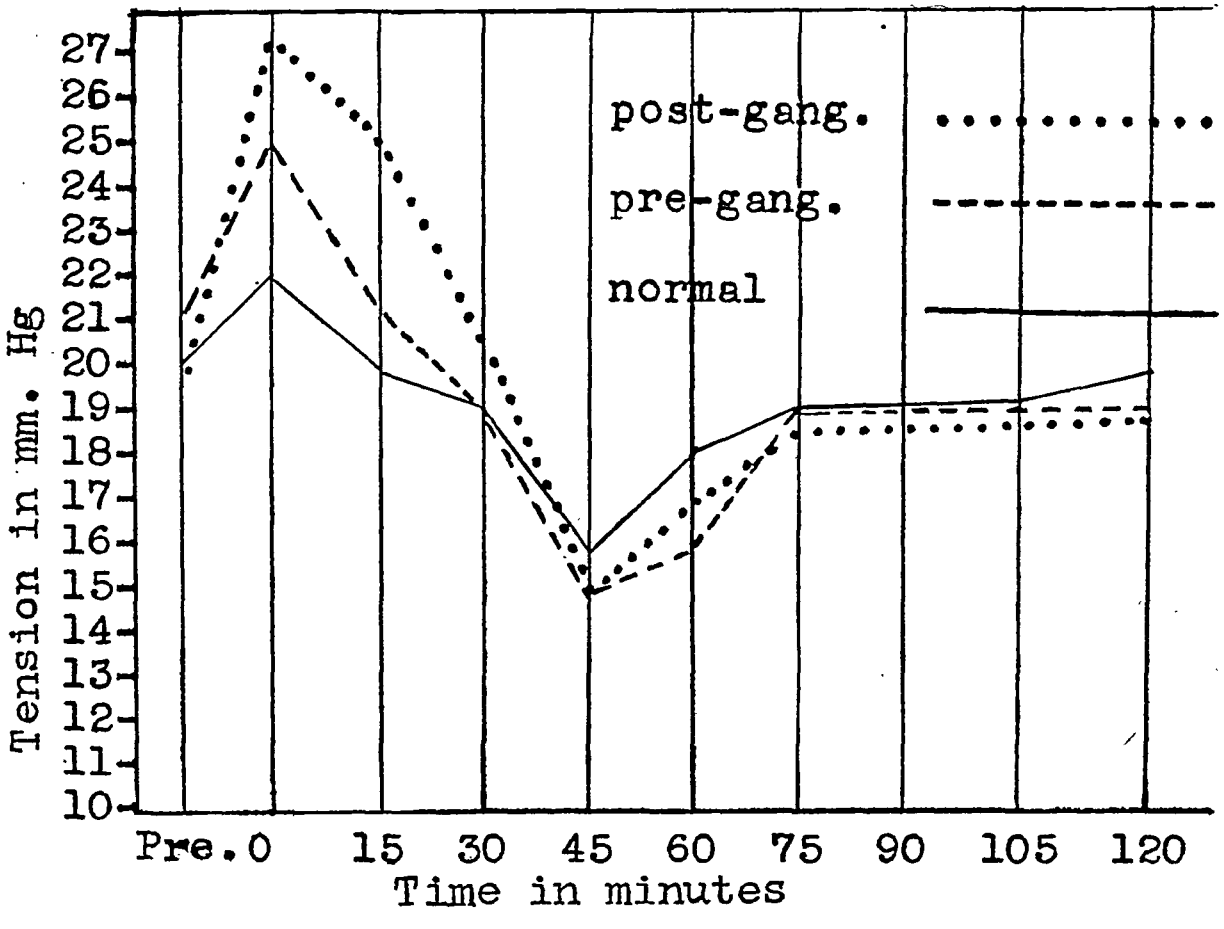
TABLE 3

INTRAOCULAR PRESSURE IN CATS AFTER ADMINISTRATION OF ETHER

Cat	Operation	Tension before anesthesia O.D./O.S.	Tension after anesthesia O.D./O.S.								
			0′	15′	30′	45′	60′	75′	90′	105′	120′
24	Postgang.	16/18	24/21	21/21	18/18	14/17	14/16	18/18	18/18	18/20	20/20
25	Postgang.	18/21	24/21	18/18	18/18	14/16	16/18	18/18	18/16	18/18	18/20
26	Postgang.	18/20	26/24	24/21	21/21	16/18	18/21	20/20	20/20	20/18	20/20
27	Postgang.	18/20	26/24	24/21	21/21	17/17	16/20	18/20	20/20	18/20	18/20
28	Pregang.	18/18	28/20	26/20	20/20	16/16	18/20	20/20	20/18	20/18	20/20
29	Pregang.	20/20	26/24	24/18	18/18	14/16	18/18	20/20	18/20	20/20	20/20
31	Pregang.	18/18	26/21	24/21	20/20	14/14	16/18	18/20	18/20	20/20	20/20

end of one hour when the tension was essentially the same as that recorded before the commencement of ether administration. The second hour (60′ to 120′) showed no variations. The normal eye showed the same response; namely, initial rise with subsequent fall in tension, but to a less exaggerated extent (graph 2).

However, the type of sympathectomy is important after the law of denervation has manifested itself (two weeks or more after the operation), as shown in Experiment 2. The effector cells in the walls of the blood vessels show a more marked sensitivity to adrenalin in the case of a postganglionic than a preganglionic sympathectomy. This may



Graph 2 (Jaffe). A composite record of the results in Experiment 3.

COMMENT

The drop in pressure following cervical sympathectomy is not permanent. It lasts less than two days. It seems likely that this fall is due to paralysis of the unstriped musculature of the lids, globe, and orbit. The secondary return to normal may be the result of the accompanying vasodilatation caused by the elimination of the sympathetic tonus. There is no difference in the drop observed with preganglionic and postganglionic sympathectomies since both cause a complete removal of sympathetic tonus.

explain why the tension is lower after a postganglionic sympathectomy, since vasoconstriction results when the sensitized effector cells are exposed to the normal adrenalin level. The normal values seen after preganglionic sympathectomy are certainly due to a lack of sensitization of the effector cells.

In Experiment 3, ether, which is sympathomimetic,[16] was given to each animal. Excitement caused both sympathetic nervous system stimulation and adrenalin secretion. The initial rise in pressure of the denervated as well as the normal eye is due mainly to

elevation of the general blood pressure with passive rise in the pressure within the ocular arterioles. Contraction of the smooth musculature also contributes to this initial rise.

The rise is considerably greater with the postganglionic than the preganglionic sympathectomized animals in accordance with the law of denervation. Sensitivity of denervated autonomic structures is twice as great if a postganglionic section rather than a preganglionic section is performed.[17] Sensitivity of the effector cells in the smooth musculature of the lids, globe, and orbit cause this effect. There is also an appreciable amount of sensitization after a preganglionic sympathectomy so that the increase in tension here is greater than in the normal eyes. Also since vasoconstriction is not effective at first in the ocular arterioles and since the sympathetic tonus has been removed, the passive rise in the sympathectomized eye is greater than in the normal eye.

However, after several minutes the tension begins to fall precipitously. This is due to the onset of effective vasoconstriction of the arterioles within the eye. The latter are now able to present an adequate barrier to the induced generalized hypertension. As expected, the normal eyes do not respond as markedly as the sympathectomized eyes. The fall is greatest with the postganglionic sympathectomized eyes since the vasoconstriction is most effective. The preganglionic eyes also exhibit some sensitivity (about 50 percent) so that the fall is greater than in the normal eyes. Again the phenomenon of denervation forms the basis of these results.

As the increased adrenalin level induced by the ether excitement begins to fade, the vasoconstriction wears off and the tension returns to normal. It has been shown that the amount of adrenalin liberated during the excitement stage of ether anesthesia requires about one hour to be metabolized.[16] After slightly more than one hour, the tension in all eyes is about the same as it was before the experiment. This corresponds to the return of the adrenalin level to normal with subsequent release of the vasoconstriction. There are no changes in tension during the second hour of the experiment.

It is clearly shown that at least one of the factors associated with changes in the intraocular pressure is the sympathetic nervous system. Animal experimentation is not perfectly comparable to human experimentation due to differences in the anatomic structures concerned with the maintenance of normal tension. Nevertheless, sympathetic elements are important. However, before its role in glaucoma can be accurately estimated, considerable human experimentation will be necessary.

Summary

Section of the cervical sympathetic nerves in a cat causes a drop of from 5 to 7 mm. Hg in intraocular pressure. This fall is maintained for at least two days after which the pressure returns to normal.

After several weeks, animals previously exposed to a postganglionic sympathectomy will show a decreased tension; whereas, those exposed to a preganglionic sympathectomy will show a normal or slightly increased tension.

Excitement induced by ether causes an initial rise in intraocular pressure in all animals. The rise is greater in a postganglionic than in a preganglionic sympathectomized eye. The rise in the latter is greater than in the normal eye. The increase lasts about 15 to 30 minutes. After this time, there is a fall below normal and then a return to normal tension.

The underlying factors concerned with these changes are discussed.

The sympathetic nervous system is intimately concerned with the maintenance of intraocular pressure and only after much more experimentation will we be able to determine its exact role in glaucoma.

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Indebtedness is expressed to Dr. Isadore Givner for valuable suggestions and criticisms.

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SULFATHIAZOLE SENSITIVITY: WITH A REVIEW OF THE LITERATURE

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Sulfathiazole sensitivity in its minor manifestations is well known and not infrequently encountered. However, extremely severe reactions simulating Arthus's phenomenon may occur, as indicated by a recent case at Percy Jones General Hospital.

CASE REPORT

History. A former infantry lieutenant, aged 32 years, sustained a grenade wound in action with the Japanese on March 24, 1945. Fragments penetrated his shoulders, right arm, back, left leg, and right eye. Immediately after injury, vision in his right eye was reduced to light perception.

All wounds, except those of the eye, were debrided and sulfanilamide powder was introduced. An undetermined number of fragments were removed from the right orbit on Leyte Island in April, 1945. Another fragment was removed in October, 1945, at O'Reilly General Hospital. Vision improved gradually. However, several episodes of sharp pain in both eyes and frequent frontal headaches, relieved by aspirin, remained as his chief complaints. Discharged on a limited-duty status, he was recalled for reëvaluation and was admitted to Percy Jones General Hospital on January 14, 1947.

Physical examination revealed numerous, well-healed scars on the back, both shoulders, right arm, and left leg.

Eye examination. Vision was: O.D., 20/50, J6, correctible under cycloplegic with a +2.0D. sph. ⌒ +0.75D. cyl. ax. 105° to 20/30+2, J2. O.S., 20/20, J1, correctible to 20/15, with a +1.25D. sph. ⌒ +0.5D. cyl. ax. 105°. External examination was not remarkable.

Slitlamp study of the right eye revealed pigment granules in a fluid vitreous. Ophthalmoscopic examination showed a large area of healed traumatic chorioretinitis in the superior nasal quadrant near the periphery.

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This was circumscribed by pigment. The left eye was normal.

X-ray examination with Sweet localization revealed a foreign body, 1 by 2 by 1 mm. in size, lying 7 mm. above the horizontal plane of the cornea, 9.5 mm. to the nasal side of the vertical plane of the cornea, and 15 mm. back of the center of the cornea, in or near the sclera of the right eye. The Berman locator confirmed the position of the metallic fragment, and at operation on January 24, 1947, with its help the foreign body was found in the sclera and dissected free without difficulty. A small amount (approximately 30 mg.) of 5-percent sulfathiazole in lanolin ointment was placed in the conjunctival sac and a dry dressing applied.

Reaction. Within 24 hours the patient developed a generalized urticaria, edema of the lids and conjunctiva in the right eye. Itching of the face and body became generalized and severe. A macular rash developed over the trunk and extremities. By this time the right eye was swollen almost completely shut, while the left eye began to show similar involvement. The healed scars of the arms and trunk became swollen, formed blebs which erupted, exuded serum, and finally became slightly necrotic. On the day following surgery, the temperature rose to 101.8°F., with a pulse rate of 142 per minute. Two days later both gradually subsided to normal.

Treatment consisted of repeated irrigation of both eyes immediately after the allergic manifestations were noted, and instillation of adrenalin (1:1,000) in both conjunctival sacs. Benadryl (50 mg.) was given orally every four hours. Except for some relief from itching, there was no amelioration of symptoms. The systolic blood pressure dropped to 75 mm. Hg, and was brought back to normal with adrenalin, following which patient developed auricular fibrillation, confirmed by electrocardiogram.

Course. Urticaria and edema of the eyes increased in severity until both eyes were swollen shut. Edema of the right cornea was severe enough to reduce vision to light perception.

After the administration of 9.5 gr. of quinidine sulfate in graduated doses, the heart rhythm and blood pressure became normal. The electrocardiogram was normal on January 26th. Edema and urticaria gradually subsided during the subsequent three weeks, and the patient's eyes returned to normal.

On February 24, 1947, vision with correction was: O.D., 20/30, J2; O.S., 20/20, J1. On February 28th, the patient met a board, which considered him fit for general duty.

Discussion

Many points of interest arise from this case. The necrosis of the former wound areas resembles the phenomenon described by Arthus in 1903. As he inoculated rabbits subcutaneously with repeated doses of horse serum, at different sites, it was noted that the primary site of inoculation would undergo a severe tissue reaction, becoming injected, swollen, and later undergoing necrosis. This is supposed to be peculiar to the rabbit, according to Topley and Wilson.[1] Our patient had been sensitized previously by sulfonamide therapy.

Untold thousands of wounded servicemen were treated by sprinkling their wounds with sulfonamide crystals. Of these a large number were given further sulfonamide therapy in their subsequent care. Therefore, the number of ex-servicemen sensitized to sulfonamide drugs may be high.

Review of literature

In reviewing the literature, we were struck by the paucity of detailed information concerning idiosyncrasy to any of the sulfonamide derivatives when instilled in the eye. Morrison,[2] in 1942, called attention to allergic conjunctivitis from the topical use of sodium sulfathiazole and sulfathiazole, and cited a case of severe allergic blepharoconjunctivitis.

Shaffer, Lentz, and McGuire,[3] in 1943, called attention to the fact that sulfathiazole used locally on the skin is capable of causing cutaneous sensitization, which may manifest itself as a local contact type dermatitis with or without generalized eruption; also that sensitization produced by local application may be elicited by oral administration.

Alvaro[4] reviewed the literature and listed the effects of sulfonamide compounds on the eye. He lists palpebral edema, conjunctivitis, chemosis, scleral reaction, cells in aqueous, iritis, mydriasis, cataract, edema of the retina, reduction of visual fields, retinal hemorrhages, optic neuritis, undefined blurred vision, transient ametropia, changes in accommodation, and heterophorias as the side effects. Most of those listed are as a result of sulfonamide therapy taken orally.

Alvaro[5] also states that sulfonamides are almost innocuous to the ocular tissues when applied locally, and that when local intolerance occurs, it is demonstrated by lid dermatitis and conjunctivitis, which subsides as soon as treatment is discontinued. He recommends the local use of sulfonamides because of easy penetration and tolerance.

Except for the cases cited, local intolerance is mentioned more or less casually, but there have been no cases reported similar to this one. However, various ocular reactions to peroral sulfonamide have been reported. The first report in literature of sulfonamide intoxication was made by Bucy,[6] in 1937, in which a case of optic neuritis developed.

In 1939, Rosenthal[7] noted field changes with angioscotometry, in which there was a narrowing of the vessel shadow induced by sulfanilamide. In 1940, Baker[8] reported retinal hemorrhages in a patient receiving sulfanilamide by mouth.

Bloom, Leech, and Shaw[9] report a case of temporary blindness, associated with retinal hemorrhage and sulfathiazole nephritis in a patient treated by peroral sulfathiazole for pyelitis and cystitis. Goar,[10] in 1942, reported two cases of retinal hemorrhages following ingestion of sulfathiazole. In 1942, Carlbuerg[11] reports four cases with myopia varying from 2 to 4.50D. due to lens changes. Numerous cases of transient myopia have since been reported.

Bellows,[12] in reviewing the literature, mentions optic neuritis, round hemorrhages around swollen arterioles, greenish scleral discoloration, bluish discoloration, temporary blindness, transient myopia, and field changes.

Savitsky and Weitzen[13] report a case of dysmorphopsia associated with blurring of vision in a woman receiving sulfanilamide by mouth. Laval[14] reports a case of paresis of accommodation in a 17-year-old girl after she had received 11½ gm. of sulfadiazine in five days for an upper respiratory infection.

Scott and Sorsby[15] list the following complications to sulfonamide therapy, but do not specify whether the medication was given locally or systemically: Transitory myopia, retinal hemorrhage, optic neuritis, and conjunctival reactions; for example, color changes, cyanosis, and pallor.

Fritz and Kesert[16] describe a case of acute congestive glaucoma following oral sulfathiazole for sore throat.

In a recent editorial in the *American Journal of Ophthalmology*, Cordes[17] sounds a warning against the indiscriminate use of sulfonamides and penicillin. He states that sulfathiazole, locally in even infinitesimal doses, can induce sensitivity. He also calls attention to reports in the literature of individuals, sensitized to one sulfonamide by local use, reacting to another type of sulfonamide after oral administration. Attention is also drawn to kidney damage and anemia. Cordes, with Thygeson, recommends sulfadiazine as being less toxic and less apt to produce sensitivity, and that sulfonamides should not be used longer than two months.

Sodium sulfacetimide (Albucid soluble) merits consideration, inasmuch as Benedict and Henderson[18] observed only one case in 65 sensitive to this drug.

Summary

1. A small amount of 5-percent sulfathiazole ointment was instilled in the conjunctival sac of a wounded officer previously treated with sulfanilamide. The patient underwent a severe local and generalized reaction. Findings included edema and chemosis of both eyes; generalized urticaria and itching; necrosis of wounds formerly treated with sulfonamide; and fall of blood pressure.

2. Treatment of sensitivity reaction consisted of topical adrenalin, benadryl in 50-mg. doses, and sodium-bicarbonate soaks. Edema did not subside in the right eye for three weeks.

3. A reaction similar to that described by Arthus in rabbits was seen in this case.

4. The literature reveals no similar case of sensitivity.

Conclusion

Severe sensitivity reactions may develop with the use of sulfathiazole, and probably with other sulfonamides. Therefore, a word of caution is offered, with the suggestion that a careful history be elicited in the event of contemplated local use in the eye of sulfathiazole or other sulfonamides. It would appear from the literature that sulfadiazine or sodium sulfacetimide (Albucid soluble) would be the sulfa drug of choice.

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LOCAL ANESTHESIA IN OPHTHALMOLOGY*

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The purpose of this paper is to review briefly a few local anesthetic procedures that have been found satisfactory over a period of years.

We have all observed that many operative accidents which occur during intraocular operations are due to a forcible contraction of the orbicularis, the rectus muscles, or to a quick movement of the eye, all a result of incomplete anesthesia. Therefore, it is extremely important to produce complete anesthesia, and as painlessly as possible, before beginning the operation.

While the principal aim of anesthesia is to prevent physical pain, it is also important to allay fear and apprehension which may shock the patient as severely as pain. The patient who comes to us for operation has confidence; otherwise he would not entrust his most valuable possession, sight, to us. His confidence though is easily undermined so every act and word in connection with the preparation of the patient for operation should be carefully studied. Usually the less said, the better. A thoughtless remark or trivial act may excite fear and apprehension. Then, confidence, which is so illusive, is difficult to regain.

Patients undoubtedly differ to as great an extent in their mental as they do in their physical characteristics and so should be approached as differently as one would approach the various surgical conditions encountered.

Before operation and during the preparation of the patient and the production of local anesthesia, patients are particularly apprehensive. Their sensibility to pain is greatly exaggerated so that each needle prick seems to be of increasing intensity. It is, therefore, of the greatest importance to induce anesthesia painlessly in order to retain and strengthen the patient's confidence. Any complaint of pain usually indicates the incorrect administration of the anesthetic rather than a defect in the procedure or the anesthetic agent.

Local anesthesia demands and allows deliberation and care in all of the manipulations of the surgeon, and the time during which local anesthesia is produced offers an excellent opportunity to build up the patient's confidence.

SEDATIVES

Sedatives, if used carefully, are a valuable aid and assist greatly in production of a quiet and tranquil patient. But, as we all know, the action of sedatives varies greatly with different patients. In some they increase excitability and may cause nausea and vomiting, so that it does not seem advisable to use any sedative, particularly for intraocular operations, without first ascertaining the action of the drug on the patient. Usually the patient is admitted to the hospital at least one day before the operation. On the first night in the hospital a sedative may be given which acts as a test dose. This allows the operator not only to learn the action of the drug on that patient but, if it acts in the usual manner, gives the patient a quiet, restful sleep, which is excellent preliminary preparation for the operation and may be repeated with comparative safety before operation.

Some of the barbituric acid group, such as pentobarbital sodium and phenobarbital, are popular preoperative sedatives for globe operations as they rarely cause nausea or other undesirable reactions. They also have the added value of counteracting to some extent the toxic action of the anesthetic agent.

Some patients require a larger dose than

* Presented at the Clinical Congress of the American College of Surgeons, New York City, September 9, 1947.

others. Small doses repeated until the desired effect is produced, seem more satisfactory than the routine use of a large set dose. With too much sedative the patient may be as uncoöperative as an acute alcoholic. Elderly persons often take a sedative regularly and, if so, it is advisable to prescribe the one to which they have become accustomed.

As a test dose, pentobarbital sodium (1.5 gr.) with acetyl salicylic acid (5 gr.) has been found excellent for the average adult. If there is no undesirable reaction, pentobarbital (3 gr.) with acetyl salicylic acid (5 gr.) is given one hour before the operation. Only in exceptional patients is it necessary to increase this dose.

Instillation anesthesia

Since the introduction of cocaine, chemists have produced numerous local anesthetic agents, some of which have in a large measure replaced cocaine. While cocaine is still popular, the chief objections to its use are that it dilates the pupil and may influence the intraocular pressure. Cocaine also causes desiccation of the corneal epithelium and may devitalize the cornea which tends to retard healing.

Tetracaine (pontocaine) hydrochloride, a derivative of procaine, is one of the more popular local anesthetic agents used for instillation anesthesia. The chief advantages of tetracaine are: it smarts very little when it is instilled in the eye; its action is rapid and prolonged; the pupil is not dilated; the intraocular pressure is not influenced, nor is the accommodation affected. Tetracaine does not cause desiccation of the corneal epithelium nor does it devitalize the cornea.

All local anesthetic agents probably delay healing of the corneal epithelium to some extent. Gundersen and Liebman[1] found 0.5-percent tetracaine hydrochloride to be the least toxic to the regenerating epithelium. Smelser and Ozanics[2] conducted experiments which confirmed the recognized belief that frequent topical application of anesthetics inhibited cell migration and mitosis. Therefore, prolonged use of any local anesthetic is contraindicated.

Patients are rarely sensitive to tetracaine but, as with atropine and many other drugs used in the eye, a conjunctivitis and dermatitis of the lids may be caused so this possibility should be kept in mind. Larocaine, metacaine, nupercaine, and other local anesthetic agents may compare favorably with tetracaine. However, the use of tetracaine routinely for 15 years has convinced me that it is an excellent local anesthetic agent. Other anesthetics have been tried and compared with tetracaine clinically but none were found to be superior. The usual strength of tetracaine hydrochloride used for instillation anesthesia is 0.5 percent, although some surgeons prefer a 1-percent solution.

Infiltration and block anesthesia

Although there have been many anesthetic agents produced for infiltration and block anesthesia, procaine hydrochloride (novocaine) is still generally conceded to be the anesthetic of choice for injection.

The strength of the procaine hydrochloride used for the injections to be described later is 2 percent with epinephrine hydrochloride (1:1,000) 1 mm. in 5 cc. The amount of epinephrine is increased for the retrobulbar injection when hypotony is desired and to retard the absorption.

Braun[3] states that a 0.4-percent solution of potassium sulphate added to the solution of procaine hydrochloride greatly increases its anesthetic properties and in this concentration produces neither local nor general injury.

Instruments

Syringes. The Luer-Lok syringes, 2 and 5 cc. (fig. 1), have been found excellent for injections around the eye. They have a lock which prevents the needle from coming off during the injection; they are light and are not damaged if placed in a boiling sterilizer.

Needles. Three sizes of needles are desirable: a 27-gauge needle, 12.5 mm. in length,

for subconjunctival injections, intradermal wheals and small subcutaneous injections; a 25-gauge needle, 2 cm. in length, for deeper subcutaneous injections, production of akinesia, and so forth; and a 22-gauge needle, 3.5 cm. long, for still deeper injections, such as retrobulbar injection within the muscular cone and to block the lids. If the point of the needle used for retrobulbar injections is ground down so that the point is rounded, it is less likely to injure the tissues or pierce a vessel (fig. 2).

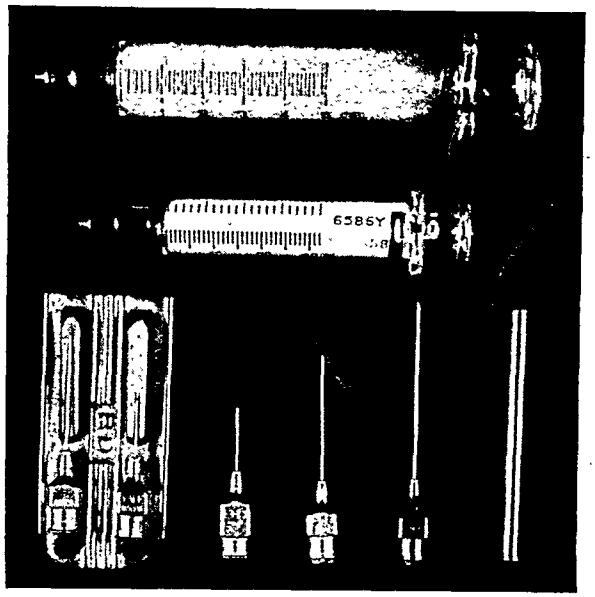


Fig. 1 (Atkinson). Luer-Lok syringes and needles.

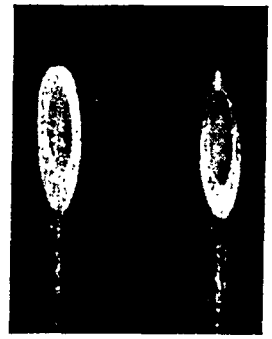


Fig. 2 (Atkinson). Rounded needle point and the regular sharp-pointed needle.

Akinesia

The desirability of having a temporary paralysis of the orbicularis muscle for intraocular operations, particularly extraction of cataract, is so generally conceded that comment is unnecessary. The method used to obtain paralysis of the orbicularis seems of less importance than to be certain that it is obtained before the operation is begun. Of the various modifications of the van Lint[4] method of producing paralysis of the orbicularis the simplest and most satisfactory is the one proposed by O'Brien.[5]

As is well known, in the van Lint method the needle is introduced at the temporal margin of the orbit (fig. 3) and an injection is made downward and nasally close to the bone to block the branches of the facial nerve which supply the lower lid. The needle is then partially withdrawn until the point is just beneath the skin and the needle is then redirected and the injection made upward to block the branches which supply the upper lid.

By the O'Brien method the temporofacial division of the facial nerve is blocked just anterior to the tragus of the ear (fig. 3). If the patient is asked to open his mouth, the condyloid process can be easily felt. The needle is then introduced until the condyloid process is just felt with the needle and about 3 cc. of the anesthetic solution is injected. If the periosteum is pricked with the needle unnecessary pain is caused.



Fig. 3 (Atkinson). The dotted line indicates the site of the van Lint injection, and the needle marks the site of the O'Brien injection, to produce temporary paralysis of the orbicularis muscle.

Deep massage with firm pressure over the site of the injection will diffuse the anesthetic solution and produce more rapid and complete paralysis of the orbicularis muscle. The course of the nerve varies considerably, so that paralysis is not always obtained with the first injection. If, after several minutes, the muscle is still active, another injection should be given and the site of the injection changed to correspond to the more common variations in the course of the nerve. Klein[6] found on dissection that the nerve more often crossed the ramus of the mandible lower than shown in most textbooks. In any event, the object of the injection should be accomplished before proceeding with the operation. A simple test to tell whether or not complete paralysis of the orbicularis has been obtained is to hold the lids open and ask the patient to close the eye. The slightest action of the orbicularis can, in this way, be felt.

One now rarely hears the criticism that the lids may come open under the dressing and so damage the eye. This does not occur, in normal cases, if the dressing is applied carefully. When the eyes are prominent and the lids do not close well, a suture to hold them closed may be easily introduced. The reason the O'Brien method is preferred is because one small injection to block the temporofacial nerve before it branches seems simpler and more efficient than to block its many branches at the orbital margin.

While the principal indication for akinesia is to prevent a "squeeze" or forcible contraction of the orbicularis in globe operations, it is also of value in other operations to obtain a larger operative field when the lids are not held open well, such as operations for detachment of the retina and muscle operations when done with local anesthesia.

When more prolonged paralysis of the orbicularis is indicated, as with patients who have a tic, with spasmodic contractions not only of the orbicularis but of other facial muscles, alcohol may be added to the solution to be injected as suggested by de Saint-Martin.[7]

The following solution, which contains 25-percent alcohol, causes little pain when injected, and the paresis lasts 7 to 10 days, sometimes longer:

Isotonic solution of sodium chloride U.S.P. ..8 cc.
Procaine hydrochloride .....0.2 gm.
Absolute alcohol .....2.00 cc.

Less pain will be experienced if 1.5 cc. of procaine hydrochloride (2 percent) is first injected, after which the syringe may be removed and the needle left in place. Beginning paresis of the orbicularis muscle indicates that the needle is in the proper position. The syringe containing the alcohol is then attached to the needle and 1.5 cc. are injected.

Retrobulbar injection within the muscular cone

In the preparation of the patient for an intraocular operation, such as a cataract extraction, let us assume that the patient has had a sedative and an anesthetic solution instilled in the eye to produce superficial anesthesia of the anterior segment and anesthesia of the conjunctiva. A retrobulbar injection within the muscular cone, or cone injection, is now given to produce more complete anesthesia.

Technique

An intradermal wheal is first made to avoid causing unnecessary pain whenever the skin is to be pierced. To some this may seem unimportant but since the aim of anesthesia is to eliminate pain we should certainly try to avoid causing pain during the production of anesthesia. Braun[8] emphasizes this and reminds us that the skin, with its innumerable nerve endings, is probably the most sensitive tissue in the body.

For the cone injection, the wheal is made just below the inferior temporal margin of the orbit (figs. 4, 5, 6) using a 27-gauge needle with the bevel toward or flat against

the skin. The 22-gauge needle, 3.5 cm. in length, is then introduced through the wheal, the skin is moved upward with the needle until the point just clears the inferior orbital margin. About 0.5 cc. of the anesthetic solution is now injected so that little pain will be experienced when the orbital septum is pierced and it can be pierced more

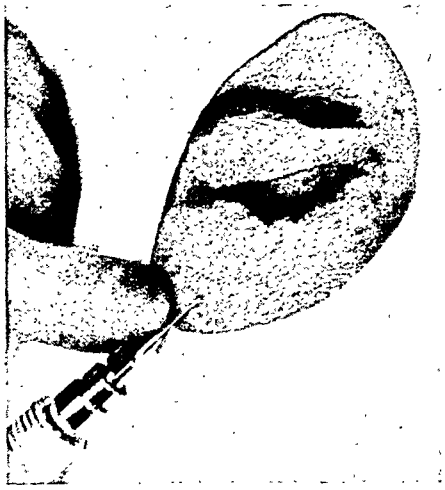


Fig. 4 (Atkinson). Intradermal wheal.

easily close to its attachment to the orbital margin.

A pause of a few moments allows the anesthetic to work during which time the patient is directed to look upward and away from the site of the injection; in this instance up and to the left for injection of the right cone. The needle is then directed upward and inward, midway between the lateral and the inferior rectus muscles. It is then advanced toward the apex of the orbit for a distance of 2.5 to 3.5 cm., the distance depending upon the size of the orbit. When the needle has reached the proper depth, one should aspirate before injecting the anesthetic solution in order to determine whether or not the needle has entered a vessel. However, in this location this is practically impossible unless there is an anomalous vessel, since here the vessels are normally smaller than the needle and are freely movable.

Again the importance of using a large, 22 gauge, needle not longer than 3.5 cm. with a rounded point should be emphasized. If a 4.5- or 5-cm. needle is used and the point carried to the apex of the orbit, obviously



Fig. 5 (Atkinson). Retrobulbar injection within the muscular cone.

a vessel or the optic nerve might easily be pierced, because here the vessels converge to reach their bony exits and are fixed.

From 1 to 1.5 cc. of the procaine epinephrine solution is slowly injected, care being taken not to produce undue proptosis by too large an injection. For the majority of operations on the globe, 1 cc. is sufficient, but for operations on the muscles and for enucleation, 3 cc. or more may be injected, as the proptosis does no harm and, for inflamed



Fig. 6 (Atkinson). Skull showing position of needle for retrobulbar injection.

and painful eyes, more procaine is desirable.

Gentle massage with a rotary motion of the globe causes the procaine solution to become more thoroughly diffused within the muscular cone. In this way more complete and rapid anesthesia is produced. Anesthesia of the muscles is not obtained as rapidly as anesthesia of the globe; so for enucleation and operations in which there is considerable traction on the muscles it is advisable to wait 5 or 10 minutes before beginning the operation.

Blocking of sensory nerves

By means of the injection within the muscular cone, all of the sensory nerves to the eyeball are blocked, and complete anesthesia of the globe is obtained regardless of how inflamed or painful the eye may be. Pressure on the inflamed eye, which before the injection caused severe pain, is not noticed now. The rectus muscles, except the superior rectus, are also rendered practically insensitive to traction.

The injection within the muscular cone also causes paresis of the rectus muscles, except the superior rectus, so that the patient cannot look down easily. Therefore, for such operations as extraction of cataract, it is advisable to use a suture under the superior rectus muscle (bridle suture). With the rectus muscles inactive, little traction is required to hold the eye in the desired position. Also, better fixation of the globe is thus obtained. With paresis of the rectus muscles the so-called squeeze, with loss of vitreous, caused by their contraction is less likely to occur.

The superior rectus muscle usually remains active and may be sensitive to traction. For prevention of pain when this muscle is picked up for the introduction of a bridle suture or for an operation in which there is traction on the muscle, additional anesthesia is necessary. This may be accomplished by an injection of 0.5 cc. of the anesthetic solution along the superior rectus muscle. With the superior rectus muscle active and with paresis of the other extrinsic muscles, there is torsion of the globe, with rotation toward the nose. The torsion is increased when a suture is used under the superior rectus muscle. Therefore, if an iridectomy is to be performed, it should be done from 10 to 15 degrees to the nasal side, so that the coloboma will be at axis 90° when the muscles again function normally. While this is of no particular importance from a visual standpoint, a coloboma looks better in the vertical meridian.

Subconjunctival injections

When the eye is red and inflamed, as in cases of acute glaucoma, a subconjunctival injection should also be given, since the inflamed conjunctiva is not well anesthetized by topical application and only the conjunctiva immediately adjacent to the limbus for a distance of about 3 or 4 mm. is rendered insensitive by an injection within the muscular cone. This is because the nerve supply is from the ciliary nerves, which are within the cone.

The rest of the conjunctiva is innervated by the supraorbital, supratrochlear, infratrochlear, infraorbital, and lacrimal nerves, all of which are outside the muscular cone and are seldom reached by the anesthetic injected within the cone. When the eye is inflamed, less pain is caused if the subconjunctival injection is given after the retrobulbar injection.

For the subconjunctival injection the needle may be introduced through the insensitive conjunctiva directly surrounding the cornea and, if succeeding injections are made through blebs produced by the anesthetic, little pain will be experienced. In this way, pain due to the use of the fixation forceps and to suturing of the conjunctiva is avoided in eyes that are inflamed and painful. A 27-gauge needle is used and slid gently over the conjunctiva until a fold appears in front of the point; the syringe is then rotated, which produces a boring effect. In this way even a dull needle passes easily

through the conjunctiva without the use of forceps. If the bevel of the needle is toward the globe, one is less likely to prick the sclera and cause bleeding.

With such complete anesthesia of the globe, the eye being practically immobile together with paralysis of the orbicularis muscle, operations on the globe can be performed with the same deliberate precision that one can use when operating on the cadaver.

Action of anesthetic

If the patient looks upward and away from the site of the injection, access to the muscular cone is easier. The extension of the fascial sheath of the muscles which closes the spaces between the rectus muscles for a little distance back of the globe is in this way moved forward and upward, out of the way, so that the needle does not strike it, as is shown diagrammatically in Figure 7. If the needle does strike the sheath, pain is caused. The sheath is also somewhat tough, and the needle does not penetrate it easily, with the result that the globe rotates, which to some extent interferes with the introduction of the needle and the equilibrium of the patient.

The injection is made through the skin at the inferior temporal margin of the orbit rather than through the conjunctiva because it is less painful and allows a better angle of approach to the muscular cone. Procaine injected within the muscular cone is apparently held within the cone, since the nerves outside the muscular cone are rarely affected and injections outside of the cone do not reach the nerves that traverse the cone.

How is the solution of procaine held within the muscular cone, since there is no demonstrable fascia between the rectus muscles posterior to the globe, as they converge to their attachment at the apex of the orbit?

Anteriorly, the escape of fluid is prevented by the globe, surrounded by Tenon's capsule, and by the adjacent margins of the sheaths of the four rectus muscles, which are continuous with one another, with a wide sweep between them. In this manner, an intramuscular membrane is formed which, according to Whitnall,[9] exists for a short distance behind the globe. Beyond this the muscles converge to their attachment through the annulus of Zinn, at the apex of the orbit, and

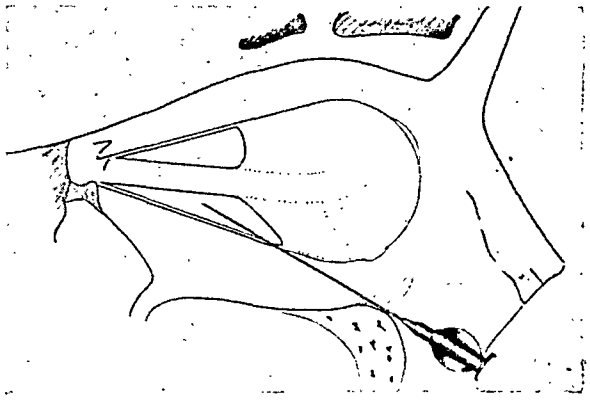


Fig. 7 (Atkinson). Diagrammatic sketch showing the eye turned up and away from the site of the injection, so that the fascial extension is moved forward and upward out of the way.

their margins come closer together, so that comparatively little space is left between them. In this location the escape of the procaine solution is probably prevented, or at least retarded, by the closely packed layer of fat, with its connective-tissue reticulum.

According to Whitnall,[10] the orbital fat which fills the entire space in the orbit not occupied by other structures varies in consistency in different regions. Within the muscular cone the fat has the appearance of large and loosely connected lobules, broken up by the passage of the nerves and vessels. Outside the muscular cone the fat is more firmly packed and contains a quantity of connective tissue, which is closely attached to the muscular sheaths. No doubt this fat and connective tissue serve as a sufficient barrier so that the anesthetic solution is held within the cone, with production of anesthesia or blocking of the nerves that traverse it—the nasociliary nerve, the long and short ciliary nerves, the ciliary ganglion, the optic

nerve, and all the motor cranial nerves except the trochlear, or fourth. The importance of injecting the anesthetic solution into the cone is obvious if complete anesthesia of the globe is to be obtained.

Decrease in intraocular pressure

A decrease in the intraocular pressure occurs after injection within the cone. If the amount of epinephrine hydrochloride (1:1,000) is increased to 3 or more drops to 5 cc. of the anesthetic solution, the decrease in the intraocular pressure is greater, and a decrease of as much as 20 to 30 mm. Hg may be noted in cases of acute glaucoma with high intraocular pressure.

After the injection within the cone, there is often noticeable deepening of the anterior chamber, particularly when the amount of epinephrine hydrochloride is increased. This indicates a decrease in the fluid contents of the eye posterior to the diaphragm. The incision for cataract extraction is thus made easier in cases in which the chamber has been shallow. Also, with lowering of the pressure behind the lens, the anterior capsule seems to become relaxed. In some cases the capsule of the lens, which prior to operation appears to be too tight to be grasped with smooth forceps, is found to be loose enough after an injection within the cone so that a good bite of the capsule can be obtained with the forceps.

With some methods of intracapsular extraction of cataract a decrease in the intraocular pressure seems to be an advantage, as it lessens the possibility of prolapse of the vitreous. This is also true in the removal of intraocular foreign bodies by the scleral route. In extraction with capsulotomy it is often more difficult to express the lens when the pressure is decreased. With deeply set eyes the operation is somewhat facilitated if the eye is slightly proptosed. With lowered intraocular pressure the iris may not prolapse well in corneoscleral trephinations, an incident which may be embarrassing.

The decrease in the intraocular pressure following the injection of procaine and epinephrine within the cone may be accounted for by the constricting action of the epinephrine on the arteries entering the globe, an effect which would tend to decrease the amount of blood entering the globe but would not impede its exit through the venae vorticosae, since the solution does not reach them, located as they are in the episcleral space. The free anastomosis of the venae vorticosae and other orbital veins with the facial vein allows free exit of the blood.

Indications for cone injection

The indications for a cone injection are: globe operations, muscle operations, enucleation, evisceration, and, as suggested by Icaza,[11] in cases of acute glaucoma for the immediate relief of pain. In acute glaucoma the intraocular pressure is also lowered rapidly, particularly if the amount of epinephrine is increased. The pupil is then more easily contracted and the pressure controlled with a miotic. However, Scheie,[12] has found that physostigmine (eserine) has no effect on the pupil for 1 to 3 hours following a cone injection of procaine hydrochloride while pilocarpine promptly constricts the pupil.

Operations on the lacrimal sac

For extirpation of the lacrimal sac quite satisfactory anesthesia may be obtained by infiltration anesthesia around the sac and the injection of anesthetic solution into the sac. However, some pain will usually be experienced when the sac is excised from the nasolacrimal duct, or when the duct is curetted, because the anterior superior alveolar nerve which supplies these parts is not reached. To block the anterior superior alveolar nerve, an injection proximal to where it branches off the infraorbital nerve within the infraorbital canal is indicated because it passes through osseous canals to supply the lower part of the lacrimal sac and the nasal duct and so is not reached by an injection around the sac.

More complete anesthesia for operations on the lacrimal sac may be obtained if the nasociliary nerve is blocked at the anterior

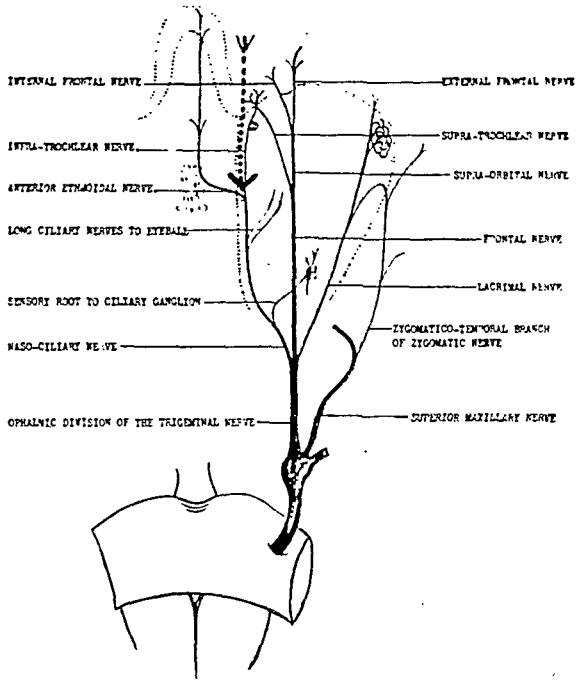


Fig. 8 (Atkinson). Diagram showing the distribution of branches of the ophthalmic division of the trigeminal nerve (after Whitnall). Arrow indicates site of injection for block of nasociliary nerve.



Fig. 9 (Atkinson). Skull showing needle in position to block the nasociliary nerve.

ethmoid foramen so that both the anterior ethmoidal and infratrochlear nerves are blocked (fig. 8).

For this injection, the 3.5-cm. needle is



Fig. 10 (Atkinson). Injection to block the nasociliary nerve.

introduced a little above and to the nasal side of the trochlea (figs. 9, 10). The needle is kept close to the superior nasal wall and at a depth of 3 cm., and 2 or 3 cc. of a 2-percent solution of procaine hydrochloride with epinephrine hydrochloride is injected. On withdrawing the needle another injection is advisable along the orbital margin in the vicinity of the supraorbital notch anterior to the orbital septum but close to the periosteum. Occasionally the angular vein (fig. 11) is pierced, but if the anesthetic solution is not injected into the vein no harm is done,

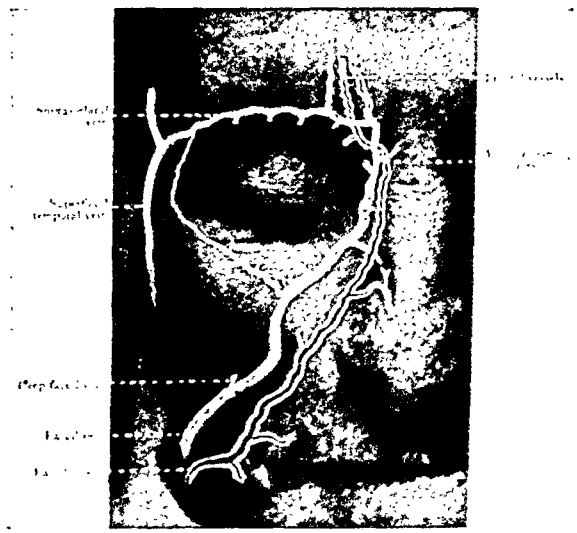


Fig. 11 (Atkinson). Vessels to avoid in block of nasociliary nerve (after Whitnall).



Fig. 12 (Atkinson). Skull showing position of the needle for injection into the infraorbital canal to block the infraorbital and the anterosuperior alveolar nerve.

although the resulting ecchymosis is annoying.

The block of the infraorbital nerve proximal to the anterior superior alveolar nerve may be made in the infraorbital canal or inferior orbital fissure.

To inject the infraorbital canal, the needle



Fig. 13 (Atkinson). Injection into the infraorbital canal.

is introduced 1 cm. from the middle of the ala of the nose and carried almost to the bone. It is then directed upward and temporally at an angle of 20 degrees (figs. 12, 13) and kept in close contact with the bone, injecting the procaine solution as it advances.

The foramen is found more easily if the index finger of the other hand is placed over the foramen, as suggested by Labat,[13] indicating the location of the foramen and the axis of the infraorbital canal. Usually a small depression is felt at the opening of the canal, 0.5 to 1 cm. below the inferior orbital margin, about in line with the supraorbital

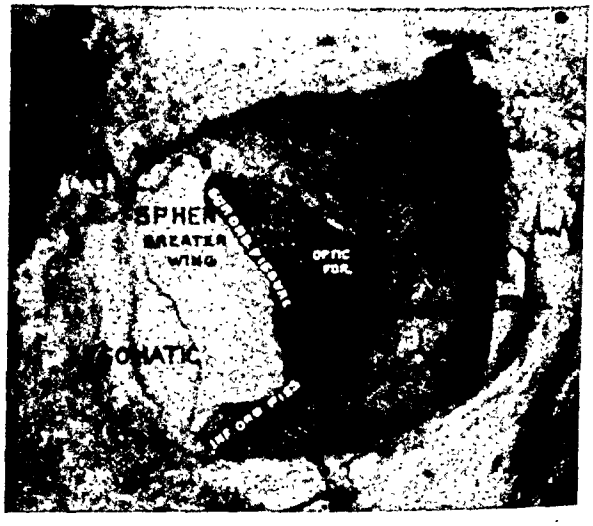


Fig. 14 (Atkinson). Orbit showing inferior orbital fissure and infraorbital canal (after Whitnall).

notch which helps to locate it. The needle is introduced along the canal 0.5 cm. to 1 cm. so that the injection will be proximal to the branch of the anterior superior alveolar nerve.

If the foramen is not found or is not present, as is occasionally the case, the block can be made in the inferior orbital fissure (fig. 14). To reach the fissure, the 22-gauge, 3.5-cm. needle is introduced as for a cone injection. As soon as the point of the needle passes through the orbital septum it is directed toward the floor of the orbit in the same plane as for the cone injection (fig. 15, 16). The point of the needle is moved along the orbital floor from 1.5 to 2.5 cm. until the fissure is felt; it is then introduced 1 cm., and 1 to 2 cc. of the procaine solution is injected.

Infiltration over the site of the sac decreases bleeding but is not necessary for anesthesia. For the operation of dacryocystorhinostomy, in addition to block of the nasociliary and the infraorbital nerves, topical anesthesia of the nasal mucous membrane should be obtained by the use of a nasal pack.



Fig. 15 (Atkinson). Skull showing position of needle for injection into inferior orbital fissure for block of the infraorbital nerve.



Fig. 16 (Atkinson). Injecting the inferior orbital fissure to block the infraorbital nerve.

FIELD BLOCK FOR ANESTHESIA OF THE LIDS

Since there are so much overlapping and variation in the sensory nerve supply of the lids (fig. 17), it is simpler in operations in-



Fig. 17 (Atkinson). Right eye: The sensory nerves are indicated by solid lines (after Whitnall). Left eye: Injections for block of lids indicated by arrows.

volving a considerable area of the lids to produce a field block rather than to try to block the individual nerves.

Injection, using the 3.5-cm. needle, is made at the center of the orbital margin as shown (left eye) in Figure 17, above or below, the position depending on which lid is to be blocked. The point of the needle should follow the orbital margin closely but should not penetrate the orbital septum. A 2-percent solution of procaine hydrochloride with epinephrine hydrochloride (1:1,000) is injected slowly as the needle advances. In order to inject the anesthetic all along the margin and to infiltrate well the tissue around the nerves that emerge from the orbit, it is necessary to withdraw the needle a little and redirect it several times. The injection should not be made just under the skin, but should be close to the periosteum. An extra 0.5 cc. of the anesthetic solution should be injected deep in the vicinity of the supraorbital notch.

After the anesthetic solution has been injected along one half the superior or the in-

ferior orbital margin, the location depending on which lid is to be blocked, the needle is partially withdrawn; it is then redirected and the solution injected along the other half of the orbital margin. Each injection should be carried beyond the line of the palpebral fissure.

For removal of small tumors of the lids, such as papillomas, infiltration at the site of the tumor is usually sufficient and is the simplest method. It also decreases the bleeding. For chalazion and operations involving the margin of the lid which, owing to its rich nerve supply, is extremely sensitive, instillation anesthesia and infiltration at the site of the chalazion are often not sufficient to make the operation painless. However, instillation anesthesia and an injection of 1 cc. of the anesthetic solution through the conjunctiva of the cul-de-sac or through the skin to reach the same location in the sector of the lid where the chalazion is located, will more frequently produce complete anesthesia.

Conclusion

Most eye operations may be safely performed without pain with local anesthesia.

129 Clinton Street.

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ECZEMATOUS KERATITIS AND ARIBOFLAVINOSIS*

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Eczematous (phlyctenular or scrofulous) keratitis is most commonly regarded as an allergic condition. It occurs mainly in children with so-called scrofulous diathesis. Enlarged tonsils and adenoid vegetations are very frequently present, and the submandibular glands are often found to be enlarged. The disease is characterized by diffuse infiltration of the conjunctiva and the corneal epithelium, with marked hyperemia, and multiple lymphocytic nodules of varying size on the bulbar conjunctiva or at the limbus which may break down and become infected. The condition is often accompanied by intense pain and blepharospasm. Infiltration of the limbus leads to the development of superficial vessels at the periphery of the cornea, a condition which is called eczematous, scrofulous, or phylyctenular pannus. It is common to find eczematous lesions around the nose and the mouth.

The hypersensitivity of the conjunctival and corneal tissues is supposed to originate from a hidden, usually clinically healed, tuberculous lesion. However, it need not necessarily have been provoked by the tuberculous antigen, but may possibly have been induced by other bacterial toxins (hetero-allergy).

Treatment consists of the administration of yellow oxide of mercury, calomel, dionin or atropine, the local application of heat, general improvement of the diet and living conditions, change of climate, ultraviolet irradiation, or cod-liver oil. However, the treatment, which is very tedious, may prove disappointing in many cases, and frequent relapses are the rule.

In recent years several authors have claimed that riboflavin exerts a beneficial effect on a number of corneal diseases of different etiologies, among them eczematous keratitis.[1, 2] A certain clinical resemblance between eczematous keratitis and the acute manifestations of ariboflavinosis has induced us systematically to examine the efficacy of riboflavin in this disease.

CASE REPORTS

Case 1. M. M., a girl aged 10 years, with typical signs of scrofulous diathesis, had been treated at our clinic for phlyctenular keratitis four times in the course of the past four years. On every occasion treatment had to be continued for many weeks before the condition cleared up.

This time she had been under treatment for four weeks (atropine, yellow oxide of mercury, sulphathiazole, and cod-liver oil) when it was decided to attempt riboflavin therapy.

At this stage the patient's eyes were very bloodshot, multiple phlyctens were present around the limbus of both eyes, and the corneal periphery was markedly vascularized. Eczema was observed around the nose and the mouth. The urine contained 250 micrograms of riboflavin per 1,000 cc.

Local treatment was discontinued, and the child received 5 mg. of riboflavin daily. She improved steadily and, after two weeks, the eyes cleared up completely and the facial eczema also improved. The child has remained free from ocular symptoms since that time.

Case 2. A. H., a boy, aged 9 years, had been under treatment at our clinic for eczematous keratitis on four different occasions during the past two years. He was suffering from enlarged adenoids. The ocular condition had always proved very difficult to treat. Superficial and deep vessels appeared in the cornea, and vision was considerably reduced.

When he was first seen this year, both eyes presented the familiar syndrome with blepharospasm, lacrimation, and pain. The bulbar conjunctiva was deeply injected, and the entire corneal circumference was extensively vascularized and showed multiple phlyctens.

The patient received 3 doses of 5 mg. of riboflavin without any local treatment. Within 24 hours both eyes became white and quiescent, and the subjective symptoms entirely disappeared. The patient has not been seen since at our clinic.

Case 3. D. M., a girl, aged 6 years, well developed

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Fig. 1 (Stern and Landau). Case 3. Appearance of patient after a severe attack of eczematous keratitis lasting five days.

but somewhat puffed up, had been under our care for several years and suffered from frequent recurrences of eczematous keratitis. She reported to hospital after a very severe attack lasting five days. Very marked blepharospasm, lacrimation, and pain were observed; both eyes were bloodshot, and multiple limbal phlyctens, infiltration of the epithelium of the corneal periphery, and corneal vascularization were noted (fig. 1).

The patient received 5 mg. of riboflavin by mouth twice daily without any local treatment. The following day the condition was unchanged. Treatment with riboflavin, alone, was continued. By the fourth day the right eye had become white, the cornea was clear, and the infiltration around the limbus was entirely gone. The left eye, however, was still injected. By the fifth day both eyes were cured (fig. 2). No pathologic changes were found in the nasopharynx.



Fig. 2 (Stern and Landau). *Case 3.* Appearance of the same patient as in Figure 1 on the fifth day after riboflavin therapy was instituted.

Case 4. R. A., a young woman, aged 23 years, was suffering from intense pain and blepharospasm in the left eye, which showed eczematous keratoconjunctivitis with a large single phlycten at the limbus (fig. 3). The corneal periphery of the left eye was vascularized. The right eye appeared normal. The nose was very narrow, and examination revealed a deviation of the septum toward the left and compression of the left lower turbinate.

The patient had received the usual treatment for the ocular condition elsewhere, without any benefit. Local treatment was discontinued and she received 5 mg. riboflavin by mouth twice daily. After two days the eye was much improved; by the fifth day she was completely cured (fig. 4).

Case 5. A. R., a girl, aged 13 years, showing no scrofulous stigmas, applied to the hospital suffering from acute Koch-Weeks conjunctivitis. She



Fig. 3 (Stern and Landau). *Case 4.* Eczematous keratoconjunctivitis with a large single phlycten at the limbus near the 5-o'clock position.

received 2 gm. of sulfadiazine by mouth during one day. The next day the cornea showed multiple phlyctens and vascularization around the limbus in both eyes. The urine contained 260 micrograms of riboflavin per 1,000 cc. Five mg. of riboflavin by mouth twice daily were added to the sulfadiazine therapy. Two days later the eyes had become white and the intense vascular engorgement had entirely disappeared.

Case 6. T. R., a girl, aged 8 years, well developed but undernourished, sister of the patient in Case 5, suffered from acute Koch-Weeks conjunctivitis. Multiple phlyctens were present in both eyes and the corneal periphery was vascularized (fig. 5). She received 2 gm. of sulfadiazine daily by mouth which cured the acute conjunctivitis entirely within two days, but the eyes remained painful and injected. The picture was now that of a primary eczematous keratoconjunctivitis. The urine contained 255 micrograms of riboflavin per 1,000 cc. The patient received 5 mg. of riboflavin by mouth twice daily and within another 48 hours she was completely cured (fig. 6).

Case 7. A. B., a boy, aged 3½ years, pale and

with enlarged submandibular glands, suffered from pain and lacrimation in both eyes. There was some photophobia. Around the limbus of both eyes 3 or 4 small phlyctens were visible, and the eyes were mildly injected. He received 5 mg. of riboflavin by mouth twice daily. Four days later both eyes were white and clear and the phlyctens had disappeared without a trace.

Case 8. R. M., a girl, aged 13 years, exhibited pellagroid pigmentation of the arms, neck, and ears. She had a deeply furrowed, red tongue. Both eyes were very bloodshot, and the patient suffered from intense blepharospasm and lacrimation. Several phlyctens were seen along the limbus in both eyes and the corneal periphery was vascularized. The patient received 5 mg. of riboflavin by mouth twice daily, and the ocular condition had cleared up without local treatment within four days. Fifty mg. of



Fig. 4 (Stern and Landau). *Case 4.* Appearance of the same eye as in Figure 3 on the fifth day after institution of riboflavin therapy.

nicotinamide was then administered by mouth twice daily, and the dermatitis and glossitis improved steadily. After one week she was cured.

Discussion

The striking effect of riboflavin in a condition known occasionally to be very refractory to the usual local treatment may be explained in either of two ways: (1) The action of riboflavin is a purely pharmacodynamic one, or (2) eczematous keratitis is a manifestation of ariboflavinosis and riboflavin specifically relieves this deficiency.

Bessey and Wolbach[3] were the first authors to describe in detail the occurrence of corneal vascularization with infiltration of the corneal stroma and epithelium in riboflavin-deficient rats. They regarded this condition as a compensating process, whereby blood is brought into closer contact with the deeper



Fig. 5 (Stern and Landau). *Case 6.* Multiple phlyctens were present in both eyes and the corneal periphery was vascularized.

layers of a cornea deprived of riboflavin. Riboflavin constitutes the prosthetic group of the yellow respiratory enzyme on which the corneal cells depend for their respiration. This subtle process can be assumed to be disturbed in any pathologic condition involving the deeper layers of the epithelium and stroma.

Such disturbances may be due to the action of bacterial toxins, of chemical substances released by foreign bodies, and also of noxious metabolic products released in allergic reactions (histamine or histamine-like substances).

It is conceivable that in such conditions the administration of riboflavin relieves the disturbance in the respiration of the corneal cells. It has actually been claimed that riboflavin is very beneficial in a number of corneal diseases such as rosacea keratitis,[4-8] syphilitic parenchymatous keratitis,[1, 9, 10] and trachomatous pannus.[5, 11] Riboflavin has further been shown to have a certain antiallergic action.[12, 13] It is therefore possible that the relief of eczematous keratitis by riboflavin is due either to a nonspecific effect on the respiration of the corneal tissue or to the



Fig. 6 (Stern and Landau). *Case 6.* Appearance of the same eyes as in Figure 5 within 48 hours after riboflavin therapy was begun.

antihistamine action of the vitamin in a disease with undeniably allergic characteristics. However, several points argue against this assumption.

The reports on the beneficial effect of riboflavin in corneal diseases other than eczematous keratitis are open to serious criticism. Its curative effect in rosacea keratitis has been denied by a number of authors.[14, 15, 18] Its effect in syphilitic parenchymatous keratitis seems improbable at first sight, and the correctness of the diagnosis has been challenged in some of the cases published.[5, 7] In trachomatous pannus it has been shown by Landau and Stern[11] that the good results obtained with riboflavin may be explained by the concurrent presence of a true ariboflavinosis.

It is a common experience that eczematous or phlyctenular keratitis occurs almost exclusively in undernourished, scrofulous individuals, or in those on a faulty diet, and it is possible that the administration of riboflavin in these cases relieves a subclinical deficiency. Thus the curative effect would have to be ascribed not to a purely pharmacodynamic action but to a kind of adjuvant treatment. Assuming that this is possible, let us consider more closely the assumption that eczematous keratitis is a manifestation of riboflavin deficiency, particularly in view of the abnormally low riboflavin values in the urine of the three cases in which the urine was examined.

A remarkable clinical similarity exists between eczematous keratitis associated with eczematous pannus and the ocular signs of ariboflavinosis. The corneal vascularization seems to be identical with that in eczematous pannus. The cheilitis and the eczema of the nasolabial fold in ariboflavinosis are strongly reminiscent of the facial lesions in eczematous keratitis, with certain differences probably attributable to differences in age of the respective patients.

Mann[16] and Stern[17] have published descriptions of cases of acute ocular manifestation of ariboflavinosis which are very similar to typical cases of eczematous keratitis. The condition involves acute injection of the bulbar conjunctiva with marked vascularization of the cornea, accompanied by edema of the perilimbal conjunctiva and the peripheral corneal epithelium, which may break down and develop small ulcers. It is very painful and causes intense reflex blepharospasm. It seems to occur mainly in adults but eczematous keratitis may constitute a modified picture of the same disturbance in predisposed children. Our reports on the uniformly satisfactory therapeutic results, together with the subnormal urinary riboflavin values in the cases in which the urine was examined seem to justify the conclusion that these diseases are identical.

In many cases eczematous keratitis seems to be an allergic reaction. The patients frequently are scrofulous individuals with inflamed lymphatic glands, and are almost always hypersensitive to tuberculin. In sensitized humans and laboratory animals the condition may be produced experimentally by instilling a drop of allergen into the conjunctival sac (Calmette's reaction). But it is also known that patients of this type frequently have a craving for carbohydrates which they consume in great quantities, a diet likely to lead to ariboflavinosis.

While we are unable to exclude the possibilty of a pharmacodynamic effect of riboflavin in exzematous keratitis, we are inclined in these cases to ascribe the dominant rôle to ariboflavinosis. Thus it may be assumed that a chronic riboflavin deficiency becomes manifest as an ocular lesion of the above-mentioned type in predisposed individuals, mostly children, but sometimes also in adults.

There seems to be a constitutional element in such a predisposition identical with that defined clinically as the scrofulous habitus. These patients usually show the typical changes in the nasopharynx. It is not quite certain whether these represent concomitant (and coördinated) symptoms, or whether the nasal lesions are prerequisite to the ocular

manifestations. The observations of Feigenbaum[20] in cases of unilateral trachoma (or unilaterally more severe trachoma) suggest that the second possibility is more probable in our cases as well. While lymphatic changes in the nasopharynx were observed in the majority of our child patients, it was noteworthy that our one adult patient had her only ocular lesion on the same side as the nasal lesion.

Phlyctens seem to occur fairly regularly in the course of Koch-Weeks conjunctivitis. In 1921, Feigenbaum[21] found this condition in at least 8 percent of several thousands of patients suffering from this conjunctivitis, and concluded that these complications probably represent the reaction of the scrofulous individual to the toxic irritation by the agent. In a personal communication this author has stated that he repeatedly observed similar phlyctens in scrofulous children during a diplobacillary infection, as well as exactly at the point of contact after irritation of the bulbar conjunctiva by an incorrectly implanted eyelash.

It seems, therefore, that it takes two or more factors to produce the clinical picture of eczematous or phlyctenular keratoconjunctivitis, and that one of these is ariboflavinosis. On the other hand, the fact that many cases of ariboflavinosis never display the acute symptoms of eczematous keratitis seems to suggest that a second factor, in most cases an allergic reaction, is necessary.

In view of the effect of riboflavin in eczematous keratitis, further experimental and clinical investigation will be required to elucidate the question whether this condition is due to a nonspecific pharmacodynamic action of the vitamin, or to the specific relief of a riboflavin deficiency in predisposed individuals. A number of facts seem to point to the second possibility, namely that ariboflavinosis constitutes a decisive etiologic factor.

Summary

1. Riboflavin has a marked therapeutic effect on eczematous keratitis.

2. The question whether this effect is due to a nonspecific pharmacodynamic action of the vitamin or to the specific relief of a deficiency is discussed.

3. It is concluded that a number of factors (nasopharyngeal lesions, infectious agents, or mechanical irritation) in individuals with a constitutional scrofulous disposition may release the pathogenic mechanism producing eczematous keratitis, but that ariboflavinosis is the essential basic condition.

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NOTES, CASES, INSTRUMENTS

SIMPLIFIED EXTERNAL EYE PHOTOGRAPHY*

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Photography of the external eye is practical with minor modifications of an Argus model C-3. This is a medium-grade, 35-mm. camera with synchronized flash-bulb attachment. On reviewing the description of the mechanisms devised by Bedell,[1] Bogart,[2] Irvine and Stimson,[3] Katzin,[4] and Knighton,[5] it is evident that the stress has been on securing perfect focus and on being able to maintain that focus during the time necessary to manipulate the camera and lighting equipment.

In this camera, the emphasis is on creating a system having greater depth of focus, accuracy of aim, and speed of operation. Minor movements of the patient are not important. It is therefore possible to discard the table, head-holding frame, camera stand, complicated electrical circuits, and interchangeable mounts for the focusing ground glass and camera. The elimination of this complex, costly, and cumbersome equipment frees the camera for use in the clinic, on the wards, and in the operating room. These improvements are obtained by a combined fixed aiming and focusing device and a light of sufficient intensity to reduce the lens aperture to a minimum, thereby increasing the depth of focus.

In the construction of the optical system, parts made by the original manufacturer were preferred. This system consists of the original camera, which is set at 5-foot focus, and a combination of portrait lens chamber and sunshade, which screw to the lens mount. The portrait lens chamber contains a plus-3 lens and a disk of Wratten No.-2 gelatin filter. A plus-16 lens ground from a cataract lens blank, is mounted inside the front of the sunshade. This combination of camera and lenses has a focus of 48 mm., which was determied by the ground-glass method. Chromatic aberrations need not be considered. Spherical aberration is minimized by using a large diameter lens for the plus 16, so that only the central portion is used. The residual aberration is negligible.

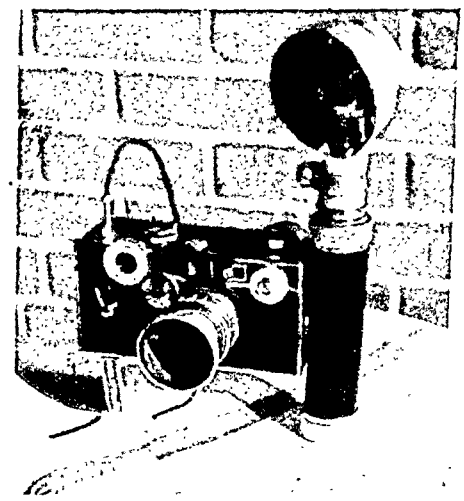


Fig. 1 (Landers). Argus C-3 camera with modifications.

A curved metal rod is bolted to the sunshade in such a manner that the tip of the rod is exactly 12 mm. below the center of the photographic field, and is exactly at the 48-mm. distance from the front lens. The size of the object and of the picture is identical. The tip of the rod is at the margin of the field but does not show in the picture.

The light source is a No.-5 press flash bulb, and the film is indoor Kodachrome (type A). The light temperature of the press flash bulb No. 5 is not perfectly adjusted to type-A Kodachrome, but this is corrected by the filter mentioned above.

* Published with permission of the chief medical director, Department of Medicine and Surgery, Veterans Administration, who assumes no responsibility for the opinions expressed or conclusions drawn by the author.

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The standard reflector for the camera cannot be used because of the size of its reflection on the cornea. A small metal shield is therefore substituted. This shield is painted black on the inside except for the area immediately behind the bulb. This is to minimize further the size of the corneal reflection. The front of the reflector has a transparent plastic cover to prevent possible injury to the patient from an exploding bulb.

With the press No. 5 bulb only 19 cm. from the eye, the light intensity permits the lens aperture to be decreased to f-16 or smaller. This factor is important because the depth of focus of the system is over 6 mm. at f-18, and only 1 mm. at f-3.5.

The speed of the shutter is not effective until it is faster than 1/100 second because of the few thousandths of a second during which the flash lasts. If it is desirable to



Fig. 2 (Landers). Demonstration of operation of camera.

reduce the light more than is accomplished by an f-18 opening, the shutter speed can be set faster.

In actual practice, this camera can be used without loss of more than a few moments, or can be operated by a nurse or secretary. The mode of operation is most un-



Fig. 3 (Landers). Illustration of a normal eye showing size of field and depth of focus.

complicated. The camera is kept loaded and with the proper adjustment set, with the exception of the aperture which is adjusted to the complexion color. The patient is warned not to be frightened at the flash, and the camera is held before his face in such a manner that the tip of the focusing rod is 12 mm. below the center of the desired field and in the proper plane. The picture is then taken instantly, and a notation made.

The same camera as described, with an additional portrait chamber attachment using a plus-3 lens, is excellent for photographing both eyes in cases of squint, or anything requiring a full face. This is accomplished by using 23- or 32-cm. distances with approximately the same settings as to shutter speed and aperture.

In conclusion, it would seem to be of more than casual importance that, with the present trend toward more and more complex, elaborate, and expensive mechanisms, a simple, effective, and inexpensive device can be constructed for making permanent color records of external and anterior eye conditions.

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OCULAR MANIFESTATIONS IN COCCIDIOIDOMYCOSIS

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Coccidioidomycosis[3] is a disease caused by a fungus, Coccidioides immitis. It is considered to be primarily a disease of rodents, transmitted to man when dusts that contain spores are inhaled. It is endemic in the San Joaquin Valley in California and in other southwestern states, and has been seen in other parts of the United States. During the war the condition became important because several thousand soldiers, who were stationed in Army camps in the Southwest, probably became infected. Some of these men will undoubtedly develop active pulmonary lesions within the next 10 years.

The lungs are usually first infected through the inhalation of the spores and the infection is spread to various parts of the body by continuity and through lymphatic and vascular channels. Up to the time of World War II, only a severe general form of the disease, resembling tuberculosis, had been recognized. It is now known that in most instances the infection is benign, simulating influenza or virus pneumonia, and lasts usually 3 to 6 weeks. X-ray studies of the lungs in the mild form resemble those shown in virus pneumonia, while in the chronic form they resemble those in tuberculosis, with cavitation a prominent feature.

The causative organism may be recovered from the sputum and other infected body fluids and tissues. Skin tests with Coccidioides-immitis antigen may be helpful in diagnosis. A positive skin test does not necessarily indicate active coccidioidal infection. A negative test is believed to exclude the infection, except where the infecton is too early for sensitivity to have developed. The pathologic condition is essentially a granuloma greatly resembling the lesions of tuberculosis.

The observation of changes in the ocular fundi in a case of coccidioidomycosis is worthy of record. To my knowledge, no previous report has appeared in the literature. Because of the protean nature of the disease and its great similarity to tuberculosis and the other granulomatous diseases, one would expect some cases to have an involvement of the uveal tract and retina.

Charles E. Smith[1] stated that the patient with coccidioidomycosis may exhibit typical phlyctenular conjunctivitis. Willett and Weiss[2] reported the occurrence of conjunctivitis in 4 of 100 cases. With the exception of conjunctivitis, ocular involvement in the course of the disease has not been mentioned in the literature.

REPORT OF A CASE

Following is the report of the eye findings in a case of coccidioidomycosis of the primary pulmonary type. The diagnosis was established by the isolation of the causative agent, Coccidioides immitis, in the sputum. Striking changes were observed in the vitreous chambers and fundi.

History. Sergeant D. T. L., white, aged 20 years, a patient in the medical department of Fletcher General Hospital, Cambridge, Ohio, was referred to me by Dr. Frank J. Mellencamp on August 14, 1943, because of visual disturbances of both eyes.

While overseas he became ill with what was initially diagnosed as lymphocytic choriomeningitis. He was hospitalized in the

British 40th General Hospital in British West Africa and was subsequently evacuated to the United States.

The only complaint on admission to Fletcher General Hospital was pain in the back and legs. Physical examination, including the chest, was negative. X-ray studies of the chest revealed an infiltrate in the right middle lobe which had the appearance of a tubercular lesion. A fungus, presenting typical structure and cultural characteristics of Coccidioides immitis, was recovered from the sputum.

The patient complained that vision of the left eye first became blurred for intervals of ½ to 1 hour and that later similar episodes were experienced in the right eye. For two weeks prior to my examination he had noticed "shimmering spots" first in the right eye and then in the left eye.

Eye examination revealed vision to be: O.D., 20/30, J1; O.S., 20/20, J1; correctable to 20/15, O.U., with a compound hyperopic astigmatic lens of moderate degree; no significant muscle imbalance; small discrete follicles in the palpebral conjunctivas of both lower lids; white globes; small corneas; pupils that reacted actively to light and accommodation.

The pupils were widely dilated with 4-percent solution of homatropine hydrobromide. The anterior segments of the globes were entirely normal on slitlamp study. Both vitreous chambers were clouded by whitish-appearing, globular opacities which, while movable, maintained a relatively fixed position, indicating a basically normal vitreous structure. The optic nerveheads were of good color with slightly indistinct margins due to the astigmatic refractive errors. The nerveheads were not elevated.

In the right fundus there were several small oval-shaped masses of what appeared to be whitish connective tissue, attached to the retina and moving up and down in the vitreous The bases of these masses at the level of the retina were hemorrhagic. These were mostly evident in the nasal and lower fundus about 1½ disc diameters from the margin of the optic disc. Just below the optic disc, there was a denser strand of similar tissue projecting into the vitreous. A like picture was observed in the left eye with a lesion also present below the left disc. There was no abnormality of the retinal blood vessels. The macular zones were free of pathologic manifestation.

The diagnoses were: (1) follicular conjunctivitis, benign; (2) vitreous opacities and retinitis of proliferative type, considered evidence of probable localization of the causative agent in the eyes; (3) compound hyperopic astigmatism, bilateral.

On the day following my examination the patient left the hospital on a 30-day sick furlough. On his return on September 16, 1943, I reëxamined his eyes and found the vitreous chambers entirely clear and the fundi perfectly normal. There was no trace of the previous pathologic findings.

The lesions noted in the retinas in this case, and their rapid disappearance, offer a striking parallel to the type of granulomatous lesions noted in other parts of the body, and the frequent rapid clearing of the physical signs and pulmonary changes visible to X ray.

Summary

The main features of coccidioidomycosis are presented.

Changes in the vitreous chambers and ocular fundi in a case of coccidioidomycosis are described.

Because of the protean nature of the disease and its great similarity to tuberculosis, one would expect some cases to have intraocular involvement. It is suggested that the ocular fundi should be watched during the course of the disease.

It would not be amiss to include a coccidioidin antigen skin test in the etiologic survey of cases of endogenous ocular infection, particularly in veterans of World War II.

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PERIPHERAL IRIDECTOMY IN CATARACT SURGERY

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In cataract extraction, I have observed a practice in the use of peripheral iridectomy which does not seem to be quite rational. A peripheral iridectomy is made in the 12-o'clock meridian when there is also a single corneoscleral suture in the same meridian. The reason given for making the iridectomy is to furnish a communication between the posterior and anterior chambers. This is necessary, it is explained, because it is the aqueous in the posterior chamber which causes iris prolapse, not that in the anterior chamber.

This fact has been established for a long time. However, there is another fact which seems to have escaped notice very largely; namely, that, at the time of iris prolapse, there is no anterior chamber. If there were then the pupil could serve better as a communication between the anterior and posterior chamber than a small peripheral hole. The communication must be between the posterior chamber and the out-of-doors. With the escape of its aqueous the anterior chamber has become merely a potential space, and the iris lies in such close contact with the cornea as to form virtually a water-tight seal. It is under these conditions that that portion of the iris which overlies the breach in the incision begins to herniate as the aqueous in the posterior chamber makes pressure. Only one of two things will stop it: either cessation of pressure or escape of aqueous through a hole in the iris which coincides with the breach in the incision. If the iridectomy does not coincide with the breach in the incision, the aqueous will not escape, and prolapse takes place. Therefore, iridectomies at other points, even though fairly close, will not prevent the prolapse.

The incision, when it gives way, usually does so in the middle of the longest unsupported arc. It would not give way at the site of a single corneoscleral suture in the 12-o'clock meridian. Therefore, a peripheral iridectomy in this meridian would seem to be useless. If the incision gives way, it would do so somewhere between this central suture and one or the other of the angles of the wound. If peripheral iridectomies are to be used with a single suture in the 12-o'clock position, there should be two of them, and they should be placed respectively at about the 10:30- and 1:30-o'clock positions. If a single peripheral iridectomy is made at the 12-o'clock position, then there should be at least one suture on each side midway between the iridectomy and the extremities of the incision.

Either of these procedures would give at least three points of protection along the arc of the incision. according to some previous studies,* 4 or 5 points of protection are much better than 3. They may be furnished by 2, 3, or 4 corneoscleral sutures, combined respectively with 3, 2, or 1 peripheral iridectomies. Any one of these combinations gives reasonable protection against prolapse, but the iridectomies should be

*Hilding, A. C.: Experimental and clinical studies on certain safety factors in closure of cataract incisions. Am. J. Ophth., 28:871-885 (Aug.) 1945.

placed between the sutures and not under them. The sutures can all be placed before the anterior chamber is opened.

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STREPTOMYCIN IN OPHTHALMOMILIARY TUBERCULOSIS*

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Recently McDermott and others‡ reported their results in the employment of streptomycin in the treatment of tuberculosis in human beings. We wish to present a case of ophthalmomiliary tuberculosis treated with streptomycin.

REPORT OF CASE

History. R. Q., a 28-year-old white woman, married, was well until May, 1947, when pharyngolaryngeal symptoms became apparent. These were characterized by dsyphagia, hoarseness, and pharyngodynia. For several months prior to this, increasing fatigability was observed. Until July, 1947, her laryngopharyngeal symptoms persisted. Then, an otolaryngologist was consulted and a diagnosis of laryngophthisis was made. Pulmonary X-ray studies revealed an acute miliary tuberculosis. She was admitted as a patient to the Glenridge Sanatorium on August 9, 1947.

Physical Examination. The patient was poorly developed, poorly nourished, and thin, appearing acutely and chronically ill. There was a moderate amount of pallor of the mucous membranes. Only the arytenoid area of the larynx was visible. It was the site of marked edema and of severe injection; on its anterior surface a thin, grayish, diffuse exudation was present. There were no abnormal signs in the lungs.

Laboratory Data. Pulmonary skiagrams showed a fine, disseminated miliary type of infiltration scattered evenly throughout both lungs.

Ophthalmic Examination. Biomicroscopy and ophthalmoscopy revealed negative findings in the cornea, aqueous, iris, lens, and vitreous. The fundus of the right eye showed 5 small, pinpoint-sized, gray-white nodules. Three of these nodules were 2½ disc diameters from the papilla at the 1-o'clock meridian; 2 were at the 6-o'clock meridian. There were no pigmentary changes in the areas adjacent to the nodules.

Treatment and Course. Two days following admission, streptomycin therapy was instituted, 1½ gm. daily in 6 divided doses. The laryngeal symptoms showed an almost immediate response, and the general response was unusually satisfactory. Comparative pulmonary X-ray studies, one month after admission, showed less density, giving the impression of beginning resolution. During the second month after admission, no definite change occurred. By the third month, however, there was definite resolution, with marked clearing of the infiltration throughout both pulmonary fields—the most striking change in the entire serial studies.

At this time, an ophthalmoscopic examination showed that the choroidal tubercles situated at the 1-o'clock meridian had completely disappeared and those at the 6-o'clock meridian previously easily detectable were scarcely perceptible.

SUMMARY

This report of a case of ophthalmomiliary tuberculosis, treated with streptomycin, shows that the use of streptomycin definitely altered the course of the miliary choroidal tubercles and sponsors the conclusion that streptomycin therapy is of value in arresting miliary choroidal tuberculosis.

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* From the Glenridge Sanatorium for Tuberculosis, Dr. James Blake, chief tuberculologist.

† Assistant tuberculologist at the Glenridge Sanatorium.

‡ McDermott *et al.*: Streptomycin in the treatment of tuberculosis in humans. Ann. Int. Med., 27:769 (Nov.) 1947.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

January 15, 1948

DR. PERCE DELONG, *chairman*

OPHTHALMOSCOPY AND OPERATIONS FOR HIGH BLOOD PRESSURE

DR. ARTHUR J. BEDELL (guest speaker) of Albany, New York, said that the majority of hypertensive patients are free from symptoms, and the high pressure is discovered on routine physical examination.

The ophthalmologist often makes the original diagnosis of hypertension and inaugurates the investigations which may lead to an operation. The prime symptoms for which he is consulted are intense, persistent, treatment-resisting, generalized headache, or nuchal, occipital, or frontal distress, frequently most intense in the early morning hours.

Because of visual defects a patient may visit the ophthalmologist who recognizes the causative significance of the vessel changes, the congestion of the fundus, the lack of retinal definition, the retinal hemorrhages, the retinopathy or the papilledema.

Ophthalmologists should be able to state with reasonable certainty that a given fundus pattern indicates a favorable postoperative outcome, one of doubtful value, or a disappointment. They must know the life history of the retinal variations, and estimate the life expectancy of the individual patient. They should render a concise but genuinely explanatory report, including an opinion based on a knowledge of the favorable and unfavorable results following operation, and upon an understanding of the fundus signs.

If this is done, more cases with a good prognosis will be operated upon, and fewer of the hopeless subjected to the trying ordeals from which little or no benefit can be expected. The prognosis is based on the state of the retinal vessels.

The ophthalmoscopic signs which determine the feasibility of operation are correlated. Many exceptions may be made to them and occasionally what seems to be a hopeless case may, by operation, be given a few more years of life.

It must be remembered that hypertension is a complex manifestation of many factors all of which must be evaluated before an accurate prognosis can be given. All advice is predicated on the integrity of the kidneys, heart, and cerebral vessels.

From the ophthalmoscopic standpoint, there are two types of hypertension: one in which there are very slight vessel changes even after many years of high pressure. Eventually, the majority of such patients die from a cerebral or cardiac accident without ever having a retinopathy.

The other, labelled malignant, should be called fulminating because of the rapidly progressing retinopathy. Frequently at the time of the initial examination there are extensive exudates and hemorrhages with or without retinal edema and an irregular outline of the blood column, a spasm, or white-walled sclerotic vessels.

The fulminating type is comparatively seldom engrafted upon the simple form of essential hypertension. There is, however, no definite duration of the benign stage and no reliable guide by which we can prognosticate the imminence of the signs which almost invariably foretell an early death. It is to these potentially fulminating cases that the surgeon's attention is often directed, for without help, such patients are doomed. As a last resort, an operation may be tried; for medical treatment is ineffective.

The severe cases of retinopathy are usu-

ally associated with signs of marked kidney dysfunction, so that they rarely reach the standard of kidney efficiency demanded by the most careful surgeons.

Patients with papilledema and extensive neuropapillary edema should not be subjected to operation.

Discussion. DR. W. EMORY BURNETT: It has been a great pleasure to hear Dr. Bedell, and to consider certain additional helps in choosing patents for sympathectomy for hypertension. As a surgeon, I am a little out of my depth tonight, but can discuss some of the other considerations besides the eyegrounds at least in our selection of these patients.

I think the only thing we have to contribute tonight is the consideration of the patient as a whole, not depending entirely on eyegrounds, as much as we would like to, but feeling that there are multiple other considerations which have to be taken into our estimate. We have been watching very carefully the results of the operations, and comparing them with the forecasts. We have approximately 60 cases now on which we have operated. Some of them are too recent to evaluate properly, and, therefore, it is hard to say what is of great value and what is not.

We started out using the criteria which had been set up for us by the then known authorities in this work, particularly Peet and Smithwick, but none of the items have been too reliable or accurate, and often there is great difficulty even using all of them. Actually the tests on which we have depended most in the past two years have been the production of sympathectomy of a temporary nature, such as tetra-ethyl-ammonium bromide, or chloride, and ascending spinal or ascending caudal anesthesia, which imitate the operation for a few minutes, the latter more accurately than the former, because the tetra-ethyl-ammonium bromide is a total sympathectomy for a few minutes and the spinal is a selective or partial one. So far these have been the best forecasts that we have found. Although eyegrounds have helped tremendously, we have to realize that what is seen is the effect in a local situation, and this does not necessarily mean the entire body is similarly affected.

Another thing that may contribute to the inaccuracy of our correlation between results and forecasts is the fact that, until recently, certain sympathectomies have been rather limited, and limited sympathectomy may not be sufficient to produce the desired effect; thus, the accuracy of forecast is not actually disproved. The eyegrounds and other studies may indicate that a patient is a good prospect, that he is very likely to obtain benefit from sympathectomy. If the operation is too limited to interrupt all nerve connection with the splanchnic plexus that does not actually prove or disprove the point.

Because of this, we began not quite two years ago to do a rather extensive sympathectomy more in the nature of Grimson's type, although he was doing complete lumbar removal as well. We have not done that, but have utilized a transpleural approach so as to get to the entire thoracic chain and easily approach the upper portion of the lumbar chain, and have almost routinely, not quite universally, removed ganglia from thoracic 2 to lumbar 2, inclusive, thus leaving very little of the sympathetic chain still functioning.

The results of this more extensive operation are definitely better immediately and, probably when we have followed these patients long enough to evaluate the late results, we may be able to say that the eyegrounds furnish much more accurate forecasts than we are now prone to believe, probably on the basis that we have not given them a chance to be accurate by doing adequately the job which they indicated we should do.

Results of this more extensive sympathectomy have been much better not only in the percentage of patients who have improved, but in the degree of improvement so that we no longer have to hunt around for 10 mm. of diastolic drop. We are rather disappointed if they do not get 30 mm. or better. There have been some failures in our group. There have been failures despite the in-

clusion of spinal anesthesia and tetra-ethyl-ammonium bromide administration, but they have not been nearly so numerous as previously.

Dr. Frederick Bothe: We surgeons have a long way to go to appreciate the finer points of the eyeground study with which you gentlemen are so familiar. However, there are a few things that I wish to discuss from that angle.

You are all familar with the excellent results that Peet has obtained in cases of malignant hypertension. In the early cases I was reluctant to do a sympathectomy once the case was diagnosed as one of malignant hypertension. I did two cases at the request of the patients after I had told them I did not feel sympathectomy would help them. The symptoms, particularly headache, were relieved in both instances, but otherwise they were not benefited. Others have experienced results comparable to mine in malignant cases.

This variation in results could be explained on the grounds that the criteria of eyeground changes denoting the beginning of malignant hypertension are variable in the minds of ophthalmologists.

Sympathectomy was performed in cases of essential hypertension to reduce the vasoconstriction. This constriction is either neurogenic or humoral in origin. In the early sympathectomies only the splanchnic nerves were removed. As the results were studied, some surgeons felt that an improvement could be obtained if a more extensive sympathectomy was performed. Today there are various procedures employed.

Griscom has performed a very radical procedure. He has removed all the thoracic and lumbar ganglia in addition to the splanchnic nerves and the celiac ganglion. Others are not so radical. The procedure Dr. Burnett just described is more radical than that which I use.

At present my routine is composed of excision of the sympathetic cord from thoracic −10 to lumbar −2 ganglion, inclusive, with removal of the splanchic nerves and a piece of the celiac ganglion. We hope that future analyses of the results will decide for us whether the conservative or more radical procedures give the best remote results. The improvement in the eyegrounds seems to be about the same with the various procedures.

In the past few years we have increased the scope of the use of sympathectomy. In the early work it was felt a sympathectomy was not indicated if a patient gave a history of a serious cardiovascular catastrophe. In the light of the excellent results that Peet reported in this type of case, I have tried a few in the past several years. My patients had a history of either a hemiplegia or coronary occlusion. These cases have been followed 2½ to 3 years, and their improvement has justified the procedure in carefully selected cases.

One word as to the return of the hypertension. Let us not forget we are not in any way attempting to cure the hypertension. All we hope to do is to produce a safety valve for these patients in an effort to prevent or postpone the cardiovascular catastrophies characteristic of this disease. Sympathectomy increases capacity of the closed system through which the blood circulates. When the spasm again reduces it to the preoperative capacity the pressure returns, but it is hoped the safety valve persists. Results universally show that many patients have symptomatic relief even though the blood pressure returns to the preoperative level within 3 to 6 months postoperatively.

Dr. Glenn G. Gibson: Dr. Bedell is better equipped than any man in the world to bring this message to us, because of his extensive studies on over 2,000 cases of hypertension, which he has recently reported, and also because of his unexcelled fundus photographic material.

The surgery of hypertension has placed an additional burden on ophthalmologists in their diagnosis and classification of these vascular disturbances. When an ophthalmologist is called in consultation on a patient with hypertension, he is asked to make a prognosis. That prognosis is composed of

two parts. The first part is how much damage has been done to the patient's vascular tree. The criterion for that is how much sclerosis is present.

Dr. Bedell has mentioned that the classification of sclerosis into four main types, as advocated by Wagner, is very difficult to do correctly, and he objects to it on that basis. I agree with his objection that it is difficult to learn. In teaching residents, it is one of the most difficult tasks that we have in the whole field of teaching of ophthalmology. However, once students of ophthalmology do learn this classification, they have a tool which is very useful. At least that has been my experience in the past 15 years.

The thing I was taught that stood up best under clinical trial is the classification of hypertension into four grades of sclerosis as taught to me by Dr. Henry Wagner, who devotes most of his time to the classification of these vascular diseases. He believes thoroughly in this grading of sclerosis of the arterioles, and we have found it to be a very useful thing in the study of these cases.

The second part of the prognosis is what is the future course of this case most likely to be. We feel we can estimate this to a certain extent by dividing hypertensive cases into two main groups. The first of these is a chronic hypertension which takes a very chronic course, and the second is what we refer to as a more active type of hypertension which runs a more fulminating course.

What are the eye findings which differentiate these two different clinical courses? In a case of chronic hypertension, the most important one is arteriovenous compression. We attach more significance to arteriovenous compressions than Dr. Bedell seemed to employ in his cases. We feel that arteriovenous compression is the most reliable sign of chronic sclerosis. The other sign which is most important in the chronic group is the color of the vessel. In early chronic hypertension there is a mild accentuation of the reflex stripe and, as this condition becomes more marked, the change is that of the so-called copper-wire artery. The silver-wire changes represent the more marked degrees of chronic sclerosis.

Turning to the other extreme, what are the changes associated with active hypertensive disease? They are: (1) Marked attenuation; (2) presence of angiospasm and intermittent caliber constrictions; (3) presence of edema localized in the retina to an arterial distribution; and (4) presence of the various types of retinopathy, particularly edema of the discs. These signs are the signs of activity of the more rapid fulminating types of hypertension.

Dr. Bedell has made some very dogmatic statements, and has some pretty set ideas on which cases are suitable for surgery and which are not. We feel that our data are much too incomplete, both as to number and as to duration, to assume any dogmatic point of view about which cases should be surgical and which should not. Therefore, what we have to say in this regard is to be taken as conjectural and not as definite established fact.

Analysis of our data suggests that the prognosis is best in those cases where there is grade-one sclerosis. I am not sure that is a very significant statement, because the prognosis in grade-one sclerosis is better than in the more severe grades of sclerosis. The next trend that we find in our data is that those cases which show signs of activity, mainly the vasospastic group, are the ones which show the most convincing evidence of improvement following surgery. Conversely, the more chronic cases show less encouraging results. It is only fair, however, to point out that these are only trends, because there are examples of successful results in both groups, but by and large the more active group shows the better response.

One of the main difficulties in this problem is to differentiate between the retinopathy of acute vasospastic hypertension and retinopathy of malignant hypertension. Let us be fair about this and admit that the classification of the serious forms of this disease is unsatisfactory.

Dr. Bedell implies he does not like the term malignant hypertension. I am only too willing to agree with him that the classification is unsatisfactory as it stands. I think that one of the important contributions of surgery in this field may be that classification and understanding of hypertension will be on a higher plane than it was in the pre-surgical days.

Early in the history of this condition, we felt that the main benefit from surgery was relief of symptoms, and that, even though the blood pressure dropped temporarily, there was not much in the way of permanent value to be had from this operation. We particularly felt that malignant hypertension was much too serious a disease for surgical approach.

Dr. Burnett has operated on a number of cases of malignant hypertension and, from a review of the records, they seem to show the best results. Dr. Bedell states that these cases should not be operated and, on a logical basis, I would be inclined to agree with him, but some of the cases that have had malignant hypertension have shown a number of different signs and symptoms of improvement. They have received benefits which could not be expected by the ordinary remissions that occur in these cases. The results of Dr. Burnett's surgery have changed my opinion of this problem from one of complete disbelief in the value of the procedure to one of cautious enthusiasm. The postoperative fundus findings are unpredictable, but are dramatic in some cases.

Dr. Arthur J. Bedell (closing): Dr. Burnett, I am deeply grateful to you. You have given us the benefits of your mature deliberations. I was told before I came to Philadelphia that the address of a guest was not discussed, and I asked that the habit be broken. How fortunate that the rule was laid aside. You were gracious to come and tell us about your long experience in the surgical treatment of hypertension.

You, Dr. Burnett, have added much to our knowledge. I have, of course, read the literature, and as a result have been left in a state of confusion. The reports from the various clinics have shown that some surgeons go high in the thoracic region and some low in the lumbar, and all have claimed good results; so I have felt that perhaps it was the skill of the operator rather than the extent of the operation that led to the favorable outcome.

I did not tell ophthalmologists the details of operations for I felt that, if they were sufficiently interested, they would read about them. You, however, have saved them the effort, and I am sure they are grateful to you for the clear exposition of the nature of the present operation.

Dr. Bothe, you have added much to the value of the exposition. You have helped us understand some of the problems you encounter and overcome. You have referred to the Peet summaries. In going over his last report, I believe it is the latest one, he reported 1,500 operations. From an ophthalmic standpoint, and, of course, that is all I am discussing, his citations are rather incomplete. He had done things that I would not wish to have done to me. He has reported some conclusions at variance with other surgeons.

Your statement regarding hemiplegia has been of great interest for your good results are surprising. They cause us to pause, and to be more cautious in excluding this type of case from possible benefits of operation.

Dr. Gibson you have added much to the value of the paper, because you have amplified and clarified many of the points which I have touched upon, and brought into relief some questions in which there is a difference of opinion. Your stand has been made so clear that we all recognize your extensive experience and the value of your deductions.

M. Luther Kauffman,
Clerk.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

March 9, 1948

Hysterical amblyopia

Dr. James E. Wilson reported that J. F. W., a 36-year-old white man, complained of sudden loss of vision. His wife gave a history that he had always been quite a nervous person. He said that his father at the age of 33 years had suddenly lost his vision while walking down the street. His father's vision never returned. Report on the father from a soldier's home reported optic atrophy, cause undetermined.

For a few days before coming to my office he had said that he had felt a roughness and saw specks before his eyes. On January 6, 1948, his vision was good when he went to bed but when he awoke on January 7, 1948, he could not see.

At interview on this date he denied seeing light but at examination admitted seeing 20/200. The pupils reacted normally. The fundi were normal except for a slight temporal pallor of the papilla and a temporal choroidal crescent. Extraocular movements were normal, as were his eyes in every other respect. A blind person will face the examiner to converse but Mr. W. sat semirigid not turning his head or eyes. Spinal puncture and encephalogram were normal. Field examination could not be done.

His wife was told that he had hysterical amblyopia and that his vision would return as suddenly as it had left him. In spite of warning she told this to the patient so that the planned treatment could not be effectively used.

He was hypnotized and given sodium pentothal anesthesia without establishing his ability to see. Reëxamination on January 30, 1948, showed his eyes and condition to be unchanged. On February 20, 1948, at a special church prayer service Mr. W.'s eyes were anointed with olive oil and his vision suddenly returned. Now he is planning to enter the ministry.

Welfare agencies seemed determined to help this "blind man" but were advised that any help would prolong his disability.

Removal of orbital tumor

Dr. J. Wesley McKinney reported the case of J. S., a girl, aged 11 years, who was first seen in the Pediatrics Department of John Gaston Hospital on April 24, 1945. At that time she had a marked swelling of her right eye. This swelling had increased in the past five days, but the right eye had always been larger than the left. A rash was present over the entire body, there was a marked photophobia, and the patient was having frequent headaches.

Temperature on admittance was 103°F. Physical examination revealed a marked swelling of both upper and lower lids of the right eye. The cornea was not ulcerated and the fundus looked normal. There was a marked swelling of the nasal mucous membranes which were red and congested. A vesicular eruption covered the entire body.

Diagnosis on admittance was (1) chicken pox and (2) orbital abscess or cellulitis possibly from rupture of ethmoid or antrum sinuses.

The patient received penicillin, sulfadiazine, cold compresses to the eye, and supportive treatment. Two days after entrance, an external ethmofrontal drainage and a simple antrotomy were performed. No pus was found in the ethmoids or frontal sinuses and only a small amount of pus was encountered when antrotomy was done and the conjunctiva incised and probed. She improved under treatment and was discharged on the 15th hospital day, reporting to the Ophthalmology Clinic one week later.

At this time the examining doctor stated that the right eye showed marked exophthalmos with a dilated pupil which was fixed to light. The right fundus revealed a small red area in the macula, a bit larger than the

size of a pinhead. Vision was: O.S., 20/20; O.D., gross perception of light only. The exophthalmos, as noted, was extreme. No measurements were made since no exophthalmometer was available in the clinic. A tumor mass could be palpated deep in the orbit.

She was sent back to the hospital for removal of the orbital tumor. Repeated X-ray studies were entirely negative. However, on June 22, 1945, the orbit was entered by the Krönlein method. A wedge-shaped sector of the lateral wall of the orbit was resected and left attached to the periosteum. By finger dissection in the depths of the orbit, a well-encapsulated tumor was separated from the optic nerve. It was found to be attached by a broad lease to the greater wing of the sphenoid. There was rather profuse bleeding on reaching the base of the tumor. A tonsil snare was looped over the tumor to the base which was cut by this instrument. Fortunately, there was no further bleeding. The tumor was apparently a larger hemangioma. The child made an uneventful recovery. Vision is now light perception; ocular movements are normal.

Pencil penetrates orbit

Dr. William F. Klotz presented G.E., aged seven years. The child was seen about one hour after having fallen on her way to school, sticking a pencil into her face. She had a gruesome appearance with one inch of the eraser end of the pencil protruding from the face about the level of the lower orbital margin. X-ray films showed the pencil extending back through the orbit and the point sticking into the body of the sphenoid. It appeared to stop within about 2 mm. of the sella turcica. The child was anesthetized with pentothal and the pencil, stuck tightly, was removed with a rotary motion, leaving no portion in the wound. The wound healed within 2 or 3 days without infection, leaving a very small linear scar. She now has vision of 20/20, normal visual field, and no disturbance of any of the extraocular muscles. The mark on the pencil shows the depth, measuring 6 cm., that the pencil had penetrated. The X-ray films show the pencil in position and the postoperative X-ray picture shows no indication of a foreign body.

Ammonia burn of corneas

Dr. M. B. Seligstein presented a case of ammonia burn of both corneas. While the patient was tearing down a 3-inch ammonia pipe on December 29, 1946, some of the liquid squirted through a leak in the gasket in the values, and hit his face, catching the mouth, eyes, and lids. He was sent to St. Joseph's Hospital by the company physician.

Examination the next day showed that both lids and eyes were inflamed, as was the conjunctiva. The cornea of the right eye showed a large stain involving three fourths of its area. A streak about 1½-mm. wide spread from the center of the left cornea toward the 3-o'clock position. Holocaine and metaphen ointment were applied, together with cold boric compresses and atropine. Daily treatment at the hospital brought marked improvement and the patient was allowed to come to the office for treatment.

On January 4, 1947, the left cornea was clear and showed no staining. The right cornea still stained below the center. Gradual improvement of the right eye was noted until January 15th, when the patient complained of severe pain in the right eye. Tension was 28 mm. Hg(Schiøtz) and there was again well-developed staining of the cornea. He was put on eserine ointment for 24 hours but severe pain continued.

On January 16th, there was a small amount of pus in the anterior chamber of the right eye. Precipitates on Descemet's membrane, tension of 32 mm. Hg, and posterior synechias were present. Instillation of 10-percent neosynephrin was started at once, and in addition atropine ointment (1 percent) was used.

By January 20th, the hypopyon had disappeared, the pupil was semidilated, tension

was 26 mm. Hg, and 10 cc. of sterile milk were injected. The next day, tension was 26 mm. Hg, and the patient was still being treated with neosynephrin, atropine, and dionin. Iritis was still present and the cornea stained below. During the day, the patient was fairly comfortable but had pain at night.

On January 24th, tension returned to normal and he was comfortable, with no pain. Since that date, tension has remained normal. Synechias were present but the pupil was kept partially dilated. There was still cloudiness of the cornea in the area below the deepest burn but it did not stain.

The patient again had severe pain and watering of right eye on March 4th. Examination showed a well-developed staining of the cornea, but tension was normal. Atropine and dionin were used in addition to 10-per-cent neosynephrin. There is still some staining present below; some corneal opacity is present; the pupil is semidilated; tension is normal; vision is 20/200.

LATE FISTULOUS WOUND WITH EPITHELIAL INGROWTH FOLLOWING CATARACT EXTRACTION

DR. PHILIP MERIWETHER LEWIS presented O. G. H., a white man, aged 57 years, with an unusual series of complications coming on late after an apparently successful cataract operation.

The patient had noticed his vision failing for about one year. He had been under the care of Dr. J. B. Blue who diagnosed a posterior cortical cataract of both eyes and referred him for operation. Corrected vision was 20/100, J14 in each eye.

On January 30, 1947, a combined intracapsular extraction was performed on the left eye and four days later the same procedure was done on the right eye. No difficulty was encountered and no vitreous was lost. Stallard sutures were used on both eyes. The anterior chamber was slow to become restored in each eye, the left requiring 4 days, and the right, 6 days. Convalescence was otherwise uneventful. On April 1st, he obtained on refraction a vision of 20/20 plus in each eye and with both eyes together 20/15. A +2.50D. sph. addition gave a near vision of J1 with an unusually good range. He obtained his glasses on April 11th, and resumed his work as an accountant.

Twelve weeks after operation, on April 24th, he returned because his left eye had been sore for two days and the vision in it had become blurred. Examination showed that the anterior chamber was entirely flat and vision reduced to 20/40. The eye was slightly congested. No leak could be discovered with fluorescein. Atropine was used and a dressing applied. By the following day the anterior chamber was restored. The next day it was lost again and minute leak was discovered in the 12-o'clock meridian. The area was cauterized with trichloracetic acid and a firm dressing was applied.

For about a week the anterior chamber remained normal but on May 7th it was flat again. The actual cautery was used without benefit. On May 10th, he was readmitted to the Memphis Eye and Ear Hospital and a conjunctival flap was dissected up from the limbus. The limbal wound was cauterized with actual cautery and then the flap drawn over it and fastened with heavy silk sutures. Following this the anterior chamber was restored and has so remained.

After about 10 days, the flap slid off but the eye remained highly congested. Intraocular pressure now rose to 35 mm. Hg, (Schiøtz) and there was considerable iritis. Eserine was used for a short time, but mydriatics were employed most of the time. The tension remained around 25 mm. Hg usually, occasionally rising into the 30s. The iritis continued in spite of the regular use of atropine, injections of foreign protein, and salicylates.

Complete physical and laboratory examinations and also X-ray studies of teeth, sinuses, and so forth were negative. On about August 1st, a whitish-looking membrane appeared in the anterior chamber just beneath

the apex of the wound. This growth enlarged very slowly.

The patient was referred for X-ray treatment and to date between 600R. and 700R. have been given. Apparently the epithelial ingrowth had become inhibited. The eye was less congested and less sensitive.

This case was unusual in that no complication developed until 12 weeks after cataract operation, when a leaking wound with loss of the anterior chamber developed. This was followed by irtis, secondary glaucoma, and finally by an epithelial ingrowth. It was felt that if the X-ray therapy failed to control the condition, further surgery might be attempted.

Berman locator brings success

Dr. Philip Meriweather Lewis reported a case in which the Berman locator proved of great value.

B. N., a colored man, aged 37 years, was struck in the right eye while using a hammer in the repair of some machinery. When seen the following day, there was a 2.5-mm. horizontal wound in the center of the cornea. There was a wound also in the lens, which was milky throughout. Vision was reduced to counting fingers. He was sent to the Memphis Eye and Ear Hospital for X-ray localization.

The report showed the foreign body to be just outside the sclera in the inferior nasal quadrant. The globe was of normal firmness, which suggested that the sclera had not been perforated. Application of the giant magnet to the cornea gave no response. An exposure was made of the sclera in the inferior nasal quadrant.

Application of the tip of the Berman locator to the sclera showed that the foreign body was within the eye. The greatest intensity of sound occurred when the tip was at a point in the 135-degree meridian, 11-mm. posterior to the limbus. An incision was made at this point, and 6-0 silk sutures were inserted when the incision was about two thirds through the sclera. After completing the scleral and choroid incision, application of the tip of the hand magnet to the wound immediately drew out the foreign body. It measured 2.5 by 1.2 by 0.5 mm. The scleral incision was closed and surface diathermy was applied to the wound and the immediate surrounding area. Convalescence was uneventful. The Berman instrument made the removal of this foreign body extremely easy in spite of a misleading X-ray report.

Daniel F. Fisher,
Recorder for Eye Section.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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THIRTIETH ANNIVERSARY OF THE JOURNAL

With the issue for January, 1948, Series 3 of the AMERICAN JOURNAL OF OPHTHALMOLOGY entered its fourth decade. The changes in ophthalmology during this period can be culled from the JOURNAL's pages. The developments are recorded in many original articles, abstracts, and editorials.

Volume 1 of Series 3 witnessed the amalgamation in 1918 of six publications under the name of the AMERICAN JOURNAL OF OPHTHALMOLOGY. These journals with their chief editors and dates of founding were as follows:

The American Journal of Ophthalmology .....Adolf Alt, 1884

Annals of Ophthalmology .....James Pleasant Parker, 1891

The Ophthalmic Record .....Giles C. Savage, 1891

Anales de Oftalmologia .....M. Uribe-Troncoso, 1898

Ophthalmology .....Harry V. Wurdemann, 1904

Ophthalmic Year Book and Literature .....Edward Jackson, 1904-1911

Of these editors only our distinguished

confrere Dr. M. Uribe-Troncoso survives. He continues to contribute articles regularly to the JOURNAL as he does to ophthalmology as teacher and practitioner and our readers know that he edits our Pan-American page. His work on gonioscopy has been the most outstanding of anyone in that field.

On the editorial staff of Series 3, Volume 1, were: Adolf Alt, M. Uribe-Troncoso, Meyer Wiener, Casey A. Wood, Harry V. Wurdemann, Edward Jackson, and Clarence Loeb. The first issue was made up of 92 pages, the departments being not too different from those of the JOURNAL today—Original Papers, Abstracts, Society Proceedings, Editorials, Book Notices, News Items, Index of Ophthalmic Literature, and Digest of the Literature, the last under four headings: Methods of Diagnosis, Edward Jackson; General Therapeutics, William H. Crisp; Operations, M. Uribe-Troncoso; Refraction, Theodore B. Schneideman.

Appropriately enough, the first editorial was on the new JOURNAL by Edward Jackson who had the idea of the amalgamation of the six publications and was the first editor-in-chief and for many years the spirit and soul of the JOURNAL. The second editorial in the same issue was on advertising. Dr. Jackson was always strict as to the type and character of the advertising and set a standard for that. Many of the advertisers in the first issues have continued to utilize the JOURNAL through all the intervening years.

Among the contributors to the first issue was Thomas Hall Shastid who for many years wrote interestingly and forcefully on ophthalmic matters. His autobiography *Tramping to Failure* is a classic. In this first issue he wrote on "A Composite Ophthalmia Neonatorum Law." He stated in characteristic fashion "At all events, our present ophthalmia neonatorum laws, fragmentary and hastily constructed as they are, for the most part

'Play such fantastic tricks before high
Heaven
As make the angels weep.'"

He then proposed a new form of law.

Samuel D. Risley of prism fame discussed "The Rise and Progress of Ophthalmology in Philadelphia." It was he, I believe, who stated that myopia increases on the turnstile of astigmatism. David Wells, whose stereoscopic charts have been so much used, was writing from Boston about the stereoscope. Marcus Feingold, famous pathologist of New Orleans, had a paper on "Essential Atrophy of the Iris" with a beautiful colored illustration and excellent insert plates of a specimen.

We seem not to be much further now in our efforts at finding a satisfactory treatment for retinitis pigmentosa, as it was then universally called, than we were then. In the February, 1918, issue, E. L. Jones reported a series of cases of retinitis pigmentosa treated with thyroid extract, his paper being entitled "Relation of Retinitis Pigmentosa and Allied Conditions to the Ductless Glands." Today there are those who are treating this condition with liver extracts and placental injections. One wonders whether 30 years have added anything of value to the treatment of this disease.

Throughout this first year there are many papers that had to do with the war. In the July issue one of Jackson's ever-recurring articles on "Education for Ophthalmic Practice" is to be found. In this article he stressed the importance of establishing in each medical school "short courses in physiologic optics, ocular anatomy, and ocular pathology, and would bring these to the notice of every medical student as courses to be taken before seeking the clinical part of training for ophthalmic practice." In his last paragraph he suggested that the American Board of Ophthalmic Examinations should divide its examination into two parts giving "students who have been out of medical school one year or more an examination on ocular anatomy, the physiology of vision, geometric, experimental, and physiologic optics, and ocular pathology. Two or more

years later there could be given the examinations in the clinical subjects."

Orozimbo Netto's paper on "An Etiological Factor in Trachoma" is interesting as illustrating the diversity of thought on this subject at that time. He suggested that pediculus vestimenti might be an intermediary host and stated that "The best treatment known today for true trachoma is, undoubtedly, the excision of the trachoma tissue."

In an editorial in the September issue, Jackson wrote about "An Ophthalmic Adventurer—Julius Homberger." He was a German who came to New York in January, 1861. In July, 1862, he published the first number of a journal which he named "The American Journal of Ophthalmology." It was to be issued bimonthly. In the first volume of 256 pages all those authors mentioned were foreign except E. Williams of Cincinnati. Of the second volume only two issues apparently were published though the character of Volume I was good. Adolf Alt who started the second JOURNAL series apparently named his journal "The American Journal of Ophthalmology" without knowing of Homberger who had disappeared from professional view some 15 years earlier.

With January, 1919, the format of the editorial list was changed. Edward Jackson and Casey A. Wood were listed as editors while Alt, Wiener, Troncoso, Wurdemann, and Loeb were listed as associate editors. From 1918 to 1928, *The Ophthalmic Year Book* was published as a supplement to the AMERICAN JOURNAL OF OPHTHALMOLOGY. In 1918, this was Volume XIV of the *Ophthalmic Year Book*. The year book was begun and edited by Jackson and later by Crisp until 1926. After 1918, the year book was under the financial auspices of the JOURNAL and was published each year at a considerable monetary loss. However, the directors of the JOURNAL always considered the year book such a valuable contribution to ophthalmology that they continued to publish it until finally the burden became too great and for lack of other sponsors the year book was discontinued.

The spring of 1919 saw the sunrise for which all the world was waiting. This was reflected in the JOURNAL articles for that year. However, there were still later war articles published toward the end of 1919 and for several years thereafter. One of these on "The Control of Trachoma Among the Alien Labor Companies of the British and American Expeditionary Forces" was by George S. Derby, a senior ophthalmic consultant to the A.E.F. He, Alan Greenwood, and Nelson M. Black occupied important consultative positions with our forces overseas in this war and were continually to be found in one hospital or another striving to bring order out of the chaos that is inevitable whenever a peace-loving and peace-serving nation undertakes a world war.

In the issue of October, 1920, there is a biographical sketch of Adolf Alt, one of the original editors, who migrated from Germany to become an assistant to Herman Knapp in the New York Ophthalmic and Oral Institute, in 1875. In 1880, he moved to St. Louis. He was a distinguished ophthalmic pathologist and one of the founders and first president of the American Academy of Ophthalmology and Otolaryngology, and as previously noted founder of Series 2 of the AMERICAN JOURNAL OF OPHTHALMOLOGY.

The year 1922 saw the introduction of butyn, a drug still used by many, especially by those sensitive to pontocaine. However, pontocaine has largely replaced butyn for anesthesia of the globe when dilatation of the pupil is contraindicated.

Many pages in five successive issues in 1922 were devoted to a consideration of the proceedings of the International Congress held in Washington from April 25th to 28th. These were prepared by George E. de Schweinitz. Twenty-six years have elapsed since then and regrettably the Con-

gress has never returned to the United States. Many notable figures attended this convocation. The opportunity to meet them constituted one of the most important features of the congress for United States ophthalmologists.

In 1924 was published one of William C. Finnoff's famous papers on "Changes Found in Eyes of Rabbits Following Injection of Living Tubercle Bacilli into the Common Carotid Artery." It was a great loss to ophthalmology that one so gifted must die so young. An accompanying paper "Changes in Eyes of Rabbits Following Injection of Dead Tubercle Bacilli into Common Carotid Artery" appeared later in the year.

In 1926, John Evans published a preliminary report on retinal visual scotoma, the beginning of exact and beautiful studies that he has continued to make through the years. A comprehensive article appeared in July of the same year.

In 1928, M. H. Post made a first report on his studies on the sterilization of instruments. In 1928 also, S. Judd Beach began to write about the selection of test types for refraction. It is interesting to note how consistently ophthalmologists have maintained through the years their interest in and studies on subjects that once attracted them.

William H. Crisp replaced Edward Jackson as editor of the JOURNAL in 1928 and retained this position for three and a half years at which time he planned to be absent from the country for a while and so turned over the editorship to the writer. Dr. Crisp has always been interested in higher culture, having himself a remarkable knowledge of literature and languages with many of which he has conversational ability. The JOURNAL during his editorship gave evidence of his exactness as a student. One of his first articles while editor was on "The Literary Phase of Ophthalmology." Long before this he had popularized Jackson's cross cylinder by demonstrating its use and by writing clarifying articles on the subject.

Of historical interest in Volume 13 is the paper by W. H. Wilmer on "Some of the Early Eye and Ear Infirmaries in the United States and the Men Who Made Them."

At this point it might be interesting to JOURNAL readers to know something of the financial policy and history of the JOURNAL. Dr. Jackson, when he amalgamated the other periodicals with the AMERICAN JOURNAL OF OPHTHALMOLOGY, believed that the publication would prosper and represent the profession best if a large number of ophthalmologists rather than only a few had a financial interest in it. He, therefore, formed a stock company owned entirely by oculists who were encouraged to subscribe to one or more shares up to a limited number. Many eye physicians were interested and purchased stock which sold at $20 a share. This method of underwriting has remained throughout the years and from time to time when a few shares were offered for sale, the JOURNAL has purchased them and resold them to ophthalmologists. Jackson also established a policy of paying small dividends to stock holders and putting any excess profits back into the magazine to make it a better publication. A policy of paying for articles accepted for publication was followed for a few years, but then discontinued. The JOURNAL has been financially successful so that dividends were paid in all but two years which were in the depth of the depression.

When Dr. Crisp relinquished the editorship in 1931, Miss Emma Buss joined the staff as manuscript editor. She served efficiently and devotedly until her death, 15 years later. She gave unstintingly of herself to this work, having a fine mind and a splendid education, and was most helpful in the mechanics of editing.

For two or more decades, the leading figure in the world of ophthalmology was Ernst Fuchs of Vienna. His death, in 1930,

was memorialized in the January, 1931, issue of the JOURNAL by tributes from many of his former friends and students. From about 1870 until the first World War, Vienna was the Mecca of American ophthalmologists. From the early 1880s, Professor Fuchs's clinic was the most popular in the world. After World War I he brought his teachings to America, since Austria was no longer in a position to care for foreign ophthalmologists.

In July of 1931, the writer succeeded Dr. Crisp as editor of the JOURNAL. No radical changes took place since the new editor was in accord with the policies of his predecessors. Two years later, however, the editorial board underwent several changes. Clarence Loeb retired from the staff because of incapacitating illness which not long thereafter claimed his life. His loyal and long-time service with the JOURNAL was deeply missed. Rommel Hildreth, Park Lewis, and M. F. Weyman were added to the board. The death of the last named shortly thereafter robbed the profession of an extremely promising young man who had already been appointed associate professor of ophthalmology at the University of Southern California and departmental head in that institution.

In 1932, Otto Barkan described a procedure for the extraction of soft cataracts since widely associated with his name. In the September and October issues appeared articles on historical and experimental keratoplasty by Ramon Castroviejo which did much to popularize this operation. In the 16 intervening years many other articles on this subject have appeared in the JOURNAL, the technique and results continually improving.

Throughout the years distinguished foreign ophthalmologists have frequently contributed original papers to the JOURNAL. In 1933 alone were included such men as Lieut. Col. R. E. Wright of Madras; Ignacio Barraquere of Barcelona; R. Sondermann of Berlin; Carlos Charlin of Santiago, Chile; and T. Wassenaar of Pretoria, South Africa.

In the first issue for 1934, the leading article was on retinal detachment by Clifford B. Walker. Already well known for stressing the value of tiny test objects in taking fields of brain-tumor cases, he spent his later years in a meticulous study of retinal detachments, and was undoubtedly one of the most important figures in the development of the surgery of this condition. This was the first of many articles published by him in the JOURNAL on this subject.

The year, 1934, saw also a paper by George H. Stine on "A Method for Accurate Localization of Retinal Tears." This is probably the method most frequently followed to this day by ophthalmic surgeons in this operation.

In this volume we also find one of the many papers by that most able laboratory worker, Jonas S. Friedenwald, this one on "Retinal Vascular Dynamics." Throughout the years his alert mind has continued to explore new paths. His Jackson Memorial Lecture this year described his utilization of a new staining method for polysaccharides and mucoids that had been used for general pathology and applied by him to the eye. In his preliminary report it was obvious that a new field was opening in ocular physiology and pathology. His thesis on this subject will be published in a later issue of the JOURNAL.

In 1938 and 1939, a remarkable series of 12 lectures on motor anomalies by A. Bielschowsky appeared in the JOURNAL. These were considered so valuable that they were later published by Dartmouth College as a monograph and have served as a text for many students since then.

The editors have always had a keen interest in research and early made arrangements to publish the proceedings of the Association for Research in Ophthalmology. These papers have been a valuable addition to the JOURNAL and at the same time the JOURNAL's coöperation has been a real help

to the Society. Another effort sponsored by the JOURNAL has been the publication of the papers read at the joint meeting of ophthalmologists and orthoptic technicians in connection with the meeting of the American Academy of Ophthalmology and Otolaryngology each year.

In 1941 the writer, having served 10 years as editor, deemed it wise to pass this editorship on and suggested the name of Derrick Vail to the directors who appointed him editor-in-chief. One cannot praise too highly the efficient manner in which he has carried on since that time. He has been able to obtain the best papers and to increase both the size of the JOURNAL and the list of subscribers. This list is now well above 4,000, including many subscribers in foreign countries.

Before the first World War there were no ophthalmic publications equal to those of the Germans. For a time it appeared that these would be successfully revived, but the events preceding the second World War and the war itself obviously have reduced European ophthalmology to a very bad state. It now devolves, therefore, upon England and the United States to carry the torch for the world until such a time as our European brothers can again light their lamps for the benefit of us all.

Lawrence T. Post.

BOOK REVIEWS

MODERN TRENDS IN OPHTHALMOLOGY. Edited by Arnold Sorsby. 2nd edition. Clothbound, 600 pages, 169 illustrations, 3 color plates. New York and London, Paul B. Hoeber, Inc., Medical Book Department of Harper & Brothers, 1947. Price, $12.50.

This book has provided an important part of the reviewer's technical summer reading. The intention had been to give it a rather brief examination since the first edition of seven years earlier was well known. But so much change has taken place in ophthalmology and general medicine during that period and the book contains such a large amount of this new material that it was found to be too interesting to hurry through.

The book is composed of 48 monographs on ophthalmic subjects of unusual interest. Many authors who have exceptional information about them have contributed the chapters. There are five main divisions: Physiology, Diagnostic Procedures, Pathology, Treatment, and Social Aspects.

Part of the first section will be unfamiliar to many ophthalmologists and the most difficult to read. If they will take the necessary time, however, they will find a rich reward. Even if the ophthalmologist is familiar with the basic principles, he will find much recent experimental work described that has materially changed the current thinking on the topic. Chapters that are particularly intriguing are those on the mucopolysaccharides and mucoids, and the one on variations and correlations of the optical components of the eye. F. P. Fischer has written a provocative chapter on senescence of the eye.

John Evans is always convincing when he writes about angioscotometry; so much so in this chapter that the reader may wonder why he has not spent more time on this technique. Probably the inhibiting factor is the very lack of time. This presentation forms a good antithesis to the following one on *ophthalmodynamometry* by Espildora-Luque, especially on the theories of glaucoma. Evans considers it possible to make a diagnosis of pregnancy in very early stages by angioscotometry.

It should be noted that each subject in the book is only briefly considered and not at all intended as a complete monograph on the subject. It considers only some point that has interested the author. The reader is in fact in danger of being carried away by the writer's enthusiasm until he reads further and finds, perchance, a contrary view

equally ably advocated by someone else!

A fine example of contrary viewpoints is that of the two adjoining chapters on focal infection, one by Woods and one by Berens; the former thinks it plays a very small part in uveal disease, whereas the latter contends that virulent coliform bacilli located in the throat and nose may be of serious import in many cases.

Ballantyne and Michaelson present a good discussion on "Affections of the Retinal Veins," and Wagener and Rucker on "Eye Changes in Blood Dyscrasias."

Stina Björk in writing on "Hypertensive Retinopathy" points out that many observers cannot concur completely with Bailliart and others in their conclusions regarding the relationship of retinal arterial hypertension and systemic arterial hypertension.

There are good chapters on X-ray and Grenz-ray treatment.

In another section Weekers states that 40-percent alcohol retroörbital injections are not used nearly often enough and overlooked in many conditions in which they are helpful.

All in all we have here a most instructive and entertaining book which will enable the ophthalmologist to keep up to date in his thinking.

Lawrence T. Post.

CHILDREN'S EYE NURSING. By James H. Doggart. London, Henry Kimpton, 1948. 144 pages, 93 illustrations including 13 in color, index. Price, 9 shillings, 6 pence.

This is a useful little manual of eye nursing in general, with particular mention of that pertaining to children. It contains a brief description of the anatomy of the human eye and adnexa and a discussion of its more usual afflictions and their nursing care based on a knowledge by the nurse of what the physician sees and does. This is a sound approach because the more the nurse knows and understands of ophthalmology the better is her professional attention.

One of the most useful chapters is that on instruments and dressings. It is generously illustrated with full-size cuts of the more common eye instruments. A description of their care and storage merits especial attention, for in many places the delicate tools of our trade are often cruelly manhandled.

It is too bad that the title implies that eye nursing for children is different from that for the adult. This is not so, as we all know. The use of the manual would not be quite so restricted either if the title were not. It is a good job and is recommended not only for the ophthalmic nurse but chiefly to those beginning that specialty.

Derrick Vail.

TRANSACTIONS OF THE SOCIÉTÉ FRANÇAISE D'OPHTHALMOLOGIE. Volume 60, 1947.

This volume contains the report of the scientific sessions from May 18, 1947, to May 22, 1947. Sixty-three papers and their discussions are presented.

The demonstration of Professor Bonnet's ophthalmoscopic atlas was one of the most important features in the symposium on fundus diseases. Toulant, Beuhamou, and Foissin report on an epidemic dacryoadenitis, characterized by the severeness of the general symptoms, the mildness of the local disease, a fall in the blood proteins, and a high eosinophylia. H. Pagès and J. Duguet describe brawny ectropion as a rare complication of Koch-Weeks conjunctivitis. Dejean and Gassene used a full-thickness postauricular, skin-hair flap in the reconstruction of a burned upper lid. F. Thiébauts, L. Guillaumats, and P. Bregeats present their study of relative hemianopia, with a new perimetric technique—the simultaneous examination of the nasal and temporal fields in one eye or the corresponding fields in in both eyes.

A. Busacca has a detailed paper on the lymph channels of the normal and diseased

conjunctiva made visible by the injection of Trypan blue. R. Nataf reports his studies on trachoma resumed after the war years.

Primary edema of the cornea was discussed by L. Paufique, H. Chavanne, and J. Prost. They studied, clinically and anatomically, eight cases of this rare and mysterious disease which they suggest should be treated by lamellar keratoplasty.

In the symposium on keratoplasty, an anatomic and clinical observation of a nonperforating graft is recorded by L. Paufique and Guy Offret. The graft survived.

Jean Sédan and G. Farnarier discuss the spontaneous clearing of a traumatic cataract. Jean Sédan and Simone Sédan-Bauby add some details to the previously published description of the micropuncture of the taut capsule of a cataractous lens.

The experimental transplantation of vitreous from one eye of a rabbit to the other was successfully accomplished in a certain percentage of cases under a painstaking technique by John D. Blum and H. M. Katzin who emphasize the surprising lack of inflammatory reaction of the uvea after this operation.

Diathermy coagulation of wounds in the ciliary region is recommended by Thomas, Cordier, and Michel in preference to other therapy of this dangerous type of injury.

A valuable contribution to the diagnosis of human toxoplasmosis and a detailed description of the eye lesions are given by Franceschetti and Bamatter.

Calmettes, Deodati, and Tabarly suggest repeated small blood transfusions in recurrent retinal and vitreous hemorrhages of young adults. E. Redslob suggests tonoscopic examination in the differential diagnosis of real ophthalmic migraine which is characterized by a retinal hypotension. R. Weekers reports on his results in the treatment of hypertensive uveitis with nonperforating cyclodiathermy. Kalt discusses X-ray treatment in retinal blastoma which he recommends be continued through several years.

The possible hypersensitivity of the carotid and cardio-aortic sinus and the danger of a glaucoma attack in the sudden fall of blood pressure are mentioned by Streiff. M. Rauher describes the late and immediate effects of novocaine on normal and pathologic retinal circulation. Jean Gallois emphasizes the importance of capillary dilatation in the evaluation of intraocular diseases and explains the effect on the retinal elements.

A very original paper by R. Weekers deals with the exploration of visual function by testing the critical frequency of fusion—the smallest amount of illumination per second under which a discontinuous stimulus gives a continuous visual sensation. The measurement of the critical frequency of fusion is an extremely sensitive method and sometimes reveals defects which the campimeter does not show.

Other papers of interest include a study on visual disturbances and retinal changes caused by anoxemia in aviators (P. Dumont, J. P. Bailliart, A. Mercier, and J. Duguet) and a study of the cells in the aqueous (Thomas Verrey).

In another group of essays various aspects of intraocular chemotherapy are described. L. Alearts records the circulation of sulfonamides in the aqueous; A. Dubois-Poulsen and H. Miller observe the therapeutic effect of penicillin injections into the anterior chamber; and W. I. Kapuscinsky recommends the puncture of the anterior chamber as a most powerful vasodilatator of the retina in toxic neuritis and optic atrophy.

G. Renard and P. Bregeat discuss their first eight cases of retinitis pigmentosa as treated with subconjunctival implants of placental tissue. They could not notice any change in the appearance of the fundus. Visual acuity was slightly improved in three cases; visual fields slightly enlarged in four; adaptation was subjectively improved in seven.

Many papers carry a detailed biography.

Alice R. Deutsch.

CORRESPONDENCE

Ophthalmic equipment needed*

Editor,

American Journal of Ophthalmology:

This is a great work and the professorship of ophthalmology takes me half time during the year. The rest of the time I am in Mungali. The department is going well but I do need 25 used and fixed-up ophthalmoscopes for my medical students. Do you suppose there are in the profession even more than that good ophthalmoscopes not being used?

So great is the demand and so scarce is the supply that it would be a great lift to ophthalmology in India if we could have here old, used, but good equipment—slit-lamp microscopes, ophthalmometers, instruments of all kinds, charts for examining eyes, just everything that an ophthalmologist needs.

We are doing 1,500 cataracts a year in Mungali and Vellore now and when we do the 10,000 we want to do we will have more work for our fine young, and older surgeons, too.

(Signed) Victor C. Rambo,
Vellore, South India.

Tonometric readings

Editor,

American Journal of Ophthalmology:

If one follows the recent literature relating to the early recognition of glaucoma, one gains the impression that many physicians attach too much importance to small differences in the readings obtained by the use of the tonometer. While efforts have been directed toward enlarging the scale of the tonometer, so that readings can be made with greater accuracy, the inherent sensitivity of the instrument remains the same.

The application of the tonometer in diagnosis is limited by two important factors: (1) The technique of carrying out the measurement is subject to unavoidable errors arising from the personal equations of both patient and doctor, as well as from the nature of the instrument itself; (2) there has been recognized a wide variation in the rigidity and thickness of the coats of the normal eyeball.

These factors, which affect the ability of the tonometer to indent the cornea irrespective of the intraocular pressure, have been analyzed by Friedenwald (American Journal of Ophthalmology, 20:985, 1937) in an attempt to arrive at a more accurate estimate of the intraocular pressure.

From an historical point of view, it is interesting to note that Schiøtz, himself, was aware that the tonometric reading was influenced by factors other than the intraocular pressure. The following is quoted from his article in the *British Journal of Ophthalmology*, 9:150 (April) 1925:

"We may safely assume that for each degree of pressure the maximum and minimum deflections in living eyes will be about the same as we have found on dead eyes. . . . With 29 mm. Hg one may have, in different eyes, deflections varying from 2.2 mm. to 4 mm.; with 15 mm. Hg one may have deflections from 6.2 right up to 9.4 mm. Consequently with a deflection of 3 mm. (5.5. gm. weight), the pressure will as a rule no doubt be about 29 mm. Hg, but that deflection might be properly referable to the minimum graph and to an intraocular pressure of 26 mm. Hg, or to the maximum graph and a pressure of 33 mm. Hg. *This should absolutely be borne in mind when using a tonometer: the deflection of the pointer does not indicate a precise pressure but a pressure-range, which for the 5.5 gm. weight is about 6 to 8 mm., Hg, for the 7.5 gm. weight 8 to 10 mm. Hg, for the 10 gm. weight about 13 mm. Hg,* and for the 15 gm. weight about 15 mm. Hg, nor can it be otherwise when we take into consideration

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*Editor's note: This request comes from the Union Christian Medical College at Vellore, South India. The establishment of this college represents one of the most significant developments in the history of missionary enterprise. Actively coöperating in the work of this medical college are 38 mission boards from all over the world and their aim is to establish a medical college to serve all India.

the individual peculiarities in the size of the eye and in the thickness and elasticity of its wall."

From the foregoing, it appears that even if one assumes with Schiøtz that 30 mm. Hg represents the average upper limit of normal tension, one is never certain whether this normal limit may be applied to the eye in question. Thus, a tension of 30 mm. Hg obtained with a 7.5 gm. weight may represent as much as 5 mm. above normal for one eye and as much as 5 mm. below the upper limit of normal in another. Any criteria based on the use of the tonometer must be evaluated in the light of such observations.

(Signed) Adolph Posner,
New York.

PSYCHSOMATIC INTERRELATIONSHIPS

Editor,
American Journal of Ophthalmology:

In his interesting paper on "Psychosomatic interrelationships in ophthalmology" (Am. J. Ophth., 31:1241 (Oct.) 1948), Dr. Harrington writes: "The prescription of a pair of glasses, no matter what their dioptic power, may result in immediate relief of eyestrain, headache, blurring of vision and the like. Without a true analysis of the underlying cause and its treatment by psychotherapy, however, no more than a transient improvement, at best, can be expected."

One wonders if this is not riding the psychosomatic theory too hard. Every ophthalmologist has daily experience with refraction cases in which the prescription of glasses causes permanent, not transient, elimination of asthenopia or deficient vision or both. That the correction of the refractive error eliminates the trouble caused by the refractive error is a self-evident truth.

Perhaps Dr. Harrington means that it is the emotional conflicts that cause the refractive errors in the first place.

In that case, he should furnish proof that this is true. It is probably true in certain selected cases, but so far as I know, exact data are lacking. The claim is a familiar one. The late Dr. Bates, for example, stated dogmatically that "myopia" results when the patient is telling a falsehood. It is difficult to understand how lying can affect axial myopia even if one disputes established theories of accommodation!

Certainly, the psychosomatic theory offers a fruitful approach. One feels it can be most effective when it is limited to selected cases that are difficult to explain on a strictly organic basis.

(Signed) Philip Pollack, New York.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

7

CONJUNCTIVA, CORNEA, SCLERA

Bietti, G. B. and Pasca, G. **Research on the activity of streptomycin and its use on the inclusion bodies of trachoma in the conjunctiva.** Boll. d. Soc. ital. di biologia sperimentale. 24:82-85, Jan., 1948.

Fourteen patients with trachoma were treated with streptomycin and penicillin. Streptomycin has no advantage over penicillin. Improvement was slight and late. I. E. Gaynon.

Bietti, G. B., and Pasca, G. **Use of paraminobenzoic acid in trachoma.** Rev. internat. trachome. 25, Jan., 1948.

In eight cases of acute trachoma and six of chronic trachoma treated with 25-percent paraminobenzoic acid drops were given every two hours for ten days. Two patients were also given the same drug orally. There was no change in the number of inclusion bodies found. After the use of 0.1-percent sulfathiazole ointment the microscopic manifestations of trachoma disappeared. I. E. Gaynon.

Glees, M. **Clinical picture of smoke damage to the eye.** Klin. Monatsbl. f. Augenh. 113:43-44, 1948.

This short article discusses the various grades of conjunctival and corneal inflammation after smoke damage. The most malignant corneal lesions were seen in those in whom anaesthetic drops or ointments had been used.

Max Hirschfelder.

Harms, H. **The technique of penetrating corneal transplantation.** Klin. Monatsbl. f. Augenh. 113:59-64, 1948.

Following the idea of Vannas the author uses condom rubber of the size of a cornea to hold the transplant in place. The rubber is anchored by sutures in the episclera. A manual trephine is preferred to the motor driven type, as it permits more precise control. In order to obtain discs of equal size the pressure should be approximately the same in the donor and in the recipient eye. The danger of injuring the lens and iris is avoided in the following way. The trephine is rotated until aqueous is lost. Instead of completing the incision with scissors rubber is introduced into the anterior chamber as a protection to the underlying structures. The completion of the circular penetration is then continued with the hand trephine which will not penetrate the rubber in the

anterior chamber. The rubber is then removed through the completed trephine hole. The rubber is sterilized by a two-minute suspension in ether and in alcohol solutions ranging from 96 down to 15 percent. (References.) Max Hirschfelder.

Hartman, K. **Ectogenous conjunctival bovine tuberculosis and its treatment by electrocoagulation.** Klin. Monatsbl. f. Augenh., 113:20-28, 1948.

Infection in a young girl who had handled a dead rabbit is described. The patient exhibited papillary, partially ulcerated granulations of the conjunctiva of the upper lid with severe swelling of the parotid, submaxillary and regional glands. Laboratory tests showed bovine tuberculosis and one excised gland showed caseous necrosis. The persistent conjunctival granulations were removed by electrocoagulation in six sittings. The literature of the Parinaud syndrome is discussed briefly and the author feels that the clinical diagnosis of Parinaud's disease should be superseded by more specific etiologic terms. (References.)

Max Hirschfelder.

Maschler, J. **A case of pyocyaneus ring abscess of the cornea treated with streptomycin.** Brit. J. Ophth. 32:426-428, July, 1948.

A foreign body imbedded in the cornea of a 15-year-old boy was removed after two days. Three days later there was an extensive abscess in the cornea accompanied by hypopyon. Culture revealed B. pyocyaneus. He was immediately given 100,000 units of penicillin. It was injected under the conjunctiva and dropped into the anterior chamber after paracentesis. Heat, atropine and sulphadiazine were also prescribed. After a few hours streptomycin was instilled into the eye hourly, given intramuscularly every three hours and injected under the conjunctiva once, a total of one gram daily. During one paracentesis it was dropped into the anterior chamber (2,500 units in 2 drops). A broad Saemisch section was done and after three days the whole process regressed completely. After a few days an intense secondary glaucoma occurred and was relieved by a broad basal iridectomy. The central corneal area remained moderately opaque. Morris Kaplan.

Paton, R. T., McLean, J. M., Castroviejo, R., Maumenee, A. E., Kornblueth, W., Owens, W. C., and Woods, A. C. **Symposium: corneal transplantation.** Tr. Am. Acad. Ophth. pp. 312-353, March-April, 1948.

Paton discusses the selection of cases. A patient with reduced vision as a result of scarred cornea, but well adjusted and self supported, might better be left alone even though the corrected visual acuity is below 20/200. Highly nervous patients and those who are poorly adjusted emotionally make especially poor candidates for this type of surgery. Corneal grafting is done in much younger patients than cataract surgery, and it is well to remember that failure in them leads to more serious consequences from an emotional and economic point of view. No eye with scarred cornea should be operated on if iridectomy would bring about an improvement of vision. The most favorable cases are those in which there is a central nebulous opacity in an otherwise normal eye. There must be no active corneal disease, no infection of conjunctiva, cornea, or uvea, no increased tension, and no vascularization of the cornea. Blood staining of the cornea and conical cornea are favorable lesions, but in conical cornea it is not advisable to graft if the vision can be corrected to 20/200 even with a contact glass. Most cases of corneal dystrophy are not favorable for corneal transplantation. Calcareous degeneration, if it involves the entire cornea and full thickness, should not be operated on, but

if it is bandshaped with some clear corneal tissue in the periphery, transplantation should be attempted. Densely scarred corneas from powder burns do not do well. In general tattooing and corneal transplantation do badly in a highly vascularized cornea. There is perhaps no more favorable treatment of descemetocele than corneal transplantation.

McLean describes the process. Local anesthesia supplemented by akinesia and retrobulbar block is preferred. Donor eyes should be enucleated within six houfs after death, and preserved at 4 degrees C. in a sealed container having a saturated water vapor atmosphere. Both the square and circular types of transplant operations are described and illustrated. Beveling of the edges of the graft on the recipient cornea is not necessary. Present methods are all variations of the overlying suture to hold the graft in place. The shape of the graft is not of great importance. The high-speed mechanical trephine is the best means of cutting a true-edged graft. When cutting a graft by hand it is easier to make a square one. The operation can be mastered by any competent intraocular surgeon, but it should not be attempted by one who has not had considerable experience in developing his technique through many animal grafts.

Castroviejo describes complications that may occur during the operation and in the period of postoperative recovery. Partial detachment may be resutured, though usually unsuccessfully. If necessary, iris hernias should be excised about the third week and synechiae, the second week. Infection is best combatted with subconjunctival penicillin, streptomycin, and sulfadiazine. In complicating glaucomas, miotics, heat, and, if necessary, sclerectomy are advised. Excessive vascularization is best treated about the fourth week with 1,500 r. of radiation. Excessive and degenerative inflammations may justify the removal of focal infective process with or without intravenous injections of amino acids. Excessive edema may be reduced with 15-percent hypertonic sodium chloride jelly applied 3-6 times daily. Excessive protrusion of the implant is best treated with a properly applied pressure bandage.

In a section on physiopathology Maumenee and Kornblueth describe their experiments which were designed to elucidate the process of regeneration. The wound is closed at first by a fibrin clot, and later by fibroblasts which form fibrous tissue between the graft and the adjacent cornea. The epithelium is replaced by a migration of epithelium from the recipient cornea. The endothelium may be replaced from uninjured cells of the graft, or by migration of cells from the recipient cornea. The majority of the stromal cells continue to live in the graft and do not show massive degeneration or replacement at any time. They are supplemented to a limited extent by newformed keratoblasts from the macrophages of the recipient cornea.

Owen presents a statistical analysis of the results of 417 corneal transplant operations. The graft remained clear in 36.5 percent of the cases. The best results were obtained in keratoconus, hereditary dystrophy, interstitial keratitis and nonspecific inflammatory scars. No grafts remained clear in cases of Fuchs's dystrophy. The visual results after corneal transplantation in patients with preoperative vision of 20/100 do not warrant the risk of operation. Chas. A. Bahn.

Pines, N. **Denig's operation for trachomatous pannus.** Brit. J. Ophth. 32:385-394, July, 1948.

In this operation, mucosa of the lip is substituted for the scarred conjunctival mucosa. Under local anesthesia the bulbar conjunctiva is cut at the limbus to make a wound one and one half times as

long as the width of the pannus. It is important that this section go down to the episclera. All tissues are removed and the episclera is layed bare. While the assistant is securing hemostasis with hot saline sponges, a special forceps is applied to the lip and a section of the mucosa is cut out slightly longer and wider than the conjunctival wound. This graft is dropped in saline solution and the lip wound closed with one uninterrupted suture. The graft is laid out on a piece of glass and all the fat removed from it after which it is laid into the conjunctival wound with the mucosal side up and stitched with fine silk on three sides. The corneal side remains free. After five days the sutures are removed. At that time the graft will be pink and somewhat edematous if the operation has been successful; it will be white and freely movable if it has not.

The improvement in the eye is usually striking. However, the operation is applicable only in the third and fourth stages of the disease. There is a difference of opinion as to what brings about the improvement. Some observers believe that the peritomy alone is sufficient while others feel that the new tissue is a mechanical obstruction to the progress of the disease. The author presents four case reports. Morris Kaplan.

Rizk, K. **A case of keratomalacia cured by penicillin and vitamin A.** Brit. J. Ophth. 32:416-419, July, 1948.

A 2-year-old infant developed very severe keratomalacia of both eyes after a brief fever. Both corneas were almost completely opaque, bulged markedly and were covered by deep ulcers. There were few signs of inflammation and the baby seemed to be in no pain. The disease is primarily an avitaminosis A and is not ordinarily considered to be an infectious process. However, penicillin instillations and penicillin in wax were given in large doses. The opacities and the ulcers began to heal almost instantly although the epithelium was slow to regenerate. As soon as vitamin A was given healing progressed rapidly and completely. Dense leucomas remained only in small central areas. Both corneas resumed their normal shapes. Morris Kaplan.

Sjøgren, Henrik. **Keratoconjunctivitis sicca and chronic polyarthritis.** Acta Med. Scandinav. 130:484-488, 1948.

The author quotes Stenstam's statistics on the occurrence of this ocular condition to show that it exists in 10.5 percent of the cases of primary chronic arthritis. Sjøgren in his studies found that 93 percent of his cases occurred in males; Stenstam found the disease equally divided among the two sexes, yet further along in the article Stenstam is said to have found the severe form of keratoconjunctivitis sicca to be much more prevalent in women. Gifford in 1943 was said to have found one man to eleven women affected by the severe form. The author feels that the diagnosis of a mild case is rather difficult especially since Schirman himself says that his tear-function test is only a "very rough method," one which has never been standardized. As in the Gifford report, Sjøgren, too, found that in 40 percent of his pronounced cases no arthritis was present. The cause of this disease is unknown but two factors are worthy of consideration: one, infection, and the other, endocrine disfunction.

Francis M. Crage.

Stephenson, R. W. **Phlyctenular keratoconjuntivitis treated with penicillin.** Lancet 2:144-145, July 24, 1948.

The author reports a case of phlyctenular keratitis caused by an allergic reaction to staphylococcus. Response to penicillin therapy was good. I. E. Gaynon.

Swan, K. C., Emmens, T. H., and Christensen, L. **Experiences with tumors**

of the limbus. Tr. Am. Acad. Ophth. pp. 458-469, May-June, 1948.

The diagnostic differences of unusual limbal neoplasms are discussed. Benign leukoplakic lesions are nonvascular and carcinomatous lesions contain new or enlarged blood vessels. The transition to malignancy may therefore be observed by the appearance of new blood vessels. Lymphangiomas of the limbus tend to grow steadily. They do not metastasize but are locally invasive and destructive. They should be completely removed in the earliest possible stage. Simple lymph cysts tend to enlarge especially if they are near the palpebral fissure, and should be excised and not incised. Malignant melanotic tumors commonly arise from precancerous melanomas rather than nevi. Extensive surgical procedures are imperative. Granulomatous lesions may contain foreign bodies. It should be explained to the patient that the excision of lipodermoidal tumors frequently leaves extensive scar tissue. In the removal of limbal lesions a standard laboratory stereoscopic dissecting microscope is preferred. Stretching of Tenon's capsule may reduce or eliminate the need for mucous membrane grafts. Chas. A. Bahn.

Velhagen, K. **The type of vascularization in the differential diagnosis and clinical picture of some corneal diseases.** Klin. Monatsbl. f. Augenh. 113:28-36, 1948.

The differential diagnosis of corneal inflammations leading to deep vascularization is presented. The vessels take a straight course to the corneal center in luetic parenchymatous keratitis and do not show anastomosis. In the so-called sclerosing keratitis, which is usually caused by tuberculous scleritis, deep vessels enter the cornea for a short course, but instead of proceeding towards the corneal center they either form arcs or run straight through the peripheral parts of the cornea. Interstitial keratitis due to tuberculosis has very irregular and anastomosing vessels without a definite direction. They often surround grayish nodules in the cornea like a net. Rosacea keratitis is characterized by single branches or very small groups of vessels which often appear in the lid aperture. Frequently one finds small subepithelial or ulcerated infiltrates at the end of these vessels and some vessels may overshoot the location of the infiltrate. (4 figures, references.) Max Hirschfelder.

Venco, L. and Morone, G. **Some notes on the pathologic anatomy of grafted human cornea after keratoplasty.** Ann. di ottal. e clin. ocul. 73:221-246, April, 1947.

Histologic examination was made of six corneal transplants removed because of loss of transparency or for other cause from seventy days to one year after grafting. Dominant in the histologic picture was the edema affecting all layers. The epithelium was found to be markedly edematous from imbibition of fluid. Bowman's membrane was absent in two but was preserved in four cases. Since this membrane lacks regenerative power, its preservation points to the survival of the original membrane in the graft. In four cases the stroma showed cellular infiltration and new formation of capillaries; the lamellae were markedly dissociated and irregularly arranged; in two cases the stroma had undergone fibrillar transformation. Descemet's membrane was broken, detached, and rumpled, but was absent in only one case. In every case the endothelium was missing, probably because of handling in preparation of the specimens and because of involutional processes.

No one scheme was found sufficient to interpret the histologic processes observed. Venco and Morone believe they can distinguish four different possibilities.

1. A total transformation, in which the

graft is replaced by fibrous tissue. This occurs especially when the postoperative course is disturbed by such complications as infection, glaucoma, adhesion of iris to graft, and extensive vascularization and infiltration.

2. A subtotal transformation, in which the graft is only partially replaced by fibrous tissue. This occurs especially when the surrounding corneal tissue of the host is leukomatous. Presumably the leukomatous tissue lacks the vitality needed to cause complete transformation. Some of the original elements of the graft are found to persist, but not without losing their normal characteristics.

3. A partial transformation, in which localized opacities form in certain sectors of the graft and other parts remain transparent. An injury to Descemet's membrane in making the graft may result in poor union and thus occasion a localized organization of the stroma. Irregular edges or improper placement of the graft may cause the failure of normal metabolic relations to be established between host and graft at all points of contact. The part of the graft which will suffer most is that which is in contact with leukomatous or other abnormal tissue in the host.

4. No transformation of the tissue of the graft, which remains transparent throughout. This ideal result may be achieved when the postoperative course is perfectly quiet, without any kind of untoward reaction. In such cases the cicatricial ring between graft and host is frequently so fine as to be almost invisible, and there is reason to believe that a great part of the original tissue survives, especially the fibrillar framework.

(Review of the literature, 9 photomicrographs, bibliography.)

Harry K. Messenger.

Wolffersdorff, v. H. **Comparative studies of the course, treatment and epidemiology of epidemic keratoconjunctivitis in Saxony during 1941 and 1944.** Klin. Monatsbl. f. Augenh. 113:36-43, 1948.

The author gives a detailed clinical picture of epidemic keratoconjunctivitis as it appeared in Glauchau, Saxony, during two epidemics in the early forties. He presents a statistical analysis of an equal number of patients (322) during both epidemics. In 28 percent of the patients there had been major or minor trauma. The 37 patients operated on for cataract showed symptoms of the disease, but did not suffer serious consequences. In addition to 10-percent albucid solution and vitamin A ointment the author used X-ray irradiation, given in doses of 5 to 10 percent HED at 8 to 10-day intervals up to six doses and injections of 10 to 15 cc. own blood intramuscularly. He believes that injections of blood of convalescents properly typed for blood groups should be further investigated.

Max Hirschfelder.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Bernstein, M. E. and Burks, B. S. **A note on iris rim color and width.** J. Heredity. 39:93, March, 1948.

Rim color of the iris falls into nine classes: two shades of blue, six shades of gray and one of very dark. In 78 percent of the people studied, the color of the main part of the iris was the same as that of the rim. If one parent had a narrow rim, the incidence of the narrow rim in the offspring was increased.

I. E. Gaynon.

Braun, R. **Tuberculosis and focal infection as causes of iridocyclitis.** Klin. Monatsbl. f. Augenh. 113:9-20, 1948.

It is pointed out that the importance of tuberculosis as cause of acute and chronic

iritis has been overemphasized in the German literature. The various pertinent clinical and laboratory findings as well as animal experiments are critically discussed. The proof for a hematogenous spread of tuberculosis to the eye is lacking except in the case of miliary tubercles. Much points to the correctness of the American idea of focal infection. Iritis, rheumatism and arthritis may be the result of the sensitization of mesenchym tissues and an allergic response to the primary focus. This focus can be in the tonsils, teeth, gallbladder, pelvic organs and, in some cases, can well be a tuberculous hilus gland. Removal of the focus will not necessarily stop the allergic reaction of the sensitized tissue immediately. Climatic treatment, irradiation, treatment with heavy metals and, perhaps, salicylic acid are helpful in bringing the sensitized tissues back to normal.

Max Hirschfelder.

Gilbert, W. **Early stages of ophthalmia lenta with remarks on the etiology of this disease.** Klin. Monatsbl. f. Augenh. 113: 1-8, 1948.

Ophthalmia lenta is a most severe chronic eye disease which begins with a recurrent uveitis, but finally affects retina, vitreous and optic nerve. It is always bilateral and is part of a syndrome which includes aphthous stomatitis and ulcerations of the genital organs, particularily of the scrotum. Changes in the skin have the character of an erythema nodosum. Eye symptoms may be so slight in the beginning that the dermatologist is likely to overlook or disregard them. Later, the recurrent severe hypopyon iritis can completely dominate the picture. The author refers to a somewhat similar but much more frequent ophthalmia in horses. He adds two cases to the literature on the subject and expresses the opinion that the syndrome is the allergic response to an infection, possibly by a virus. (References.)

Max Hirschfelder.

Gorduren, S. **Operative treatment of five cases of iridodialysis.** Brit. J. Ophth. 32:429-435, July, 1948.

Traumatic iridodialysis is not uncommon. It causes cosmetic and functional defects and should be treated as early as possible. The symptoms most complained of are reduced vision, dazzling, and monocular diplopia. Since 1917 the Golowin operation has been most employed and has served quite well. After local anesthesia a keratome incision is made just on the level of the iris root and parallel to its anterior surface. The knife is withdrawn slowly and the iris is allowed to protrude with the aqueous outflow. If the iris does not appear, it is pulled out with an iris hook. With two spatulas the iris is made to rest evenly in the wound and after the instillation of atropine, both eyes are dressed. The patients sit up after the first day, are out of bed the third day and resume work on the seventh day. *Morris Kaplan.*

Hart, W. W. **Sympathetic ophthalmia. Report of a case.** New Orleans M. and S. J. 101:85-87, August, 1948.

The clinical history is presented of a 48 year old negro woman in whom sympathetic ophthalmia developed 57 days after a penetrating injury. The inciting eye was enucleated five days later. The sympathizing eye smoldered for another four months and healed with a visual acuity of 20/120. The data presented throw no new light on cause, pathogenesis or treatment. F. H. Haessler.

Hu, Jenner. **Total disappearance of the iris due to essential atrophy.** Am. J. Ophth. 31:1168-1169, Sept., 1948.

Illingsworth, R. S., and Wright, T.

Tubercles of the choroid. Brit. M. J. pp. 365-368, August 21, 1948.

The authors report their observation on choroidal tubercles in 25 of 42 cases of miliary tuberculosis because of their probable prognostic value, and to emphasize their importance in diagnosis. Choroidal lesions establish a diagnosis before a radiograph of the chest or a lumbar puncture has been performed.

The natural history of the choroidal tubercle is described. As time passes, the margin of the tubercle becomes more definite, the tubercle enlarges, the center becomes paler, and the tubercle and the surrounding area become stippled with pigment. In the final stage there is a parchment-white scar with heavy surrounding pigmentation and paling of the near-by choroid.

It is suggested that further observation may well show that the changes described are of prognostic value. Of those cases (eight in number) in which in spite of prolonged streptomycin treatment the tubercles failed to progress beyond the early intermediate stage, death has occurred in five and the remaining three are doing badly. All the cases in which the tubercle progressed to the parchment-white stage without the appearance of any tubercles in earlier stages were apparently cured. (40 references, 6 figures on colored plate.) F. H. Haessler.

Kapuscinski, W. J. **Tuberculosis and focal infection in diseases of the mesenchymal tissues of the eye.** Arch. d'opht. 8:238-263, 1948.

Kapuscinski reviews the subject of the pathogenesis of uveitis and discusses in detail the concept, attributed to German authors, according to which the majority of uveal inflammations are of tuberculous origin. He concludes that histopathologic, bacteriologic, clinical, and therapeutic data now available do not substantiate these early claims made for tuberculosis but, on the contrary, tend to give to focal infection the major role in pathogenesis. He supports the view that the uveal tissue is sensitized so that it reacts to antigens released from a distant focus. He mentions the diagnostic value of intravenous injections of typhoid vaccine; a tuberculous infection would tend to be aggravated whereas one due to focal infection would usually improve. Acceleration of the sedimentation rate accompanied by an exacerbation of the uveitis after typhoid vaccine injection would suggest tuberculosis, whereas an acceleration of the sedimentation rate accompanied by improvement in the local focus would suggest focal infection. There is no acceleration of the sedimentation rate when there is no systemic infection.

The author describes 12 cases of which two were undoubtedly tuberculous. The others were a result of focal infection, for the most part dental. He does not support the theory of organotropic bacteria (Rosenow) and concludes that the allergic theory, while more satisfying, does not cover all cases. He concludes by stating that there are only three causes of intrinsic inflammation of the mesenchymal tissues of the eye: (1) syphilis (about 15 percent), (2) tuberculosis (about 3 to 5 percent), and (3) the focal infections (streptococcic, staphylococcic, gonococcic, and others).

Phillips Thygeson.

Lasky, M. A. **Essential progressive atrophy of the iris.** Am. J. Ophth. 31: 1131-1134, Sept., 1948. (3 figures.)

Marquez, M. **Ocular hypertension in glaucoma.** Ann. d'ocul. 181:351-361, June, 1948.

Glaucoma and ocular hypertension are not synonymous. That hypertension is only one of the variable symptoms of glaucoma has been shown by the numerous cases of glaucoma without hyperten-

sion which have been reported in ophthalmic literature. The glaucomatous excavation is absolutely independent of ocular tension, and peripheral as well as central visual defects are essentially due to retrobulbar vascular degeneration. Basically, primary glaucoma is always chronic. Primary glaucoma may be controlled but never cured. Among the newer therapeutic agents now under investigation are nicotinic acid and rutin. The use of the former is based on a minimal elective vasodilatation and of the latter, on possible reduction of capillary fragility.

Chas. A. Bahn.

Moutinho, H., and De Moura, S. **Meningococcic iridochoroiditis (an exclusively ocular form of meningococcic infection).** Ann. di ottal. e clin. ocul. 73: 311-320, May, 1947.

Metastatic iridochoroiditis is a well-known complication of epidemic cerebrospinal meningitis, but the possibility of meningococcic iridochoroiditis without manifest meningitis has hardly been recognized. Moutinho and De Moura present eight cases of unilateral metastatic iridochoroiditis occurring at the height of an epidemic of meningococcic meningitis in children who had no meningitis and were otherwise quite well. The ages of the patients varied from five months to three years. In the evolution of the disease three characteristic stages were recognized: 1. mild general and meningitic symptoms, lasting less than 24 hours; 2. an interval of 2 to 4 days when everything seemed normal; 3. obvious iridochoroiditis. In three patients lumber puncture was done, and in two of these gram-negative diplococci with the morphologic characteristics of the meningococcus were found. The spinal fluid was otherwise normal. An ocular puncture was done in one eye, and the fluid showed diplococci with the same characteristics. The endophthalmitis was severe, with purulent exudate and eventual cicatricial contraction tending to phthisis bulbi.

Harry K. Messenger.

Radnot, Magda. **Contribution to data on sight disturbances caused by proliferation of pigment epithelium.** Brit. J. Ophth. 32:423-426, July, 1948.

In an 82-year-old woman, who had had an intracapsular cataract extraction with a round pupil several years before, the vision was limited to the counting of fingers and the entire pupil and coloboma was filled with a dark brown film. Slit-lamp examination revealed a solid sheet of pigment on the anterior surface of the vitreous. Presumably the pigment epithelium of the iris had been injured in the operation and had proliferated until it covered the whole anterior surface of the vitreous.

Morris Kaplan.

Sautter, H. **Some interesting findings on the iris.** Klin. Monatsbl. f. Augenh. 113:44-51, 1948.

Two malignant melanomas were cured by iridectomy. A third case is one of a metastatic carcinoma carried from the testis to the anterior uveal tract through the anterior ciliary vessels. Metastasis through the anterior ciliary vessels is relatively rare. A fourth eye is described in which hypoplasia of the dilator of the iris was found in an excised piece of iris. The pupil had not dilated well before cataract surgery. (6 figures, references.)

Max Hirschfelder.

9

GLAUCOMA AND OCULAR TENSION

Bietti, G. B. **Application of carbon dioxide snow in the region of the ciliary body as a means of lowering the intraocular pressure.** Atti del 36 congressa della Soc. oftal. ital. 9, 1947.

In 15 cases of secondary glaucoma carbon dioxide snow was applied to the bulbar conjunctiva in the region of the

ciliary body. Hyperemia is present during the first hour and is followed by a fall in tension that gradually returns to normal in three to six days. I. E. Gaynon.

Bietti, G. B. **Antiglaucomatous operations in trachomatous eyes.** Boll. d'ocul. 27:129-138, March, 1948.

In the Pavia University Eye Clinic, the occurrence of trachoma patients suffering from glaucoma is not rare and even case abstracts illustrate some of the difficulties involved. Five sclerecto-iridectomies, eight trephinations, and one iridectomy were performed. In five eyes the intraocular pressure returned to normal after fistulisation; in six remaining eyes, the pressure was either not lowered or returned to high values after a transient lowering. Anatomic changes may explain this unsatisfactory result: thickening of the conjunctiva, adhesions between conjunctiva and sclera, frequency of hemorrhages, and the postoperative inflammatory reaction in the conjunctival and subconjunctival tissue. These changes make the filtration of the scar more difficult or impossible. Larger conjunctival flaps, larger corneoscleral openings, careful attention to bloodvessels will avoid these failures. Cyclodialysis, diathermocoagulation, and cryotherapy of the ciliary body are the procedures of choice. (1 table, 17 references.)

K. S. Ascher.

Curran, E. J. **Advances in the management of glaucoma.** Postgrad. Med. 3:399-409, June, 1948.

Chronic simple glaucoma is an anatomic defect in the eye which causes it to be functionally unable to meet the requirements of normal production and exit of aqueous. Miotics should be tried. If repeated field studies reveal a diminution, surgery should be resorted to. The various operative procedures are discussed. Iridotomy is believed to be superior to iridectomy. If iridotomy is not sufficient, an Elliot trephining of the sclera with iridotomy is advocated. I. E. Gaynon.

Esterman, Benjamin. **Headache as a symptom of chronic glaucoma.** M. Cl. North America pp. 839-844, May, 1948.

The headache of chronic simple glaucoma is usually supraorbital or frontal, and tends to come on in the evening or in dim illumination. Occasionally it is present on arising and lasts less than one hours. It is most common at the age of marked presbyopia and the symptoms may be induced by such vasomotor stimuli as heat, cold, and strong coffee.

I. E. Gaynon.

Magitot, A. **Provocative tests in glaucoma.** Ann. d'ocul. 181:338-350, June, 1948.

Provocative tests are not of great practical value. At best they give presumptive evidence, especially if positive. Atropin, homatropin or other mydriatics and cycloplegics are not always followed by increased tension in primary glaucoma. Exposure to dark for 30 to 60 minutes frequently increases tension in the glaucomatous for about one hour. Pupillary dilatation and altered pituitary melanophore function are apparently causative. Caffeine administered parenterally or orally was followed by increased ocular tension in 43 percent of a series of normal subjects and by diminished tension in 27 percent. In the glaucomatous the percentages were only slightly different. Although bodily intravenous pressure parallels intraocular pressure, increased intravenous pressure of the head does not aggravate glaucoma. Increased intravenous pressure may be produced by lowering the head, cessation of breathing, stricture of the neck, or by placing an extremity in ice water. The ingestion of large amounts of water preferably on waking, was followed by increased ocular

tension in 82 percent of a series of patients with primary glaucoma.

Chas. A. Bahn.

Schmerl, E., and Steinberg, B. **Central control of intraocular pressure by active principles.** Am. J. Ophth. *31:1097-1101*, Sept., 1948. (3 tables, 1 figure.)

10

CRYSTALLINE LENS

Bietti, G. B., Nižetić, B., Jr. **Tissue therapy of Filatov in degenerative chorioretinitis.** Atti del 36 congressa della Soc. oftal. ital. 9, 1947.

Twenty-five patients with various types of degenerative chorioretinitis were treated with placental extract, codliver oil and aloe. Of these 11 had improved objectively, nine subjectively, two became worse and three were unimproved. The annular scotoma was reduced in two patients and the visual field increased in ten. (1 table.) I. E. Gaynon.

Cordes, F. C. **Surgery of congenital cataracts.** Am. J. Ophth. 31:1073-1084, Sept., 1948. (6 figures, 35 references.)

Guyton, J. S. **Prevention and management of complications of cataract extraction.** Am. J. Ophth. 31:1085-1096, Sept., 1948. (1 figure.)

Lancher, A. J. **Cataract surgery in the young diabetic.** Surg. Clin. North America pp. 508-512, April, 1948.

Two patients with bilateral senile cataract, one a women aged 34, the other a man of 46 years were operated on after adequate treatment with insulin. In the first an extracapsular extraction was performed, in the second the intracapsular technique was successfully carried out.

Proper preoperative care and tight section closure by corneoscleral sutures should make the diabetic no greater risk than other patients. Francis M. Crage.

Rossano, R. **Total lens extraction by massage.** Ann. d'ocul. 181:364-372, June, 1948.

Preliminary corneal massage softens the eye and thereby apparently facilitates lens extraction. It is accomplished by means of a Daviel spoon. Most of the force is applied at the lower limbus. The usual cataract surgery then follows.

Chas. A. Bahn.

Theobald, G. D., and Haas, J. S. **Epithelial invasion of the anterior chamber following cataract extraction.** Tr. Am. Acad. Ophth. pp. 470-481, May-June, 1948.

This malignant complication occurs approximately once in every one thousand cataract extractions. In the series of 14 cases discussed, implantation most frequently occurred because of the inclusion of a tongue of conjunctival or corneal epithelium in a technically imperfect wound. In five cases epithelization was actually traced through the wound, and it could probably have been traced by means of serial sections in the others. Delayed healing occurred with severe chronic iritis in eight eyes. Four were diagnosed clinically by a thin white line on the posterior surface of the cornea. This complication can be prevented by a limbus based flap, preferably concentric with the limbus which would adequately cover the wound with an intact layer of conjunctiva. Chas. A. Bahn.

11

RETINA AND VITREOUS

Belmonte González, Nicolás. **The pathogenesis of hypertensive retinopathy.** Arch. Soc. oftal. hispano-am. 8:478-487, May, 1948.

Ocular fundus, blood-pressure and retinal vascular pressure, urinalysis, blood urea, visual acuity, and the arterio-venous index were studied in 116 hyperten-

sive patients. Without giving the details of the study, the author concludes that stellar retinitis, with edema, exudate, and hemorrhage, represents the specific response of the retina to anoxia. Anoxia may be caused by a constriction of the afferent vessels, an impediment to the venous return, lack of oxygen in the blood, and intoxication of the retinal cells which abolishes their capacity to use the available oxygen. Before the appearance of a hypertensive retinitis the imminence of anoxia is indicated by a relative retinal hypertension. Ray K. Daily.

Biro, I. **The present state of the problem of retinitis pigmentosa.** Brit. J. Ophth. 32:411-415, July, 1948.

Although retinitis pigmentosa is most probably caused by disorders of the pituitary gland and to the surrounding diencephalon, it is not a single disease. Two groups are recognized: the inherited and the autonomous; the former may be dominant and recessive. The great majority of the inherited cases are recessive. The autonomous cases are secondary and follow the exanthemata, typhus, malaria, trauma, inflammations, vaccination, persistant vascular spasms and irregularities of nutrition. The author states that there is a clinical difference between the two types but fails to describe that difference.

The outlook for the inherited type is hopeless while that of the secondary type is more encouraging. The author believes that the work of Filatov should receive attention. In 1945 Filatov wrote of treating 110 cases of retinitis pigmentosa with "tissue therapy" but failed to publish the results of these experiments.

Morris Kaplan.

Budde, H. **Cure of a glioma retinae by radium.** Klin. Monatsbl. f. Augenh. 113: 51-53, 1948.

A one-year-old child had bilateral glioma. The eye with the more advanced tumor was removed and the orbit treated with 280-percent HED X ray filtered through 1 mm. of copper. The other eye was subjected to radium treatment with a total of 300 mgh given in two sittings. The tumor subsequently became smaller and only a big white scar was seen in the fundus six years after treatment. An irradiation cataract developed and had to be removed three years later. Vision is now 5/15. A short survey is given of the gliomas treated by X ray or radium, that have been reported. (References.)

Max Hirschfelder.

Croll, L. J., and Croll, M. **End results in retinal detachment.** Am. J. Ophth. 31: 1107-1121, Sept., 1948. (1 table, 16 figures.)

Fieandt, von O. **Experiences with transplantation of human vitreous.** Ophthalmologica 15:257-268, May, 1948.

The author has performed five vitreous transplantations on four human eyes with persistent, heavy posttraumatic vitreous opacities. Normal vitreous was obtained from normal human eyes a few hours after death. A strictly sterile surgical technique was observed during the removal of the vitreous from the donor's eye. The remarkable feature in the author's small series is the occurrence of a severe inflammatory reaction in two of his cases which caused atrophy bulbi in one and led to enucleation in the other case. To explain these severe reactions Fieandt following the suggestion of Hobart (*Arch. of Ophth.* 10:237, 1933) tested some patients for sensitivity to their own vitreous proteins. The results were equivocal. To the reviewer it seems that the possibility of a bacterial inflammation should have received more serious consideration. Only one of Fieandt's patients derived some definite visual benefit from the transplantation. There is no indication whatsoever that aspiration of

cloudy vitreous and its replacement with sterile saline solution would not have led to the same result. Peter C. Kronfeld.

Gorduren, S. **Six cases of scintillatio albescens.** Brit. J. Ophth. 32:435-439, July, 1948.

Six cases of snowball opacities of the vitreous are briefly described. The endogenous deposits in the vitreous are very rare and have been reported in 32 of 82,732 patients and in 40 of 65,000 patients. Two types are recognized: asteroid hyalitis which consists of white spherical bodies in normal vitreous, and synchisis scintillans in which sparkling gold particles appear in a fluid vitreous. It is essentially a disease of old age, and almost always unilateral. The bodies are composed of calcium soaps and are said to be associated with general debilitating diseases but this was not the case in this series. Five of these six had incipient or immature cataract in both eyes.

Morris Kaplan.

Jonkers, G. H. **Seasonal variations in the occurrence of retinal detachments.** Ophthalmologica 115:308-315, May, 1948.

A publication by R. Weekers (Ophthalmologica 110:218, 1945) caused the author to investigate whether or not the onset of retinal detachment was in any way seasonally influenced. The records of retinal detachment in 836 patients with definite histories concerning the time of onset served as the basis of this study. All these patients had contracted the detachment on Dutch soil and were treated for it at Weve's clinic in Utrecht. In this material Jonkers found the same seasonal peak in June that Weekers had observed in Belgium. Peter C. Kronfeld.

Jonkers, G. H. **Seasonal variations in the occurrence of retinal detachments.** Ophthalmologica 115:316-318, May, 1948.

In the material of the Eye Clinic of the University of Bern no significant seasonal influence could be recognized in the occurrence of spontaneous retinal detachment. This conclusion was based on the history and findings in 197 patients with retinal detachment. Similar studies in Belgium (Ophthalmologica 110:218, 1945) and in Holland (Ophthalmologica 115:308, 1948) did suggest a seasonal factor. Peter C. Kronfeld.

Lloyd, R. I. **Senile macular lesions.** Am. J. Ophth. 31:1135-1146, Sept., 1948. (15 figures, references.)

Lijó Pavía, J. **Detachment of the vitreous in chorioretinitis, and alterations of the macula.** Rev. oto-neuro-oftal. 23: 25-29, April-June, 1948.

The author describes and discusses a case of chorioretinitis with cicatrix and macular changes, in which he was able to discern a "hole" in the posterior surface of the vitreous at the site of the fundus lesion, and posterior vitreous separation. Drawings and stereophotographs of the fundus clearly describe the lesions. (4 figures, bibliography.) Edward Saskin.

Riddell, W. J. B. **Detachment of the retina.** Medical Press 219:323-325, April 14, 1948.

The short review of the subject is one of the articles in the series of "Modern treatment in General Practice." It concerns itself with the etiology, symptomatology, ophthalmic examination, and operative measures employed in the disease. Much credit belongs to Gonin for his painstaking work. There have been too many good results following surgery to assume a pessimistic attitude in the prognosis of retinal detachment.

Francis M. Crage.

Rosengren, Bengt. **The value of anticoagulant drugs in thrombosis of the retina.** Acta Med. Scandinav. pp. 212-217, Suppl. 206, 1948.

In the treatment of six cases of tributary venous thrombosis with dicumerol, thrombolysis occurred in three about four weeks after the therapy was started. The percentage of successes in these cases undoubtedly is reduced where vascular sclerosis and compression from without exist. The age range in the author's cases was 57 to 76 years. Francis M. Crage.

Silván López, Fernando. **Grouped pigmentation of the retina.** Arch. Soc. oftal. hispano-am. 8:448-456, May, 1948.

Two cases are reported. One patient had a negative family history and no other anomalies except the retinal pigmentation, the other had a number of associated congenital anomalies, traced through three generations. A 15-year-old boy had twelve groups of slate-colored foci in the inferior nasal sector of the left fundus. They were darker near the disc, and less pigmented further away. The number of foci in a group varied from a solitary patch close to the disc to 15 or 20 small ones in the periphery; the majority of the groups contained two or three. Each group gave the impression of having been formed by the fragmentation of a single focus. The contours of the pigment spots were well defined, and some had a fine granulation at the edges. The pigmented areas obscured the choroidal network, and the retinal vessels passed over them without any alteration in their level. Visual acuity and fields were normal. The other patient, 10 years old, with strabismus and amblyopia of the left eye, had three groups of slate colored foci in the fundus of this eye. They were in the horizontal meridian on the nasal side, eight disc diameters from the disc. This patient was of a hyperexcitable temperament, and in addition to the retinal pigmentation, had syndactyly of the toes and a misshaped auricle. His maternal grandmother was blind from glaucoma; the paternal grandfather was a drunkard. The father and two brothers had the same anomaly of the ears, and one brother had syndactyly of the toes. The pathogenesis of this anomaly is discussed. (2 figures). Ray K. Daily.

Soloff, L. A., and Bello, C. T. **The relationship of retinal hemorrhages in hypertensive patients to cerebral hemorrhage: a comparison of the retinal picture in hypertensive individuals who died of heart failure with those who suffered a cerebral hemorrhage.** Am. J. M. Sc. 215:660-664, June, 1948.

A review was made of the records of all patients with hypertension who had been admitted to Temple University Hospital between 1941 and 1946 and had died or had cerebral hemorrhage. It was found that retinal hemorrhages occurred in 77 percent of 18 patients who died of cardiac failure without cerebral hemorrhage, in 29 percent of 17 patients who had a cerebral hemorrhage, and in patients who had large regions of spasm with or without a marked sclerosis. Retinal hemorrhages cannot be used as a prognostic sign of future cerebral hemorrhage, as they occur more frequently in those who ultimately die of cardiac or renal failure without a massive cerebral hemorrhage. (6 tables, references.)

Bennett W. Muir.

Vetter, J. **Retinal detachment in a case of retinitis pigmentosa.** Klin. Monatsbl. f. Augenh. 113:53-59, 1948.

The combination of pigment degeneration of the retina with detachment is very rare. The case of a young man is described who developed a detachment in one eye and was successfully treated by repeated electrocoagulation. The pigmentary degeneration advanced after this operation and, after nine years, had led to tubular fields in both eyes. The author points out that in spite of the supposed coalescence of retina and pigment epithelium in pig-

mentary degeneration the union does not seem strong enough to prevent hole formation and detachment in predisposed retinas. This is particularly true in the very early stages, when sprouts from the pigment epithelium have not yet invaded the retina. The relatively good result in the author's patient seems to recommend detachment surgery, even if the detachment is complicated by an existing retinal pigment degeneration. (References.)

Max Hirschfelder.

Weekers, R., and Roussel, R. **The critical flicker frequency after successful operations for retinal detachment.** Ophthalmologica *115:297-308, May, 1948.*

In previous papers Weekers and Roussel applied the method of determining the critical flicker frequency to the study of various retinal and optic nerve diseases. It proved to be a very sensitive index of visual function. Application of this method in cases of cured retinal detachment reveals permanent impairment of visual function even when the retina had been detached for only one month. The operation for detachment of the retina is an urgent one. Every postponement lessens the prospects of healing and also the postoperative restoration of visual function.

Peter C. Kronfeld.

12

OPTIC NERVE AND CHIASM

Bruetsch, W. L. **Etiology of optochiasmatic arachnoiditis.** Arch. Neurol. and Psychiat. *59:215-228, Feb., 1948.*

Syphilis is the most common, and otitis media is another well recognized cause. The role of trauma is difficult to understand. Arachnoidal adhesions alone may be responsible for atrophy of the superficial nerve fibers, but anatomical experience tends to show that they do not produce atrophy of the nerves on a large scale. The tendency to report unexplained cases of optic nerve atrophy under the heading of optochiasmatic arachnoiditis is increasing, and in many of these there probably is a primary morbid process within the chiasm and nerves. The full status of this condition is still not at hand. (4 figures, references.)

Bennett W. Muir.

Stansbury, J. R. **Optic atrophy in diabetes mellitus. A report of three cases in one family.** Am. J. Ophth. *31:1153-1163, Sept., 1948. (6 figures.)*

Tetzu, I., Blatt, N., and Silvian, J. **Interstitial optic neuritis consecutive to a furuncle in the nasal vestibule.** Arch. d'opht. *8:264-269, 1948.*

The authors report the case of a man of 55 years with a furuncle in the left nares of four or five days duration, and with swelling of the lower lid. He had been receiving sulfonamide and penicillin therapy. The vision of the right eye was normal but that of the left was reduced to light perception. Fundus examination showed an atrophy of the optic nerve. After two days of observation and local treatment, the furuncle came to a head and was evacuated. The patient was treated with dionin, strychnine, vitamins B and C, cyclotropine, intravenous glucose, cascosan, transpupillary infrared radiation, and ultraviolet light; there was slight improvement in vision over a period of three weeks. After ruling out syphilis and sinusitis as possible factors, the authors conclude that the optic atrophy was caused by the furuncle but fail to explain the rapid development of the atrophy. They review the literature on the subject of pyogenic infections of the face and their orbital and intracranial extensions.

Phillips Thygeson.

Wood, A. C. **Optic neuropathies: a simplified classification and outline for etiologic diagnosis.** Am. J. Ophth. *31: 1053-1069, Sept., 1948. (20 figures.)*

13

NEURO-OPHTHALMOLOGY

Chamlin, Max. **Visual field studies in neurosurgery.** Surg. Cl. North America pp. 432-437, April, 1948.

Field charts showing enlargement of blind spots and homonymous field defects were proved to have provided considerable help in diagnosis of brain tumors. In some cases this evidence was corroborative, in others a stimulant to further studies, and in still others it was the most important finding in diagnosing the existence and location of a lesion. They are of great value in differentiating inflammatory lesions such as optic neuritis and retrobulbar neuritis from non-inflammatory diseases. Francis M. Crage.

Ethelberg, S., and Jensen, V. A. **"Choked disc" in neurosyphilis.** Acta. Psychiat. and Neurol. 23:49, 1948.

The author finds lumbar and cisternal puncture contraindicated when papilledema is present, especially since a positive Wassermann reaction in the spinal fluid does not give conclusive evidence of the syphilitic origin of a given intracranial neoplasm.

If ventriculography reveals a normal or slightly increased pressure without signs of tumor, we may ascribe the papilledema to cerebral meningitis and call it meningeal papilledema. If there is no sign of tumor, but the intracranial pressure is increased, then it may be very difficult to distinguish ophthalmoscopically between meningeal papilledema and papilledema produced directly by the intracranial pressure. In meningeal papilledema the veins are slightly engorged and exudates or hemorrhages are few or absent whereas we find a typical choked disc with pronounced engorgement of the veins and typical extravasates in syphilitic basal meningitis or where the pressure is due to a large solitary gummatous tumor. Apart from antisyphilitic therapy and fever treatment decompression may be necessary to prevent the papilledema from developing into secondary atrophy. Since the operation is not entirely an indifferent procedure we may watch and wait till the edema develops into a regular choked disc.

If ventriculography indicates tumor, craniotomy should be done in all cases. Most of the tumors are of nonsyphilitic origin, but even if the lesion is gummatous, which is very rare, craniotomy is indicated because the intracranial gumma is resistent to chemotherapy.

R. Grunfeld.

Godtfredsen, Erik. **Pathogenesis of cranial nerve lesions, notably ophthalmoplegias, complicating herpes zoster ophthalmicus.** Acta Psychiat. and Neurol. 23:69, 1948.

The author reports eight cases of herpes zoster ophthalmicus associated with cranial nerve lesions. The cutaneous extension, severity, duration, and prognosis do not differ from what is seen in other cases without attending neurologic symptoms. The lesion is a radiculomeningitis that proceeds from the Gasserian ganglion in which the herpes virus is localized. In the ganglion cells we find a very pronounced hemorrhagic inflammatory reaction with necrobiosis, necrosis, and consecutive regional meningitis. The inflammation spreads along the first branch of the trigeminal nerve centripetally and centrifugally. Eventually the inflammation reaches the cavernous sinus where it involves the third, fourth and sixth nerves. The involvement of the seventh nerve must be considered a manifestation of brainstem encephalitis. The zoster virus spreads centripetally into the brain stem along the descending root of the trigeminal nerve. The facial nerve fibers and the descending root of the trigeminal nerve are intimately related in the pons. R. Grunfeld.

Klein, R., and Attlee, J. H. **The syndrome of alexia and amnesic aphasia. Subarachnoid haemorrhage with symptom of partial occlusion of the spinal subarachnoid space.** J. Ment. Sc. 94:59-69, Jan., 1948.

The article describes a complete study of a case of subarachnoid hemorrhage in a women, aged 47 years. Neurologically the disease was followed through coma, mania, confusion, and finally convalescence. The neurologic signs were varied and memory suffered the most. Retinal and vitreous hemorrhages and an upper right-sided homonymous quadrantic hemianopia were the outstanding ocular defects. The latter remained unchanged but practically all the other symptoms disappeared at the end of three months. The field defect was ascribed to a break in the lower radiation fibres. Right-sided hemianopic defects when associated with alexia arise from a left lingual gyrus lesion in a right handed person.

Francis M. Crage.

May, P. R. A. **Pupillary abnormalities in schizophrenia and during muscular effort.** J. Ment. Sc. 94:89-98, Jan., 1948.

Dilatation of the pupil with impaired light sensitivity has been known to occur after muscular effort and in catatonic schizophrenia where the sign was termed "catatonic pupil." In such cases dilated pupils and impaired light reflex were usually bilateral. The author's investigations were made on 343 male schizophrenics and 100 mentally normal males all under the age of 55. Studies were made of the pupils in respect to their equality and the reactions to pain, light and muscular effort. Diminished pupillary response occurred very frequently with the above mentioned reactions in all of the schizophrenics. These abnormal changes might be correlated with the schizophrenic's lack of normal emotional response to the outside world. The pupillary signs found in these cases would complicate the differential diagnosis between schizophrenia and neurosyphilis.

Francis M. Crage.

Simpson, J. F. **Horner's syndrome due to an osteochondroma of the first rib.** Canad. M.A.J. 59:152-155, August, 1948.

A case of Horner's syndrome in a woman caused by an osteochondroma of the left first rib is reported. The author believes it to be the first reported case of that nature. Symptoms were apparent at the age of 7 years, the syndrome was first noticed at the age of 14, the tumor was identified at the age of 17, and removed at 34 years of age. A review of anatomy, physiology, and etiology is given. (8 figures, references.) Bennett W. Muir.

Stengel, E. **The syndrome of visual alexia with color agnosia.** J. Ment. Sc. 94:46-58, Jan., 1948.

Word blindness as a loss of visual memory has been ascribed to a localized cerebral lesion and also to a general impairment of brain function. The two cases presented occurred in men, aged 63, and 68 years of age. Each had a right-sided hemianopia, word blindness, and abnormal color vision. The lesions in both cases were obviously vascular. A discussion of the location of lesions causing this complex follows. Francis M. Crage.

14

EYEBALL, ORBIT, SINUSES

Barnett, H. N., and Ford, R. **Ophthalmic and other affections predisposed to by deformities and caused by sepsis of the nose.** Medical Press 219:239-245, March 17, 1948.

Deformities in the nasal septum and turbinates are considered the main cause for septic infections in the sinuses. The sinusitis results from the mechanical interference with the discharges from the sinuses. The treatment when surgical

must correct both the sinus lesion and the obstructive defect.

Such ocular conditions as dilated pupil, ptosis, corneal ulcers, keratitis, iritis, choroiditis, retrobulbar neuritis, and optic neuritis have been caused by sinus infections. Illustrative cases are presented. The rhinologist is advised to puncture and irrigate sinuses in disturbances of undetermined etiology, despite negative nasal and X-ray findings. This is especially true in retrobulbar neuritis. Contrary to the conclusion of others, the authors feel that the latter disease can be frequently caused by sinus disease, and, because no definite inflammation is present in the nerve, they feel that the symptoms are the result of pressure on the optic nerve by the orbital edema adjacent to the affected sinuses. They feel that a better term for the disease is "pressure paresis of the optic nerve." A strong appeal is made for a thorough nasal study in eye diseases of unknown etiology. Francis M. Crage.

Fischer, J. T. **Basedow's hyperophthalmia.** Rev. oto-neuro-oftal. 23:29-35, April-June, 1948.

This paper is a continuation of investigations described in the previous issue. To diagnose this condition, several criteria must be kept in mind. The patient complains fundamentally of his eye and vision, the thyrotoxicosis responds to medication, there is a hypometabolism with or without hypothyroidism, and an increase in thyrotropic hormone. Thyroidectomy is contraindicated. The exophthalmos is a true edematous phenomenon, and is attended by the vices of any proptosis. The condition is abetted by the administration of estrogenic hormones and iodothyroxin; relief may also be obtained by radiotherapy directed to the hypophysis and the orbit. In cases of severe proptosis, decompression of the orbit may be attempted.

Edward Saskin.

Loddoni, G., and Duc, C. **Ageing of the human eye.** Boll. d'ocul. 27:139-192, March, 1948.

This comprehensive review, consisting of 50 pages of condensed factual reports and two pages of references, can not be abstracted briefly. The anatomic and functional changes of the eye during senescence are described. Scleral hyalinization (Roper) is not mentioned. Intravascular pressure, pupillary changes, visual field defects and ageing of the color sense and of light perception are discussed. K. W. Ascher.

Lloyd, R. S., and Jones, R. M., Jr. **The Cutler-Guyton eye implant and prothesis: two cases.** Military Surg. 101:205-207, March, 1948.

Two cases in which the Guyton modification of the Cutler implant has been used are described. The implants are well tolerated, there has been minimal exudate and there has been 90 percent motility. The operative technique is described.

I. E. Gaynon.

Morone, G. **Cutaneous fibromatosis with orbital angiofibroma.** Boll. d'ocul. 27:193-199, March, 1948.

Numerous fibropapillomas of varying size were located on the back and on the chest of a 45-year-old patient who had noticed a slight protrusion of his left eye three years before the operation. Transpalpebral orbitotomy revealed the presence of a fibroangioma. The author did not find an identical case report in the literature but the coincidence of Recklingshausen's disease and various tumors has been reported previously. (4 photographs, bibliography.) K. W. Ascher.

15

EYELIDS, LACRIMAL APPARATUS

Callahan, A. **Reconstruction of the canthi.** Tr. Am. Acad. Ophth. pp. 486-496, May-June, 1948.

The outer canthus is normally higher when the lids are closed, but lower when they are opened. The reëstablishment of posterior pull is of special cosmetic importance. This is normally accomplished medially by Horner's muscle and laterally by the canthal ligament.

Two holes are made in the anterior or posterior crest with a dental drill, avoiding perforation of the nasal mucosa. A stainless steel wire is directed through the upper opening, passes between the bone and nasal mucosa and emerges through the lower opening. The ends are then passed through the canthal ligament or tarsal plates and are twisted rather than knotted. This basic technique is necessarily modified to meet individual problems. A series of 37 patients operated on by this method is analyzed. Numerous specific case reports and 27 illustrative figures are presented.

Chas. A. Bahn.

Callahan, Alston. **Severe lid deformities.** Plast. and Reconst. Surg. 3:456-463, July, 1948.

The management of bilateral multiple lid deformities is illustrated with a detailed case report. Loss of skin is replaced with a free skin graft, and displaced tissues are rearranged with a pedicle flap. Intermarginal lid adhesions are utilized to prevent contraction. When extensive repair of the lid is required after the eye has been removed, the graft or flap is kept under more adequate tension if an acrylic conformer is kept constantly in the socket. This ophthalmopedic aid also maintains ample space for an artificial eye when surgery is concluded. Intermarginal lid adhesions are divided after three months. A severed palpebral ligament of the upper lid of the other eye is reattached to the bone with wire. (7 photographs, 4 drawings.) Alston Callahan.

García Miranda, Ramón. **Sjögren's syndrome associated with acne rosacea.** Arch. Soc. oftal. hispano-am. 8:590-602, June, 1948.

A case of Sjögren's syndrome and acne rosacea is reported and the newer literature is reviewed with special reference to hormone therapy. A woman, 58 years old, developed in the course of nine years, Reynaud's disease, keratoconjunctivitis sicca, acne rosacea of the cornea, and a general dryness of the mucous membranes, anosmia, loss of taste, and menstrual irregularity. Her ocular as well as general symptoms improved rapidly on treatment with polyvitamins, liver extract, and perandren. Because of the high cost of perandren, its use was discontinued, and the symptoms recurred in their original intensity. She was then given cortical hormone instead of perandren and she again improved remarkably. The local treatment consisted of sodium bicarbonate eye baths. (2 figures.)

Ray K. Daily.

Kettesy, A. **On genesis and operation of the cicatricial (trachomatous) entropion of the upper lid.** Brit. J. Ophth., 32: 419-423, July, 1948.

Most operations for entropion of trachoma fail because it is erroneously assumed that the cause of the entropion is the progressively incurved tarsus. Actually this incurving of the tarsus occurs quite late in the process and the real cause is the obliteration of the intermarginal space by the contraction of the scars along the subtarsal sulcus. The author has devised his own operation which aims at the remodelling of the intermarginal surface. The upper lid is everted by Liebermann's sutures and the tarsus is incised through and along the line of scars in the sulcus. Three mattress sutures are placed in the conjunctival side of the section and an incision is made just behind the marginal tarsal strip through to the skin. The mattress sutures are then brought through the

tarsal strip and loosely knotted; then the loose ends are brought out through the skin above and tied. Vaseline pressure dressing is applied and the knots are removed after two days. The author dislikes the use of beads, rolls or pads beneath the skin sutures. (5 illustrations.) Morris Kaplan.

Risdon, Fulton. **The eyelid and socket surgery.** Plast. and Reconst. Surg. 3:454-455, July, 1948.

Skin grafts of .018 are used to reconstruct either upper or lower eyelids. If all four lids require skin grafting, the upper lids are done at one operation, the lower lids at a second. Intermarginal adhesions have not been satisfactory in the author's hands.

A thin lead plate with an intermediate piece of lint is laid over the graft and sutures tied around it to maintain pressure.

In the reconstruction of a contracted socket, the mucous membrane remaining is not removed and a skin graft of .018 thickness is used to cover the raw surfaces produced by the extension. Dental compound mould is preferred. Glass artificial eyes are preferred. Fascia lata strips are used to suspend ptosed lids to the occipitofrontalis muscle.

Alston Callahan.

Rosas Costa, M. T. **Treatment of styes by intrapalpebral penicillin injection.** An. argent. de oftal. 8:13-16, Jan.-Feb.-March, 1947.

In order to achieve a quick and efficient therapeutic result in the treatment of hordeola and to prevent any complications, the author advises the usual hot wet compress followed by an injection of 50,000 units of penicillin in about one and a half cc. of 2-percent novocaine. The healing is rapid, there is very little local reaction, no other medication is necessary, and one injection usually suffices. (Bibliography). Edward Saskin.

Zarrabi, M. **The operation of entropion,** Arch. d'opht. 8:269-270, 1948.

Zarrabi discusses the causes of failures in the surgical treatment of trichiasis and entropion due to trachoma. He describes an operation for which he claims a high percentage of successful results. In his operation two parallel incisions are made in the skin of the lid, the first 2 mm. above the ciliary border and the second 3 mm. above the first. This portion of the skin and of the subjacent tissues down to the tarsus is then excised with scissors. Two parallel incisions are then made in the tarsus 1½ mm. apart, the first incision being made 1 mm. from the lower border, sparing the roots of the cilia. This portion of the tarsus is then excised, the palpebral conjunctiva being left intact. A zigzag suture is then passed through the tarsus and the subcutaneous tissue in such a fashion that when tightened it draws the edges of the tarsal incision together and everts the lid border. The skin itself is not included in the suture. The author states that the operation has been employed on a large scale in Teheran with full satisfaction to patient and surgeon. Phillips Thygeson.

17

INJURIES

Cross, A. G. **The effects of mustard gas on the eyes.** Medical Press 219:281-282, March 31, 1948.

A short historical summary on the use of this war gas is given.

Acute mustard gas keratoconjunctivitis is characterized by the appearance of photophobia and blepharospasm three to eight hours after exposure to the gas. Moderate to severe pain is present in direct proportion to the extent of destruction of corneal epithelium. About 75 percent of the cases were mild and cleared up in about four weeks. Of the remainder,

15 percent with some roughness of the cornea took a little longer and the other 10 percent required many months to heal extensive necrosis of superficial corneal epithelium.

Delayed mustard gas keratitis appeared in a few cases about ten years after exposure to the gas and freedom from ocular symptoms. All these patients gave a history of original treatment of the eyes for as long as six months. The main symptoms were lacrimation, photophobia, and failing vision. The corneal stroma showed dilated vessels and aggregations of caseous material. Ulceration was also present. The vision progressively diminished despite the treatment. The treatment is that of keratitis in general. Contact lenses, where tolerated, were of considerable help to those with irregular corneal astigmatism. The essential cause for the delayed and recurrent corneal ulceration was the presence of masses of cholesterin and fat resulting from the original vascularization in the cornea and limbal region. Once the degenerative process has begun it continues.

Francis M. Crage.

18

SYSTEMIC DISEASE AND PARASITES

Bergstrand, Hilding. **Hypertensive vascular changes in the eye.** Acta Path. et Microbiol. Scandinav. 25:98-106, 1948.

Volhard's theory of spasticity of the retinal vessels rather than a reaction from toxic substance as a cause for the condition known as albuminuric retinitis is rather strongly upheld. The author substantiates this by the ease with which this theory can explain such conditions as eclampsia, chronic glomerulonephritis, and essential hypertension with or without renal disorders.

The histological changes in the vessels of the choroid and retina in essential hypertension and retinal changes are described.

Francis M. Crage.

Chandramowli, A. **Ophthalmology in relation to general medicine.** The Antiseptic 45:433-448, July, 1948.

In this lecture the author deals briefly with a large number of topics. He points out the similarity in the behavior of the eye and other organs to stimulation by drugs, he discusses the medical aspect of eyestrain, and describes ophthalmic manifestations of disease of the blood and cardiovascular system, the organs of respiration, and of diabetes, allergic states, and endocrine disturbances.

F. H. Haessler.

Del Río Cabañas, J. L. **Ophthalmoplegic migraine, caused by a metastatic tumor.** Arch. Soc. oftal. hispano-am. 8: 622-630, June, 1948.

The literature is reviewed, and a case reported. A 66-year-old man with an intestinal neoplasm and bronchial metastasis developed a typical ophthalmoplegic migraine on the right side after a blow in the right temporal region. The third, fourth, fifth and sixth nerves were involved. The ophthalmoplegia is attributed to metastasis at the base of the brain. (6 figures.)

Ray K. Daily.

Ferrié, J. **Complications of relapsing fever.** Ophthalmologica 115:227-240, April, 1948.

A severe epidemic of relapsing fever broke out in Morocco in January, 1945 and spread from there all over North and Northwest Africa. Visual complications were observed chiefly after the use of pentavalent arsenicals. A neurotropism of the spirochete may also have been a factor in causing optic nerve lesions. The lesions were chiefly retrobulbar and often associated with signs of polyneuritis. The author warns against the use of pentavalent arsenicals in the treatment of relapsing fever.

Peter C. Kronfeld.

Holland, H. **Hydatid of the orbit.** Brit. J. Ophth. 32:395-396, July, 1948.

Very briefly the author discusses eight cases of echinococcus cyst of the orbit which occurred in India. In all of them the cyst was in the upper fornix. Proptosis was the most prominent symptom and pain one of the least. Vision was little disturbed unless ulceration of the cornea had developed. It was always unilateral and the diagnosis was made by finding typical hooklets in the fluid obtained by aspiration of the tumor. It is important to completely excise the cyst which is most difficult to do. The author succeeded in two of his patients. Ecchymosis reaction is very severe in patients in whom portions of the cyst remain; however, the prognosis for vision is very good.

Morris Kaplan.

Palmer, R. S., Nyssens, A. F., and White, J. C. **Severe hypertension with papilledema simulating brain tumor.** New England J. Med. 239:322-327, August, 1948.

The similarity in symptoms, physical signs, and spinal fluid findings in patients with severe hypertension with papilledema and in those with expanding intracranial lesions is pointed out. A comparison is made of observations in 30 patients with severe hypertension and papilledema, in 25 patients with expanding intracranial lesions, and in 15 patients with severe hypertension without papilledema. The differential diagnosis between severe hypertension with papilledema and an expanding intracranial lesion with coincident hypertension is discussed and illustrated by a report of three cases. The most important differential characteristic is the slow, steady progression of neurologic localizing signs in brain tumor. Proper evaluation depends upon expert neurologic examination and sometimes upon supplementary pneumograms. In the hands of the writers extensive sympathectomy has been the measure that relieved symptoms, reduced the papilledema and stayed the usual rapid progress of malignant hypertension. It is suggested that denervation of the splanchnic bed abolishes or minimizes the orthostatic pressor responses and thus protects the cerebral circulation. (3 tables, references.)

Bennett W. Muir.

Rosen, E. **Some new concepts concerning ocular complications following vaccination.** Ophthalmologica 115:321-332, June, 1948.

Following the mass vaccination against smallpox in New York City during the Spring of 1947 the essayist observed several cases of ocular complication which he reported in various periodicals. They included such syndromes as interstitial keratitis associated with vestibuloauditory symptoms, metaherpetic keratitis, dendritic keratitis, exudative chorioretinitis, central serous retinopathy, iritis and panophthalmitis, thrombophlebitis and lesions of extraocular muscles. In all these cases the eye complication occurred from 9 to 13 days after the vaccination, which period has become recognized as the incubation period of postvaccinial encephalitis. None of the essayist's cases showed definite signs of encephalitis, but in his opinion "it is not difficult to assume that the eye may be the mirror in which allergic cerebral changes encountered in the postexanthematous encephalitic state may actually be visualized." Since postvaccinial encephalitis is a comparatively new disease first described 23 years ago, it is not difficult to understand the infrequency of observation and recognition of the postvaccinial ocular complications. The clinical manifestations of postvaccinial encephalitis are just as variable as the postvaccinial eye complications. The ophthalmologist is in

an advantageous position to observe post-vaccinial complications.

Peter C. Kronfeld.

Saebo, J. **Xeroderma pigmentosum with affection of the eye.** Brit. J. Ophth. 32:398-411, July, 1948.

Xeroderma pigmentosum is a congenital skin disease which is relatively rare and very difficult of diagnosis. It develops under the influence of sunlight in the course of the first few years of life. Three stages are recognizable: the first is a hyperemic and inflammatory phase most often called ordinary freckles; a second stage is characterized by brown warts and excrescences; and in a third stage malignant growths appear. The disease takes many years to develop but most patients die at an early age. Serious ocular manifestations occur often, such as malignant palpebral affections, pigmented conjunctival tumors, teleangiectases and papillomas. They may spread to all parts of the eye and to other parts of the body.

The author describes three cases which were closely watched for many years. The first two were in siblings in whom the disease was discovered early. Each outcropping was promptly treated with heavy doses of X-ray or radium radiation, with good and apparently lasting results. The third case was not diagnosed for many years. Both eyes had to be removed and the patient died with extensive metastases at the age of 21 years. It is important that even benign-looking tumors in the eyes associated with pigmented spots on the skin be studied most carefully. (10 figures.) Morris Kaplan.

Teichman, B., and Greer, K. C. **Ocular manifestations of myasthenia gravis.** Canad. M. A. J. 59:55-58, July, 1948.

The onset is usually gradual and increased muscular fatiguability is most often observed in the ocular muscles. Ptosis of one or both upper lids is the first symptom in over 50 percent of cases, and soon is associated with variable diplopia. Less frequently the bulbar muscles are involved. A characteristic is the increase in signs and symptoms with bodily fatigue, and regression after rest. Orbicularis weakness is sometimes seen. Pupillary reflexes are not interfered with, and accommodation paresis is rare. Visual acuity and visual fields are not involved. Sometimes symptoms remain evident only in the ocular structures for years although usually they spread to other skeletal muscles. Subcutaneous injection of 1.5 mgm. of progstigmine gave improvement of the levator muscle action in all of one series of cases. The muscles attached to the globe, however, may require a larger dose to improve ocular motility. Two doses of 0.6 gm. each of quinine may be used if the progstigmine gives no results. Myasthenia should be included in the differential diagnosis of external ophthalmoplegia. The exact relationship of the thymus to this disease is not known. However, a patient may benefit from thymectomy. (1 figure, references.) Bennett W. Muir.

19

CONGENITAL DEFORMITIES, HEREDITY

Busacca, A., and Pinticart, de W. E. **Gonioscopic study of a case of posterior corneal embryotoxon.** Ophthalmologica 115:283-290, May, 1948.

In 1920 Axenfeld gave the name posterior corneal embryotoxon to a congenital anomaly of the cornea characterized by a white annular band situated in the deepest layers of the cornea just inside the limbus. In the paper under review the clinical and gonioscopic findings in such a case are described in detail and well illustrated. The white band proved to be

an anterior extension of the corneoscleral trabeculum. The glistening white line that formed the inner border of the band was the thickened tip of the scleral septum which is the posterior extension of sclera into the cornea and serves as foundation for the corneoscleral trabeculum and the canal of Schlemm.

Peter C. Konfeld.

Crespi Jaume, G. **Congenital ocular melanosis.** Arch. Soc. oftal. hispano-am. 8:437-447, May, 1948.

This is a comprehensive review of the literature, and a report of three cases. A child, four years old, had a darkly pigmented zone 4 to 5 mm. wide surrounding the left cornea, except for a small area on the nasal side. Its outer edge was festooned, and the inner edge was on the limbus. The iris was very dark, and the fundus so deeply pigmented as to obscure the perivascular choroidal spaces. A woman, 58 years old, had twelve dark patches in the superior and temporal portion of the right eyeball. They were separated from one another by areas of normal sclera. The iris was densely pigmented, except for one sector below, where its color and structure were similar to that of the left eye. The third patient, 15 years old, had a choroidal nevus, and small pigment spots on the disc. (3 figures.) Ray K. Daily.

Papolczy, F. **Congenital cyclopia and orbital cyst together with other developmental anomalies on the same side of the face.** Brit. J. Ophth. 32:439-443, July, 1948.

The author describes a baby with characteristics of congenital cyclops confined to the right side. A proboscis-like tube, 3.5 cm. long and 1.5 cm. in diameter, extended from the right inner canthus down along the nose and had a navel-like depression on its distal end. The lower lid was violet and was greatly enlarged into a very soft cyst. There was a hare-lip and cleft palate on the right side and no eyeball. The left side was normal. The proboscis and the cyst were removed. It was found that the tube had all the tissues of the normal nose and the cyst had only layers of epithelium. Eight days after this operation the baby developed pneumonia and died. At necropsy it was seen that the soft parts of the orbit contained tissues of lens, retina, choroid, ciliary body, iris and pigment epithelium.

Morris Kaplan.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Birren, F. **The ophthalmic aspects of illumination, brightness and color.** Tr. Am. Acad. Ophth. pp. 566-584, May-June, 1948.

In industry, glare and other symptoms result from maladjustment between increased illumination and environmental brightness. Illumination which may appear excessive is frequently made to seem normal by adjustment of surrounding brightness. Flooring materials, desks, filing cabinets, woodwork and paints enter into the adjustment. Fairly critical seeing usually requires 25 to 35 foot candles and general illumination should ordinarily not exceed 50 foot candles. The theory of uniform brightness is both impractical and misleading. The illumination of the work should moderately exceed its surroundings. Monotony, however, should be avoided. The psychologic aspects of vision including color constancy are of special importance. Ocular fatigue is largely muscular rather than retinal. The constant effort to improve vision by ineffectual adjustments causes the symptom complex known as eye strain. Chas. A. Bahn.

Currie, J. G. D. **An English experience.**

Tr. Am. Acad. Ophth. pp. 584-588, May-June, 1948.

In an English factory which produced precision work an excessive number of employees required ophthalmic treatment. A large number of the employees were not visually suited for accurate near work, ametropias were not adequately corrected, and lighting facilities were inadequate. A marked decline in the number of employees requiring ophthalmic treatment was noted when these conditions were corrected. Chas A. Bahn.

Erpf, S. F., Dietz, V. H., and Wirtz, M. S. **Ophthalmoprothesis, U. S. Army World War II.** Military Surg. 101:405-408, Nov., 1947.

A short history of the development of the artificial eye program is presented. I. E. Gaynon.

Franklin, C. F., Sr. **A bacteriological comparison of penicillin and silver nitrate for prophylaxis against ophthalmia neonatorum.** Military Surg. 102:179-184, March, 1948.

Two and one-tenth percent of the infants exhibited pus while in the nursery after penicillin prophylaxis and the cultures were positive in 80 percent of these. Six percent of the infants exhibited pus after silver nitrate prophylaxis. Fifty-two percent of the cultures were positive in both groups of infants who exhibited ocular abnormalities other than pus. After penicillin prophylaxis 3.1 percent of the eyes exhibited pus at home and 3.3 percent of the cultures of these eyes were positive. After silver nitrate prophylaxis, 2.4 percent exhibited pus in the eyes at home and 100 percent of the cultures were positive. The gonococcus was found in one case after silver nitrate prophylaxis. I. E. Gaynon.

Koch, F. L. P. **Some practical aspects of geriatric ophthalmology.** Geriatrics 3: 163-165, May-June, 1948.

Early or impending pathologic changes in the elderly may be determined by examinations. Corrective measures may be instituted at the optimum time. I. E. Gaynon.

Kefalas, A. **Eye hazards and safety practices in the Wearside shipyards.** Brit. J. Indust. Hyg. 5:51-69, April, 1948.

Of a group of 100,000 miscellaneous accidents 14,722 occurred in the eye. Eye injuries consist of flash injuries, burns or scalds, mechanical trauma, foreign bodies and hot foreign bodies. (10 tables, 7 figures.) I. E. Gaynon.

Morgan, W. G., and Stump, N. F. **Important uses of industrial vision tests and the medical director.** Indust. Med. 17:253-258, July, 1948.

Employees whose visual skills passed the minimum requirements for the job had greater comfort, simplification of work tasks, increased earning, decreased rejected materials at inspection, greater safety at the job, reduced minimum pay make-up and decreased absenteeism. I. E. Gaynon.

Saunders, E. E. **Navy eye-correction, eye-protection program.** Tr. Am. Acad. Ophth. pp. 562-565, May-June, 1948.

The numerous physical and mental factors that affect the visual efficiency of the individual are discussed briefly. The program instituted by the Navy includes the examination of civilian employees with the Ortho Rater or/and Sight Screener to test simultaneous binocular vision, visual acuity, stereopsis, muscle balance and color discrimination. To facilitate minimal transportation expense, workers are examined preferably in larger key stations and smaller supplementary stations, if necessary. The neces-

sity of occupational glasses in specific cases is stressed and illustrated.

Chas. A. Bahn.

Stewart, R. E. **Plastic artificial eye and restoration program, Veteran's Administration.** Military Surg. 101:396-404, Nov., 1947.

A step by step account of the procedure used in the manufacture of ocular plastic prosthesis is given.

I. E. Gaynon.

Vail, D. **Opportunities and responsibilities of ophthalmology.** Tr. Am. Acad. Ophth. pp. 359-366, March-April, 1948.

In industrial practice ophthalmologists have not fulfilled their duties. In the stress of private practice, most ophthalmologists have not taken the time and effort which is necessary for the reasonable understanding of industrial needs. Problems such as job analysis, illumination in industry, and more efficient industrial methods in the prevention and treatment of employees are important in industrial ophthalmic practice, but unsolved. Generally speaking, ophthalmologists feel that mass refraction means inefficient refraction. The relationship between ophthalmologists and technicians such as optometrists is discussed at some length. Chas. A. Bahn.

Young, M. N. **Ophthalmic practice with an Army Hospital in North Africa and Southern France Ports.** Military Surg. 101:211-212, Sept., 1947.

Ophthalmic practice consisted for the most part of clinic practice comprising refractions, spectacle fittings, physical examinations and consultations. Diseases encountered were keratoconjunctivitis, corneal ulcer and malarial herpetic keratitis. Surgery was performed for orbital fractures, foreign bodies, hordeolum, chalazion, lacerations, pterigium and intraocular foreign bodies. I. E. Gaynon.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
601 Union Trust Building, Cincinnati 2
News items should reach the editor by the 12th of the month

DEATHS

Dr. Robert James Lynch, Des Moines, Iowa, died May 28, 1948, aged 67 years.

Dr. Percy Jay Ross, Chicago, Illinois, died September 28, 1948, aged 46 years.

Dr. Vivean Visscher Wood, St. Louis, Missouri, died June 20, 1948, aged 61 years.

MISCELLANEOUS

TORONTO REFRESHER COURSE

Dr. Ramon Castroviejo of New York City and Dr. Lawrence R. Boies of Minneapolis, Minnesota, will be the guest speakers at the combined refresher course in ophthalmology and otolaryngology, University of Toronto, Faculty of Medicine, to be held January 24 to 29, 1949. Dr. Castroviejo will lecture on cataract surgery and give a surgical clinic; Dr. Boies will speak on general problems of interest in the practice of otolaryngology.

GILL GRADUATE COURSE

Gill Memorial Eye, Ear and Throat Hospital presents its 22nd annual spring graduate course in ophthalmology, otology, rhinology, laryngology, faciomaxillary surgery, bronchoscopy, and esophagoscopy, from April 4 to 9, 1949.

Guest speakers include the following: Dr. Banks Anderson, Dr. H. W. Brown, Dr. W. B. Clark, Dr. W. B. Dearring, Dr. W. W. Eagle, Dr. Harold Falls, Dr. E. P. Fowler, Jr., Dr. Leslie Gay, Prof. L. B. Garrod, Dr. Glen G. Gibson, Dr. C. L. Jackson, Dr. Carl C. Johnson, Dr. A. C. Jones, Dr. Harold H. Joy, Dr. Peter Kronfeld, Dr. John S. Lundy, Dr. Louis Panfique, Dr. Peter N. Pastore, Dr. Bernard Samuels, Dr. E. W. Sheldrup, Dr. Albert E. Sloane, Dr. Claire L. Straith, Dr. A. Earl Walker, Dr. Henry Williams, and Mr. L. A. Watson.

This course is open only to qualified physicians and requests for registration should be addressed to: Dr. E. G. Gill, Gill Memorial Hospital, 711 South Jefferson Street, Roanoke, Virginia.

SOCIETIES

READING MEETING

The 84th meeting of the Reading Eye, Ear, Nose, and Throat Society was held October 27th. This was an "Academy Meeting." The following reported on courses taken in Chicago: Dr. John J. Penta, Dr. Harold L. Strause, Dr. Benjamin F. Souders, Dr. Philip R. Wiest, and Dr. Paul C. Craig.

AKRON ACADEMY MEETS

The Akron Academy of Ophthalmology and Otolaryngology had its first meeting on November 1st. The speaker was Dr. James H. Allen, professor of ophthalmology at the University of Iowa, who discussed, "Bacteriology of Infectious Diseases as They Involve the Eye, Internal and External." The paper was illustrated with lantern slides and was excellently done. A number of ophthalmologists from Cleveland and surrounding communities were present making a total attendance of 35. The following are the officers for the organization for the year 1948-1949: president, Dr. Vincent C. Malloy; vice-president, Dr. Clair E. Anderson; and secretary-treasurer, Dr. A. L. Peter.

WASHINGTON SOCIETY OFFICERS

New officers of the Washington, D.C., Ophthalmological Society are: president, Dr. Jerome A. Sansoucy; vice-president, Dr. J. Thomas Schnebly; secretary-treasurer, Dr. Thomas A. Egan; directors, Dr. Everett S. Caldemeyer and Dr. Edward J. Cummings.

On November 1st the society held a joint dinner meeting with the Baltimore Ophthalmological Society at the Kennedy-Warren Hotel in Washington. The next meeting will be held on January 3rd. The February meeting, date to be announced, will be held jointly with those attending the George Washington University postgraduate course. In March there will be another joint meeting with the Baltimore society, and the final program of the year will be presented on May 2nd.

PERSONALS

PROFESSOR JOSEPH MELLER

To celebrate Professor Meller's 75th birthday a collection of scientific articles is planned. Since at the present time contributions in German periodicals are necessarily limited in number, articles will be accepted for the *Festschrift* which have appeared in any periodical provided that the article was printed with the dedication to Dr. Meller's 75th birthday. Reprints of such original articles could then be bound in one volume and could serve as a *Festschrift*. Notice of such an article should be sent to Prof. J. Böck, Augenklinik, Graz, Austria.

Dr. Derrick Vail, professor of ophthalmology, Northwestern University Medical School, Chicago, gave The Snyder Ophthalmic Foundation lecture at the International Medical Assembly of the Interstate Post-graduate Medical Association of North America held at Cleveland, Ohio, November 9th to 12th. The subject of Dr. Vail's address was "Exophthalmos."

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